



Revised Work Plan for Phase II Subsurface Investigation

Seidenglanz Property
1245 Oro Dam Boulevard, Oroville
Butte County, California
(Assessor's Parcel No. 035-270-016)



Presented to:

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Presented by:

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August 17, 2016
Project Number: 01215033.00

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USEPA Region IX

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Quality Assurance Manager, USEPA Region IX

LIMITATIONS AND DISCLAIMER

This Work Plan has been prepared specifically for the Seidenglanz Property (Assessor's Parcel # 035-270-016) and describes a proposed Phase II Subsurface Investigation at the property located at 1245 Oro Dam Boulevard, Oroville, Butte County, California (Site). The proposed field activities and sampling will be conducted in accordance with the care and skill generally exercised by reputable professionals, under similar circumstances, in this or similar localities. No other warranty, either expressed or implied, is made as to the professional advice presented herein.

Access to the Site and the surrounding area may be limited by buildings, roadways, underground and above-ground utilities and other miscellaneous Site and Site vicinity features. The field exploration and points of subsurface observation may therefore be restricted.

Changes in Site use and conditions may occur due to variations in rainfall, temperature, water usage, or other factors. Additional information that was not available to SCS at the time of preparation of this document, or changes that may have occurred on the Site or in the surrounding area may result in modification to the Site that would impact the information presented herein. This document is not a legal opinion.

We look forward working with you on this project and trust this document provides the information you require at this time. If you have any questions or need additional information, please call SCS Engineers at (530) 533-5898.

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LIST OF ATTACHMENTS

Figure No.

- 1 Site Location Map
- 2 Site Plan with Proposed Sampling Locations

Appendices

- A Field Sampling Plan
- B Revised Quality Assurance Project Plan
- C Unanticipated Discovery Plan
- D Site Specific Health and Safety Plan

LIST OF ACRONYMS AND ABBREVIATIONS

ABCA	Analysis of Brownfields Cleanup Alternatives
ACM	Asbestos Containing Materials
APN	Assessor's Parcel Number
AST	Above Ground Storage Tank
ASTM	American Society for Testing and Materials
BCEH	Butte County Public Health, Department of Environmental Health
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAC	Cal-OSHA Certified Asbestos Consultant
CAM	California Assessment Manual
CDMG	California Department of Mines and Geology
CDPH	California Department of Public Health
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Levels
COC	Chain-of-Custody
COPC	Constituents of potential concern
CPSC	Consumer Product Safety Commission
CSM	Conceptual Site Model
CVRWQCB	Central Valley Regional Water Quality Control Board
CWS	California Water Service Company
DLC	Dioxins and dioxin-like compounds
DTSC	Department of Toxic Substances Control
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ESL	Environmental Screening Levels
ESA	Environmental Site Assessment
FOPC	Features of Potential Concern
FSP	Field Sampling Plan
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HUD	United States Department of Housing and Urban Development
HVAC	Heating Venting, Air Conditioning
IDW	Investigation Derived Waste
LEL	lower explosive limit
LRC-IA	Lead-Related Construction Inspector/Assessor
LUST	Leaking Underground Storage Tank
MDL	Method Detection Limit
Memo	Memorandum
mg/cm ²	Milligrams per Square Centimeter
msl	above mean sea level
OSHA	Occupational Safety and Health Administration

PAHs	Polynuclear Aromatic Hydrocarbons
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCB	Polychlorinated Biphenyls
PCDD	dibenzo- <i>p</i> -dioxin
PCDF	Polychlorinated Dibenzofurans
PCE	Tetrachloroethylene
PCP	Creosote, Pentachlorophenol
PG	Professional Geologist
PG&E	Pacific Gas and Electric Company
PLM	Polarized Light Microscopy
POP	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PRPs	Potentially Responsible Parties
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QSD	Qualified Storm Water Pollution Prevention Plan Developer
RAW	Remedial Action Work Plan
RCRA	Resource, Conservation, and Recovery Act
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SCS	SCS Engineers
SVOC	Semi-volatile Organic Compounds
SWRCB	State Water Resources Control Board
TCDD	Tetrachlorodibenzo- <i>p</i> -dioxin
TCP	Tetrachlorophenol
TEF	Toxic Equivalence Factors
TEG	Transglobal Environmental Geochemistry
TEQ	Toxic Equivalence
TriCP	Trichlorophenol
TPHd	Total Petroleum Hydrocarbons in the Diesel Range
TPHg	Total Petroleum Hydrocarbons in the in the Gasoline Range
TPHmo	Total Petroleum Hydrocarbons in the Motor Oil Range
UDP	Unanticipated Discovery Plan
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UN/DOT	United Nations/Department of Transportation
USA	Underground Service Alert
USGS	United States Geological Survey
UST	Underground Storage Tank
UW	Universal Waste
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

SCS Engineers (SCS) presents this Work Plan to the City of Oroville (City) for the property located at 1245 Oro Dam Boulevard, Oroville, California, hereafter referred to as the Site (Figure 1). This Work Plan has been prepared in general conformance with the Professional Services Agreement (Agreement No. 3102) (Contract) between SCS and the City, which was entered into on January 20, 2015, and the Contract Amendment (Amendment No. 3102-1), which was approved by the City on March 20, 2015.

SCS has developed this Work Plan to address the findings of the Phase I Environmental Site Assessment (ESA) prepared by SCS and submitted to the City on September 22, 2015 (SCS, 2015). In particular, this Work Plan, which is based upon information contained within the SCS Phase I ESA, describes a Phase II Subsurface Investigation consisting of a series of tasks designed to provide subsurface information, upon which we can base recommendation(s) for further Site investigation and/or remediation, if necessary.

This Work Plan includes supporting documents contained as Appendices:

Appendix A - Field Sampling Plan (FSP)

Appendix B - Revised Quality Assurance Project Plan (QAPP)

Appendix C - Unanticipated Discovery Plan (UDP)

Appendix D - Site Specific Health and Safety Plan (HASP)

The FSP and Revised QAPP together are considered an integrated Sampling and Analysis Plan (SAP). The FSP follows the EPA provided template contained in the 2012 QAPP prepared by the City of Oroville for the Community-Wide Site Assessment Grant awarded to the City in 2010. In an effort to streamline project work and conserve budget, SCS obtained City of Oroville approval to adopt the 2012 QAPP and modify the document for Site-Specific activities described in this Work Plan (City of Oroville, 2012). Upon City and EPA approval of this document, the scope of work proposed in this Work Plan will be implemented in accordance with the methods and procedures prescribed in the FSP and Revised QAPP as modified.

2.0 BACKGROUND

The Site consists of a single parcel of land identified by the Butte County Assessor's Office as Assessor's Parcel Number (APN) 035-270-016. The Site formerly included 1255 Oro Dam Boulevard as an address, and the City consolidated the Site addresses to 1245 Oro Dam Boulevard in 2012. The Site is comprised of 38.75 acres (1,687,950 square feet) of land positioned adjacent and to the south of Oro Dam Boulevard.

The Site is largely paved with asphalt between five Site buildings, as well as numerous sheds, outbuildings, and concrete foundations of former Site buildings that were demolished due to their poor condition (see Figure 2 and 2b). Current and former buildings were constructed with concrete slab-on-grade foundations. No wells have been identified on the Site and potable water is reportedly supplied to the Site by California Water Service Company (CWS).

Sewer services are reportedly provided by two private on-Site septic systems. Exact locations of the two private septic systems are unknown, although the locations of the two septic tanks have been identified (see #8 on Figure 2). The Site storm water conveyance system is connected to the City storm drain system. The Site is unpaved in the northeast corner and along the southern and northern Site boundaries. A rail spur is located along the northern Site boundary. Chain-link fencing was observed on the Site perimeter. Access to the Site from Oro Dam Boulevard is provided by two paved entrances at the northwest corner and north-central portions of the Site.

The five on-Site buildings, which collectively total approximately 103,000 square feet, include:

- One approximately 74,000 square foot warehouse (tenant occupied; partially vacant [former Box Facility/Wood Truss Plant]) with an attached office building (vacant);
- One administrative office building (vacant);
- Two smaller warehouses used for storage (approximately 10,000 square feet [former name illegible on available maps] and 7,500 square feet [former Truck Repair/Machine Shop] respectively);
- An approximately 5,000 square foot building (former name not available); and,
- Numerous enclosed and open sheds of varying sizes.

Butte County Assessor's Office records indicate that the Site has a commercial use and industrial (M2) zoning, which is consistent with current Site use. The Site buildings are occupied by several tenants/companies, including: metal roll-up door sales, tire sales and service, granite sales and installation, and a CRV recycler. The Site owner plans to sell the property once environmental work is completed. In addition, the City and the Site owner are considering the extension of Veatch Street southward through the Site to allow better traffic flow and access to properties south of the Site, including a recently constructed Walmart Superstore.

The Site is owned by Mr. Robert ("Steven") Seidenglanz, who has leased portions of the Site to various commercial businesses. Mr. Seidenglanz has owned the Site since 1999 and purchased the Site from Mr. Tim Miller, Mr. Joe Sykes and Ms. Anna Sykes. Mr. Seidenglanz indicated that he does not have any redevelopment plans for the Site and instead plans to sell the Site once environmental assessments are completed (SCS, 2015).

3.0 SITE GEOLOGY AND HYDROGEOLOGY

The Site is located on the northeastern edge of the Sacramento Valley, within the northern portion of the Great Valley Geomorphic Province of California. The Site gently slopes down to the northwest and ranges in elevation from approximately 164 to 190 feet above mean sea level (msl). The topography in the Site and vicinity were modified in the late 1800's early 1900s by gold mining dredge operations which removed materials from the nearby Feather River. The dredging resulted in placement of sand and gravel derived from the Feather River onto the adjacent flood plain, including the Site. As a result, the Site ground surface is approximately 20 to 30 feet higher than property located to the north, across Oro Dam Boulevard (California Department of Mines and Geology [CDMG], 1976).

The dredge deposits generally consist of sand and gravel with cobbles and occasional boulders and generally become siltier/finer-grained with depth. Dredge materials are mapped as covering the Site on a 1949 USGS topographic map (SCS, 2015). Much of the dredged material was later used in constructing the Oroville Dam in the 1950s and 1960s (Stevens, 2006), however, the Site remains “perched” on dredge deposits, and is topographically higher than most nearby properties.

The Site lies in the Feather River flood plain, which is approximately 2.7 miles wide near the Site. The Site is underlain by fluvial deposits of the ancestral and modern Feather River flood plain about the foothills of the Sierra Nevada atop sediments composed of interbedded volcanoclastic deposits of gravel, sand, and tuff. The U.S. Geological Survey (USGS) Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California (Helley and Harwood, 1985; 1:62,500) maps surficial geology at the Site as the Laguna Formation, and lists the age as Pliocene. The sediments of the Laguna Formation overlie the Mehrten Formation and are truncated by the Red Bluff formation above. Undivided Quaternary basin deposits from the Feather and ancestral Feather River systems are present in the Feather River flood plain, with thickly and thinly bedded and interbedded clay, sand, and gravel deposits of fluvial origin. These soils vary in thickness and composition both horizontally and vertically across the Site.

Data regarding depth to groundwater and flow direction specific to the Site are not readily available. In the absence of Site-specific data, depth to groundwater and flow direction information was reviewed as part of the Phase I ESA for properties within the Site vicinity using the State Water Resources Control Board (SWRCB) GeoTracker database. Reported groundwater depths for one such property located at 890 Oro Dam Boulevard were 6 to 14 feet below ground surface (bgs) (E2C Remediation, 2009). This property, however, is approximately 35 feet lower in elevation relative to the Site. The reported groundwater flow direction beneath this property was west-southwesterly, towards Feather River.

Several interconnected water-bearing zones have been defined in the Site vicinity with the regional ground water flow generally to the south, with upper aquifers demonstrating some southwesterly components (USEPA, 2008, and US Army Corps of Engineers [USACE], 2013). The predominant groundwater flow direction in the Site vicinity is west-southwest toward the Feather River. The depth to the shallow aquifer beneath the Site is reported to be approximately 45 feet bgs. A shallow aquitard, consisting primarily of clay, is present in the Site vicinity at approximately 110 feet bgs. The Feather River is a groundwater discharge feature that is expected to impart a west-southwesterly flow influence on local groundwater. However, there are many variables that influence depth to groundwater and flow direction and the actual depth to groundwater and flow direction at the Site may be different than that presented herein.

The Basin Plan prepared by the SWRCB and the Central Valley Regional Water Quality Control Board (CVRWQCB) describes current and future beneficial uses of groundwater beneath the Site and vicinity (CVRWQCB, 1998). The Site is located in the Upper Sacramento River Basin (5A) hydrologic area and Feather River (18020106) hydrologic unit. The Basin Plan designates

groundwater within the Site basin as having existing beneficial use for Municipal, Agricultural, Recreational, Freshwater and Wildlife Habitat.

4.0 USE HISTORY AND PREVIOUS ASSESSMENTS

4.1 OVERVIEW

The Site is located in an area that is currently and has historically been used for commercial and industrial purposes. Local, state, and federal regulatory databases list a number of facilities in the vicinity of the Site that may have impacted the Site. SCS determined, however, that there is a low likelihood that off-Site facilities have impacted the Site based on distance from the Site, nature of the release, regulatory case type and status, as well as various other criteria (SCS, 2015). Specific details regarding the off-Site facilities are provided in the Phase I ESA Report. A summary of the nature, extent, and location of these facilities and potential impacts to the Site are provided below.

- Jiffy #1, located at 1408 Oro Dam Blvd, Oroville, had a leaking underground storage tank (LUST) release of gasoline that affected the local aquifer. This facility is at lower elevation compared with the Site, is located two miles west of the Site and therefore has low likelihood to have impacted the Site.
- Banks Industrial Pro, located at 1685 and 1647 Parker Street adjacent to the Site was listed in the voluntary cleanup program (VCP) database for potential diesel and motor oil release. This facility, which is reportedly a junkyard that has USTs, is positioned at an equal or higher elevation as compared with the Site. Due to the minimum distance from the Site (approximately 500 feet), it is unlikely that a release of heavy hydrocarbons such as diesel and motor oil has impacted the Site.
- Chico Metal Finishing is located at 3151 Richter Avenue, approximately 491 feet east-southeast from the Site. There was no evidence that any releases have occurred at the facility and no further action was recommended by DTSC; USEPA concurred with this recommendation. It was therefore, SCS's opinion that there is a low likelihood that this facility has impacted the Site.
- A facility located on Fort Wayne Street is located approximately 1,616 feet southeast of the Site. The SLIC database lists the Chlorinated Solvents facility status as "Open – Inactive". A release of PCE from this facility is noted to have affected a municipal well in the Site vicinity. Due to the position of the facility to the southeast of the Site, with the regional groundwater flow direction west-southwest towards Feather River, it is unlikely that a release from this facility has impacted the Site.
- In addition to facilities listed in local, state, and federal databases, historical Sanborn fire insurance maps provide additional information concerning off-Site facilities that could potentially impact the Site. From approximately 1949 until the mid-1980s, the High Sierra Pine Mills Lumber Re-Manufacturing & Box Facility was located to the north of the Site (EDR Sanborn maps, circa 1949-1952). The facility operated steam dry kilns, a

fuel vault, and a green chain for wood treatment. The kilns were apparently fueled with wood waste. The green chain was located approximately 400 feet to the north of the Site. In SCS's opinion, due to the distance from the Site and its cross-gradient hydrologic position, release(s), if any, from the green chain were unlikely to have affected the Site. The off-Site green chain is therefore considered to be a *de minimis* condition.

- Farther to the north, Richfield Oil Corp. maintained a facility that had a gasoline tank farm and PG&E had "open" transformers (EDR Sanborn map, circa 1949). In SCS's opinion, due to the distance and hydrologic position (cross-gradient), it is unlikely that releases from these locations would have impacted the Site.
- Feather River Wood Products Co. operated a lumber mill (EDR Sanborn map, circa 1962) to the east of the Site. The lumber mill had a teepee burner located along the western portion of the facility. The burner is labeled on a 1962 Sanborn map and is clearly shown on a 1962 historical aerial photograph. The teepee burner was located approximately 300 feet to the east of the eastern Site boundary. The predominant summer time wind direction in the Site vicinity is toward the north, while winter time includes winds from the north. Therefore, in SCS's opinion, due to the distance of the burner from the Site boundary and prevailing wind conditions, the teepee burner associated with the Feather River Wood Products Co. facility is unlikely to have impacted the Site.

Based on the off-Site source survey, several facilities in the Site vicinity were reported to have had releases of hazardous materials/waste or petroleum products or had a historical use that may have potential to impact the Site. However, it is our opinion that there is a low likelihood of an impact at the Site as a result of known and reported releases of hazardous materials/wastes or petroleum products or other historical industrial operations from an off-Site source. This opinion is based on one or more of the following: reported regulatory status (e.g., case closed), media affected (e.g., soil contamination only), distance from the Site, direction from the Site with respect to reported groundwater flow direction or prevailing wind direction, and information obtained through a review of agency files.

The Site was used extensively by several businesses over an approximately 75 year timeframe from the 1920s until 1997. Historical Site uses during this timeframe included: lumber milling and re-manufacturing, wood treatment and burning, trucking and truck servicing, vehicle and equipment fueling, materials recycling, real estate sales and investment services, prefabricated home construction, and wooden truss construction.

The Site was first developed as part of a larger facility during the 1920s by Swayne Lumber Company who milled, treated, and re-manufactured wood and lumber products until 1940 when High Sierra Pine Mills took over operations (A/C, 1999; SCS, 2015). High Sierra Pine Mills occupied the Site until 1958 conducting similar operations as Swayne Lumber Company. Both mills were "box plants" that remanufactured raw lumber into finished products, which were then "boxed" for shipment (A/C, 1999). In 1958, Las Plumas Lumber Company took over operations until purchased by D'Georgio Corporation in 1968, which continued lumber mill operations until the facility closed in 1995. The Site was paved with asphalt in 1972 or 1973. No rail accidents or spills were noted in the records reviewed, which were available from 1965 to present, related

to the rail spur on the Site. An on-Site electrical transformer was replaced by Pacific Gas and Electric Company (PG&E) in the mid-1980s (A/C, 1999).

In 1996, North Valley Lumber and Truss operated at the Site manufacturing pre-made trusses. In 1997, Hampton Lumber operated a wholesale lumber “reload” business which stored and shipped packaged lumber units to retail outlets. From 1997 until 1999, Endeavor Homes constructed prefabricated homes at the Site. In 2003, the Site was occupied by real estate sales and investment companies. Bettendorf Trucking operated a trucking and truck servicing business at the Site from 2008 until 2014. Various commercial businesses operated at the Site from 2013 until 2015, including those for automobile repair, tire sales, installation, and recycling, materials recycling, and marble/granite sales and installation, and equipment and materials storage (SCS, 2015).

4.2 FEATURES OF POTENTIAL CONCERN

The Phase I ESA prepared by SCS for the Site, as well as two prior Phase I ESA’s (Brown and Caldwell, 2012, A/C, 1999) identified the following areas or features of potential environmental concern (FOPC) associated with the Site including:

- Former Wood Treatment Areas (Dip Tanks and Green Chain Areas);
- Wood Waste Incinerator or “Teepee” Burner;
- Vehicle and Equipment Maintenance Areas;
- Above Ground and Underground Storage Tank (AST and UST) Areas;
- Electrical Transformers;
- Septic Systems;
- Miscellaneous Chemical Use and Storage Areas; and,
- Structures with Lead Based Paint (LBP) and Asbestos Containing Materials (ACM).

Each FOPC is briefly summarized below.

4.2.1 Former Wood Treatment Tanks and Green Chain Area

A dip tank was used for wood treatment (applying an unknown preservative) at the Site, but its use reportedly ceased in the late 1950s (A/C, 1999). A dip tank was reportedly located in the vicinity of the existing office building (A/C, 1999). The dip tank was reportedly an exterior tank located on a concrete pad that was used to treat wood with preservatives. The office building was reportedly constructed on the dip tank location (A/C, 1999). Two different wood treatment tanks were reportedly used at the Site, one located near the former green chain/planing mill (see #12 on Figure 2) and the second near the historical real estate building (see #3 on Figure 2) (A/C, 1999; Brown & Caldwell, 2012). Pentachlorophenol (PCP) and/or creosote were reportedly used at the Site.

Several lined and unlined pits and potential former pits were identified in the approximately 74,000 square foot warehouse; the potential former pits may have been dip tanks for wood treatment operations as part of a green chain (see #1 and #12 on Figure 2) (SCS, 2015). Liquid

PCP was reportedly stored at the north end of the former lumber storage shed (see #13 on Figure 2). A linear pit was also located in the former planing mill, which may have been a machinery pit or a dip tank (see #2 on Figure 2). A pit overgrown with vegetation was also located in the foundation of a demolished building, located in the northwest portion of the Site (See #5 on Figure 2). The exact historical usage of these pits is unknown.

4.2.2 Wood Waste Incinerator

A “40’ high steel burner” (wood waste incinerator or Teepee Burner) was located at the north-central boundary of the Site, circa 1949 until the early 1970s (see #9 on Figure 2) (SCS, 2015). The wood waste incinerator was located near the electrical main drop for the Site, was removed in the early 1970s to an unknown location, and no subsequent burning of wood waste is known to have occurred at the Site since that time (A/C, 1999; SCS, 2015). Teepee Burners are common sources of dioxins and furans at historical lumber mill sites. Dioxins and furans are often concentrated in shallow soil beneath Teepee Burners and in the downwind direction from burner platforms.

4.2.3 Vehicle and Equipment Maintenance Areas

Vehicle and equipment maintenance activities appear to have been conducted in several on-Site locations, including the former mechanic’s shop, the approximately 7,500 square foot warehouse, the approximately 74,000 square foot warehouse, and the former oil house. The maintenance activities may have included use of pits, drains, and USTs. The constituents of potential concern (COPC) associated with such activities include a range of petroleum compounds, oil and grease, metals, and solvents. The potentially affected media include soil vapor, shallow and deeper soil, and groundwater.

4.2.4 Electrical Transformers

Two electrical transformers are located on the Site which were reportedly installed by PG&E in the mid-1980s (see #7, Figure 2) to replace “open” transformers indicated on 1949 and 1962 historical Sanborn maps (SCS, 2015). The “open” transformers were located where located in the same approximate location as the current electrical transformers near the main electrical drop for the Site. Due to the era of the “open” transformers, it is likely that they contained oil with polychlorinated biphenyls (PCBs), a man-made chemical suite that is thin, light-colored liquid to yellow or black waxy solid, manufactured from 1929 until it was banned in the U.S. in 1979.

4.2.5 USTs and ASTs

Five historical USTs, a 10,300 gallon diesel, 7,000 gallon diesel, 8,000 gallon unleaded gasoline, 2,000 gallon regular gasoline, and 1,000 gallon waste oil UST, were reportedly operated at the Las Plumas Lumber facility on the Site (EDR HIST UST database; SCS, 2015) and located to the north of the fueling area (see #17a and 17b, Figure 2) (SCS, 2015). Prior to 1985, three USTs, including two 5,000 gallon diesel tanks and one gasoline tank of unknown capacity, were reportedly removed under oversight of the City of Oroville Fire Chief, but no soil samples were collected from the excavation (A/C, 1999). The EDR HIST UST database lists five historical USTs on the Site at the Las Plumas Lumber facility whose sizes do not match those

listed previously (A/C, 1999) and therefore may represent a different set of USTs, possibly from a different era of operations at the Site.

Four ASTs are located in a historical fueling area at the Site within a secondary concrete block wall containment, including one approximately 15,000 gallon diesel tank, one approximately 10,000 gallon diesel tank, one approximately 1,000 gallon gasoline tank, and one approximately 250 gallon waste oil tank (see #16 on Figure 2) (SCS, 2015). The ASTs are reportedly empty and no longer in use. In addition, one empty AST is also located inside the approximately 7,500 square foot warehouse along with a concrete-lined vehicle and equipment service pit (see #15 on Figure 2). The 1926 Sanborn map also shows a 1,000-gallon steel fuel oil tank, oil storage areas, and oil houses at various locations throughout the Site (see #10 on Figure 2) (SCS, 2015).

4.2.6 Septic Systems

As noted in the SCS Phase I ESA (SCS, 2015), sewer services are reportedly provided by two private on-Site septic systems. The exact locations of the septic systems are unknown, although the locations of the two septic tanks have been identified (see #8 on Figure 2). Due to the potential for discharge of residual fluids and materials used at the Site, the septic systems, including the tanks and leach fields, represent an FOPC.

4.2.7 Miscellaneous Chemical Use and Storage Areas

A facility formerly located at the Site generated several different types of California State and Federal RCRA wastes in 1999 (Partner, 2014; SCS, 2015). The Site facility was listed as a generator of wastes described as: “Contaminated Soils from Site Clean-Up,” “Blank/Unknown,” and “Halogenated Solvents.” No records or reports were found showing that investigations were performed at the Site pertinent to the halogenated solvent spill and no history of releases were found. Due to the unknown nature of the contaminated soils and other unidentified substances, Mr. Tim Miller, former Site owner, was considered by Partner to be a potentially responsible party for the tetrachloroethylene (PCE) contamination in CWS Well #05-01, which is located to the east of the Site. Mr. Miller was ranked by Partner as 6 out of 7 potentially responsible parties (PRPs) for the chlorinated solvent impacts to CWS Well #05-01 (Partner, 2014; SCS, 2015).

Four locations where air compressors were located in sheds had reportedly been contaminated by residues of oil (A/C, 1999). Many of the sheds and other have been demolished or are no longer present on the Site. SCS did not observe oil stains or residues in any of the Site buildings that were accessed during the course of our Phase I ESA. SCS is unaware of which sheds were referenced in the A/C Report and therefore could not evaluate the residues of oil reported by A/C.

4.2.8 Structures with Lead Based Paint and Asbestos Containing Materials

As noted earlier, the Site was developed for use as a mill and wood treating facility beginning in the 1920s, with the majority of structures built between the 1920s and 1940s. The use of LBP was not prohibited until 1980 although in 1973, the Consumer Product Safety Commission (CPSC) established a maximum lead content in paint of 0.5 percent by weight [or 1.0 milligram

per square centimeter (mg/cm^2)] in a dry film of newly applied paint. In 1978, the CPSC lowered the allowable lead level in paint to 0.06 percent. Buildings (structures) constructed or renovated between 1940 and 1980 such as those at the Site have a much higher probability of containing LBP.

Asbestos was historically a component of certain types of building materials (e.g., vinyl flooring, ceiling textures, structural fireproofing). The manufacture of most asbestos-containing building material(s) or ACMs especially potentially friable ACMs, ended in the late 1970's, except for roofing tars and mastic, which were restricted in 1983. In general, buildings constructed after 1985 have a reduced potential for friable ACMs and only a low potential for non-friable forms of ACMs such as vinyl floor tile. The construction date of the structures on the Site (1940s to 1970s) suggests a potential for the presence of ACMs.

Due to the age of the majority of the on-Site buildings, ACM and LBP are suspected.

4.3 CONSTITUENTS OF POTENTIAL CONCERN

Based on SCS' experience with similar operations and facilities, the COPC most commonly associated with the noted FOPC include;

- Metals, particularly arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. The presence of metals in the Site subsurface would most likely be associated with vehicle and equipment maintenance operations, wood treatment areas, and miscellaneous chemical use and storage areas;
- Petroleum compounds such as gasoline, diesel fuel, motor oil, fuel oil, and waste oil. The primary use or storage areas for these compounds include the former USTs, ASTs, vehicle and equipment maintenance operations, septic systems and miscellaneous chemical use and storage areas;
- Volatile organic compounds (VOCs) including chlorinated solvents, solvent stabilizers, and thinners. The presence of VOCs in the Site subsurface would most likely be associated with vehicle and equipment operations, septic systems, and miscellaneous chemical use and storage areas;
- Semi-volatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs). The presence of SVOCs at the Site would most likely be associated with former wood treatment areas, vehicle and equipment maintenance operations, wood disposal/burning areas (Teepee Burner) and miscellaneous chemical use and storage areas;
- Creosote, PCP, dioxins and furans. The presence of creosote, PCP, dioxins and furans at the Site would most likely be associated with former wood treatment areas, vehicle and equipment maintenance operations, wood disposal/burning areas (Teepee Burner) and miscellaneous chemical use and storage areas;
- The presence of PCBs at the Site would most likely be associated with electrical transformers present at the northern Site boundary.
- LBP and ACM would most likely be present on the surfaces, insulation, roofing tar and as mastic on historic Site buildings.

Further discussion of the COPC is as follows:

Wood treatment potentially occurred at the Site over a maximum timeframe of approximately 30 years from the 1930s until the late 1950s, the era during which were used as a wood preservative. Chlorophenols, such as PCP, tetrachlorophenol (TCP), and trichlorophenol (TriCP), were often used in and around planer buildings and “green chains” during the eras in which High Sierra Pine Mills and Las Plumas Lumber Company operated lumber mills and dip tanks for wood treatment at the Site. Chlorophenols were in common use by wood treatment operations until the early 1980s, when they were no longer available to the general public in the United States (U.S.). Widespread use of chlorophenols for wood treatment ceased in most areas of the U.S. by the mid- to late-1980s.

Chlorophenols are a group of organochlorine compounds in which one to five chlorine atoms have been added to phenol, an aromatic compound derived from benzene. Nineteen individual chlorophenol compounds are divided into five basic types: mono-, di-, tri-, tetra-, and penta-chlorophenols. PCP is an insecticide and herbicide that was widely used in the U.S. as a wood preservative from the 1930s until the mid-1980s. Beginning in 1984, PCP was no longer available to the general public, but was still used as a wood preservative for railroad ties, telephone poles, and wharf pilings. Chlorophenols are noted as probable human carcinogens and pentachlorophenol is considered especially toxic to aquatic life.

Dioxins and dioxin-like compounds (DLCs) are by-products of various industrial processes, and are commonly regarded as highly toxic compounds that are environmental pollutants and persistent organic pollutants (POPs). They include:

- 1) Polychlorinated dibenzo-p-dioxins (PCDDs), or simply dioxins. PCDDs are derivatives of dibenzo-p-dioxin. There are 75 PCDDs, seven of which are considered toxic.
- 2) Polychlorinated dibenzofurans (PCDFs) are derivatives of dibenzofuran. There are 135 congeners, and while not dioxins, ten of them have "dioxin-like" properties.
- 3) PCBs which also are not dioxins, but twelve of which have "dioxin-like" properties. Under certain conditions PCBs may form dibenzofurans through partial oxidation.
- 4) Dioxin may also refer to dioxin proper which is the basic chemical unit of the more complex dioxins. This simple compound is not persistent and has no PCDD-like toxicity.

Dioxins consist of a broad class of compounds with a varying degree of toxicity, resulting in development of toxic equivalence (TEQ). The use of TEQ facilitates risk assessment and regulatory control. Toxic equivalence factors (TEFs) exist for seven congeners of dioxins, ten furans and twelve PCBs. The reference congener is the most toxic dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) which per definition has a TEF of one.

Dioxins refers to the sum of compounds (as TEQ) from the above groups which demonstrate the same specific toxic mode of action associated with TCDD. These include 17 PCDD/Fs and 12 PCBs. Incidents of PCB contamination are also often reported as dioxin contamination incidents since it is this toxic characteristic which is of most public and regulatory concern.

The historical Site use for wood processing, treatment, and disposal (burning) likely included storage, use and/or disposal of SVOCs including PCPs, and possible generation of DLCs. The wood treatment areas, such as dip tanks, may have released COPC to shallow and underlying soils and groundwater. Disposal areas, such as the Teepee Burner, would likely have released DLCs to the ground surface.

Two transformers are located at the north central portion of the Site adjacent to Oro Dam Boulevard. Based on a review of historical aerial photographs and Sanborn maps, open transformers were present at the Site from at least 1949 until the mid-1980s, an era in which PCB-containing oils were commonly used in transformers. PG&E reportedly replaced a Site transformer in the 1980s (A/C, 1999). If released, the oils would likely have impacted the shallow ground surface, but are not expected to be present at greater depth due to their relative immobility.

The past and current use of ASTs and USTs to store fuel (diesel and gasoline) may have resulted in the release of petroleum/VOCs to the ground and/or subsurface. SCS could not find information documenting the removal and closure of the former USTs.

Vehicle and equipment maintenance activities appear to have been conducted in several on-Site locations, including the former mechanic's shop, the approximately 7,500 square foot warehouse, the approximately 74,000 square foot warehouse, and the former oil house. The maintenance activities may have included use of pits, drains, and USTs. The COPC associated with such activities include a range of petroleum compounds, oil and grease, metals, and solvents. The potentially affected media include soil vapor, shallow and deeper soil, and groundwater.

The potential on-Site and off-Site sources and distribution (releases) of chemical constituents identified in historical reports for the Site have not been characterized. There are no available subsurface data for the Site, therefore the Site use history outlined above and input from the City (below) shall form the basis for the scope of work outlined in this Work Plan.

The City indicated the following regarding the Site history: "There was a lack of regulatory handling and/or closure documentation for the former reported wood treatment tank, former Teepee Burner, former oil house, chemical cache, and former sump. There is direct evidence that the AST compound, mechanic's shop, area of former USTs, former electrical shop, former oil house, and former machine shop were associated with the use of regulated or unregulated hazardous substances with no closure reports found" (SCS, 2015).

5.0 PROPOSED PHASE II INVESTIGATION

To address the noted historical use areas and COPC, SCS proposes to conduct a phased investigation, consisting of the following Tasks:

Task 1 – Preliminary Field Activities;

Task 2 – Building Materials Survey;
Task 3 – Soil Vapor Survey;
Task 4 – Shallow Soil Investigation;
Task 5 – Deeper Soil and Groundwater Investigation; and,
Task 6 – Summary Report.

Each Task is further described below. Sampling and laboratory analytical methods, detection limits, field methods and other protocol are presented in the FSP and Revised QAPP, included as Appendices A and B to this Work Plan. In addition, the work will be conducted in compliance with the National Historic Preservation Act, as described in an UDP (Appendix C). All project personnel working at the Site will be required to read and follow the Site-Specific HASP, included as Appendix D to this Work Plan.

5.1 TASK 1 - PRELIMINARY FIELD ACTIVITIES

SCS will obtain a soil boring permit from the Butte County Public Health, Department of Environmental Health (BCEH) as needed for the Phase II Subsurface Investigation, confirm Site access with the property owner, and clear the proposed sampling locations of utilities. The utility clearance will consist of contacting Underground Service Alert (USA) at least 72 hours in advance of drilling, and retaining a private utility locator to identify potential subsurface obstructions near the proposed soil boring, soil vapor probe, and assessment trench locations, prior to drilling. Due to the complex historical use of the Site, subsurface utility placements (e.g., water supply lines, septic system leach lines, etc.) associated with current and former Site facilities have not been clearly identified.

Upon obtaining access agreements from the Site owner, Work Plan approval from the City, an approved boring permit from BCEH, and upon EPA approval, SCS will perform the field activities described in Tasks 2, 3, and 4 below. The proposed areas of sample collection are depicted on Figure 2, and a Sample Matrix identifying sample location, type, and analytical method are included on Table 1 at the conclusion of this Work Plan. SCS will retain a private utility locator to map subsurface utilities, such as storm sewer lines, water supply lines, and the septic tanks, and the results of the utility locating exercise will be recorded onto a Site Plan for use during the Phase II investigation and subsequent activities.

5.2 TASK 2 - BUILDING MATERIALS SURVEY

The use of LBP began in the late 1800s, peaked in the 1920s and gradually fell off until its ban. In 1973, the CPSC established a maximum lead content in paint of 0.5 percent by weight (or 1.0 mg/cm²) in a dry film of newly applied paint. In 1978, the CPSC lowered the allowable lead level in paint to 0.06 percent. The use of LBP was not prohibited until 1980. Buildings constructed or renovated between 1940 and 1980 have a much higher probability of having LBP. Given the age of original construction (1920s through 1980s), it is possible that LBP is present.

In general, buildings constructed before 1985 have a high potential for ACMs. The manufacture of most ACMs (except roofing tars/mastics) ended in the late 1970s. However, existing inventories of products could still be used. In addition, roofing tars and mastics can still contain

asbestos. Thus, ACMs can be present in building materials regardless of age or date of construction (for example, in roofing felt, vinyl flooring, dry wall mud, etc.). It is our understanding that the majority of the Site buildings were constructed in the 1920s through the 1980s. Based on the age of original construction, it is possible that ACMs are present.

LBP Survey – The inspection for LBP will be conducted by a California Department of Public Health (CDPH) Lead-Related Construction Inspector/Assessor (LRC-IA) in accordance with current California law and all applicable regulatory guidelines. Readily accessible interior painted surfaces, ceramic tiles, and porcelain fixtures will be tested for lead using an X-Ray Fluorescence (XRF) instrument and in general accordance with the United States Department of Housing and Urban Development (HUD) Title 10, 40 Code of Federal Regulations (CFR) Part 745 and Title 24 Part 35. The lead survey is limited to the interiors of the buildings only.

Bulk samples from major paint systems and loose and flakey paint from each building will be collected for laboratory analysis. The information from this survey can be used by contractors to appropriately manage the hazards associated with LBP should buildings be renovated or demolished. Please note, if demolition of the building is planned, building use changes, there are historical architectural considerations, etc., additional sampling and analysis may be necessary.

ACM Survey – The inspection for ACMs will be conducted by a Cal-OSHA Certified Asbestos Consultant (CAC) in accordance with current California law. In those areas suspected of containing ACMs, bulk samples will be collected for laboratory analysis. Asbestos samples will be collected from the buildings for analysis using Polarized Light Microscopy (PLM).

Roofing materials will also be sampled and analyzed for asbestos. Any core sample penetrations in roofing materials will be sealed with asphaltic mastic, and SCS will collect samples at locations that would minimize any water seepage.

Universal Waste Survey – SCS will perform a visual inspection to identify other regulated hazardous materials (universal waste or UW) within or on the Site structures that will require special handling and disposal during any future remodeling or demolition process. These materials include items that could contain PCBs such as light ballasts and transformers, non-incandescent lamps, batteries, mechanical systems that may contain coolant gases such as heating, ventilating and air conditioning (HVAC) systems and water fountains, mercury switches or thermostats, and devices that could contain low-level radioactive materials such as smoke detectors and exit signs. No samples will be taken of these materials and light fixtures will not be disassembled as part of this effort to identify ballasts; however, an inventory of these known or suspect materials including quantities and locations will be included in the final reports. The information from this survey can also be used by contractors during demolition activities.

5.3 TASK 3 - SOIL VAPOR SURVEY

SCS proposes to conduct a soil vapor survey to evaluate the potential presence and extent of gasoline and other previously identified VOCs from historical petroleum and solvent storage or usage areas at the Site. SCS plans to schedule Transglobal Environmental Geochemistry (TEG), a C-57 licensed contractor, to perform a soil vapor survey. SCS will use the Site use history as the

basis for soil vapor probe sample locations. The planned areas of investigation include the vicinity of the existing ASTs, former USTs, and historical solvent storage and usage areas, at storm drain inlets, in the vicinity of the two septic systems, and at other potential chemical use/release locations (see Figure 2). Soil vapor probes may also be located at the Site perimeter to assess the potential on- or off-Site migration of VOCs, if discovered during the survey.

Following utility location, soil vapor probes will be advanced at the approximate locations shown on Figure 2, each to a depth of 5 feet bgs. Each probe location will be cleared using remote sensing equipment by a private utility locator. The soil vapor borings will be completed using a direct push Strataprobe™ drill rig with 1-inch diameter geo rods. Samples will be collected from each location by TEG using a syringe to withdraw vapor from the sample train. Upon sample collection, each syringe will be immediately transferred to the on-Site mobile laboratory for chemical analysis by TEG's state-certified analytical laboratory. The methods for soil vapor sample collection and analysis are described in more detail in the FSP included as Appendix A to this Work Plan.

We anticipate advancing between 15 and 20 soil vapor probes followed by selection of additional "step-out" locations using the collected data to identify areas of elevated VOC concentrations in soil vapor. Soil vapor screening levels for commercial land use published by the RWQCB (Environmental Screening Levels or ESLs, SFRWQCB 2016) or the DTSC (California Human Health Screening Levels or CHHSLs, OEHHA 2010) in the absence of an ESL value will be used to guide whether additional or step-out locations are needed.

For the purposes of this Work Plan, we have assumed a three day soil vapor survey and collection and analysis of soil vapor samples for VOCs by EPA Method 8260. The soil vapor sampling event will allow advancement of approximately 20 to 25 points, including soil vapor sample collection and analysis. The number of points and samples will be subject to access and drilling conditions. The results of the soil vapor survey may also be used to adjust or modify the number and location of samples collected during Tasks 3 and 4, or if a potential source of COPC is identified during the soil vapor survey.

5.4 TASK 4 - SHALLOW SOIL INVESTIGATION

The proposed shallow soil investigation is intended to preliminarily assess the possible presence of COPC in the following areas:

- Two locations near the on-Site electrical transformers (see #7 on Figure 2);
- Four locations near the former Teepee Burner (see #9 on Figure 2);
- Four locations near the former planning mills (see #2, "Tire Shop", and "CRV Recycler", Figure 2);
- Six locations near the former oil houses, electrical shops and lumber storage areas (see #5, 10, and 12, Figure 2);
- Five locations near the vehicle and equipment maintenance areas (see #11, #15, #27, Figure 2); and,
- Ten locations near the former on-Site wood treatment (suspected dip tank) and PCP storage areas (see #3, #12, and #13 on Figure 2).

SCS will advance borings and collect soil samples from each hand auger boring at approximate depths of 0.5 to 1.0 feet and 1.5 to 2.0 feet below base rock beneath the asphalt/concrete surface in the area of the former Teepee Burner and in the former “open” electrical transformers vicinity.

In the former maintenance shops, planing mills, wood treatment and PCP storage, lumber storage, oil houses, and electrical shop areas, SCS will excavate trenches or potholes using a narrow-bucket backhoe and collect soil samples from each trench/pothole at approximate depths of 0.5, 1.5, 3.0, and 4.5 feet bgs beneath the asphalt/concrete surface. The proposed sample locations are shown on Figure 2.

Soil samples will be collected in stainless steel tubes (or laboratory supplied glass jars), covered at each end with Teflon® sheeting, and capped with plastic end caps. The samples will be logged onto a Chain-of-Custody (COC) form and will be placed in an ice-filled cooler for preservation during transportation to a California-certified analytical laboratory. Further description of soil sample collection and analysis is presented in the FSP, included as Appendix A to this Work Plan.

The near surface and shallow soil samples will be collected with a hand auger and/or drive sampler and analyzed for one or more of the following:

- CAM 17 metals by EPA Method 6010/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- PNAs/PAHs, including chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

In particular, SCS anticipates the following FOPC-specific analysis of shallow soil samples:

- Soil samples collected from the electrical transformer area will be analyzed for PCBs by EPA Method 8082;
- Soil samples collected from the former Teepee Burner area will be analyzed for dioxins/furans by EPA Method 1613;
- Soil samples collected from former wood treatment (suspected dip tank locations) and PCP storage areas will be analyzed for chlorophenols by EPA Method 8270; and,
- Soil samples collected from the maintenance areas will be analyzed for TPH (full range), VOCs, and California Assessment Manual (CAM) 17 metals.

The uppermost samples from each location will be chemically analyzed, and, depending upon the analytical results, the successively deeper samples from those locations which yield one or more COPC at a concentration above a corresponding health risk based screening level will be subject to analysis for the COPC. An estimated total of 54 primary shallow soil samples will initially be chemically analyzed as part of Task 4 activities, with the potential for analysis of additional, deeper samples depending upon the results of shallow soil sample analysis.

Following completion of Tasks 3 and 4, SCS will prepare a brief Memorandum (Memo) presenting the analytical results and recommending FOPC for further, deeper investigation. The Phase I ESA identified FOPC, which form the currently proposed areas of deeper soil and groundwater assessment. The soil vapor survey results and shallow soil sampling program results will be used to guide which of the FOPC will be subsequently investigated as part of Task 5 activities.

5.5 TASK 5 - DEEPER SOIL AND GROUNDWATER INVESTIGATION

At those FOPC identified during the Task 3 and 4 investigations as warranting further assessment, and subject to sufficient available grant funds, SCS will schedule with Clear Heart Drilling, a C-57 licensed drilling contractor, to collect soil and/or grab groundwater samples for analysis of COPC to further assess the potential presence, nature and extent of subsurface impact(s). The soil boring program will include two locations in the vicinity of the ASTs and three locations in the vicinity of the former USTs. In addition, SCS anticipates identifying at least one hydraulically upgradient and one hydraulically downgradient boring location and at least one location from each of the other FOPC shown on Figure 2 for advancement of a soil boring to groundwater. The actual number and locations of these borings will be based upon the soil vapor survey results and the soil analytical results generated during the shallow soil investigation described in Task 4 and will also be subject to the availability of sufficient grant funds.

The driller will first use a hand auger to clear the upper five feet of soils with respect to utilities and collect soil samples for lithologic description. The driller will then use a drill rig equipped with hollow stem augers to advance the soil boring to approximately five feet beyond first encountered groundwater, expected to be present at an approximate depth of 45 feet bgs. This would include soil sample collection at 5 foot intervals and at lithologic breaks or obvious indications of soil impact, until the total boring depth is achieved. Undisturbed soil samples will be collected using stainless steel tubes, sealed with Teflon[®] tape and plastic end-caps.

The driller will install temporary well screen equipped with a pre-pack filter in the borehole to facilitate groundwater sample collection using a small diameter clean, disposable bailer. The collected water would be decanted into clean laboratory supplied containers. After advancing each soil boring and collecting the soil and grab groundwater samples, the driller will decommission each boring by backfilling with cement grout using a tremie pipe from the bottom of the boring to the ground surface, in the presence of a BCEH inspector, if required, and in accordance with the approved drilling permit.

The collected soil and grab groundwater samples will be labeled, recorded on a COC form and in the field log book, and will be placed in an ice-chilled cooler for preservation during transport to a California-certified analytical laboratory for the requested analysis. Further description of soil and grab groundwater sample collection and analysis is presented in the FSP, included as Appendix A to this Work Plan.

Soil sample analysis may include one or more analyte as follows:

- CAM 17 metals by EPA Method 6010/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- PNAs/PAHs, including chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

In particular, SCS anticipates the following FOPC-specific analysis of deeper soil samples, subject to modification based upon the shallow soil sample analytical results:

- Soil samples collected from the AST and UST areas will be analyzed for TPH (full range) and VOCs,;
- Soil samples collected from former wood treatment (suspected dip tank locations) and storage areas will be analyzed for chlorophenols by EPA Method 8270; and,
- Soil samples collected from the maintenance areas will be analyzed for TPH (full range), VOCs, and CAM 17 metals.

Grab groundwater sample analysis may include one or more of the following COPC, based upon the results of the shallow soil investigation and soil vapor survey:

- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B; and,
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;

An estimated total of 30 primary deeper soil samples and 10 primary grab groundwater samples will be chemically analyzed as part of Task 5 activities, with the potential for analysis of additional, deeper soil samples depending upon the results of shallower soil sample analysis.

Soil Boring Location Surveying

As each soil boring and/or trench location is completed, SCS will mark the location with a unique location identification (i.e., alpha-numeric identification). SCS personnel will survey each boring and sample location using a Trimble Hand-held GPS Unit, with a minimum horizontal and vertical accuracy of +/- 1.0 feet. A field scientist will visit each sample location with the surveyor to ensure all sample locations are accurately surveyed. Based on this survey, an updated geo-referenced Site Plan showing sample locations and associated pertinent features will be prepared. If monitoring wells are installed, a California-Licensed land surveyor will assign each location a grid-based coordinate, with a minimum horizontal and vertical accuracy of +/- 0.05 feet.

Investigation Derived Waste

Where possible, soils and materials removed from the subsurface during Site investigation activities will be replaced into the excavated pit or borehole, followed by repair of the ground surface to match prior conditions. In the event materials replacement is not possible, and where groundwater, purge water and decontamination fluid has been generated, those materials will be stored in USDOT-approved 55-gallon drums, affixed with labels identifying the drum contents, date of generation, and indicating the contents are under analysis for possible disposal. SCS will collect representative samples of the investigation derived waste (IDW) for analysis to facilitate materials profiling and disposal.

5.6 TASK 6 - REPORTING

Upon completing Tasks 3 and 4, SCS will prepare a Memo presenting the analytical results for the Soil Vapor Survey and Shallow Soil Sampling exercises. The Memo will include tabulated data, figures depicting the data distribution, an analysis of QA/QC measures undertaken in accordance with the FSP, and an evaluation of whether Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) were met, by using precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) criteria. The Memo will recommend proposed deeper soil and groundwater collection locations, including any deviations from those locations currently presented as part of this Work Plan, to address currently-identified, or newly-recommended FOPC.

Upon completing the Task 5 deeper soil and groundwater investigation, SCS will prepare a Summary Report on behalf of the City documenting the Phase II Subsurface Investigation activities and describing the work performed, methods followed and analytical results, including tabulated data, figures depicting the work locations and results, and Appendices containing laboratory analytical results, permits and other pertinent data. Where appropriate, the Summary Report will also include recommendations for further assessment and/or cleanup alternatives.

The Summary Report will also include a discussion of the results of the QA/QC measures undertaken in accordance with the FSP, and an evaluation of whether DQOs and DQIs were met, by using PARCCS criteria.

The results of the Building Materials Survey will be included in the Summary Report, and will include a description of the building, field logs with descriptions of ACM samples and locations, a summary table of analytical laboratory results, conclusions and recommendations, and costs associated with ACM abatement. The LBP and Universal Waste surveys will also be documented in the Summary Report, and will also include field logs with descriptions of LBP samples and locations, a summary table of analytical laboratory results, a summary table of universal wastes quantities and locations, and appropriate conclusions and recommendations based on the surveys.

Following receipt and incorporation of comments from the City, EPA, and other stakeholders as appropriate, SCS will issue a Final Summary Report for publication and distribution to the City, BCEH, EPA, and others. The Summary Report will be reviewed and stamped by a California-registered professional geologist or engineer and will describe the methods used in performing

each task. The Summary Report will compare the analytical results with criteria for protection of vapor migration into indoor air, assuming commercial/industrial land use, as well as ESL values for settings where water is and is not used for drinking purposes, and water quality objectives listed in the Basin Plan, as applicable.

SCS will also assist the City by providing analytical results for IDW to waste disposal subcontractors for waste profiling and disposal purposes. This assumes the City and/or property owner will execute manifests and/or bills of lading for waste disposal as the generator.

Following completion of Summary Report, SCS will prepare an Analysis of Brownfields Cleanup Alternatives (ABCA) Plan and Remedial Action Work Plan (RAW) for review and approval by the EPA. The plans are designed to evaluate the feasibility of considered remedies, using technical and economic analyses of proposed environmental response activities to recommend an appropriate action in mitigating a Brownfields property. The RAW will also include a human health risk assessment (HHRA), consider and incorporate green and sustainable remedial techniques, and possible climate change impacts in the cleanup alternatives evaluation.

The type of HHRA to be included is currently unclear, but will be identified once data are collected during Phase II activities, and will use a Conceptual Site Model (CSM) as a means to identify and address COPCs, exposure pathways, potentially threatened receptors, and data gaps, all while considering property end use. EPA guidance will be used in where available.

6.0 SCHEDULE

SCS proposes a project schedule as follows:

Description	Duration
Limited Site Assessment	Three Months (August through October 2016)*
Summary Report Preparation	Six Weeks (upon receipt of laboratory data)

(*) – Assumes Site Access and Work Plan Approval achieved by July 21, 2016

ASSUMPTIONS AND LIMITATIONS

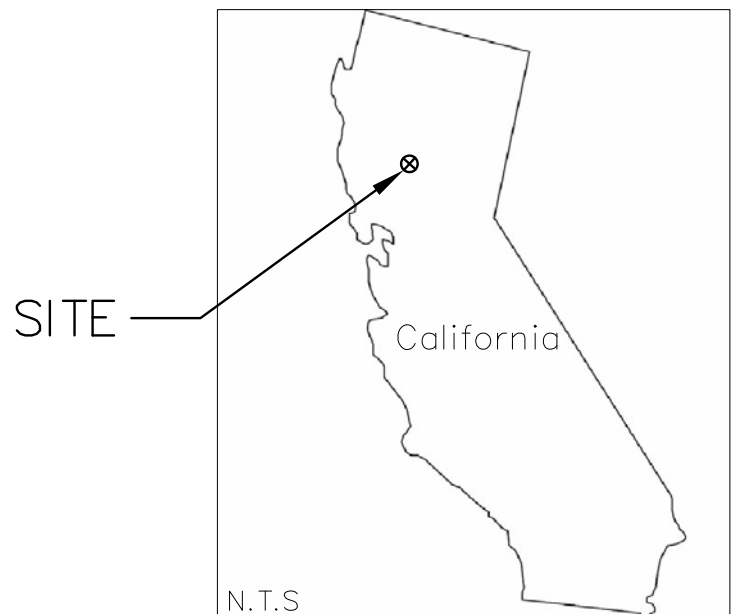
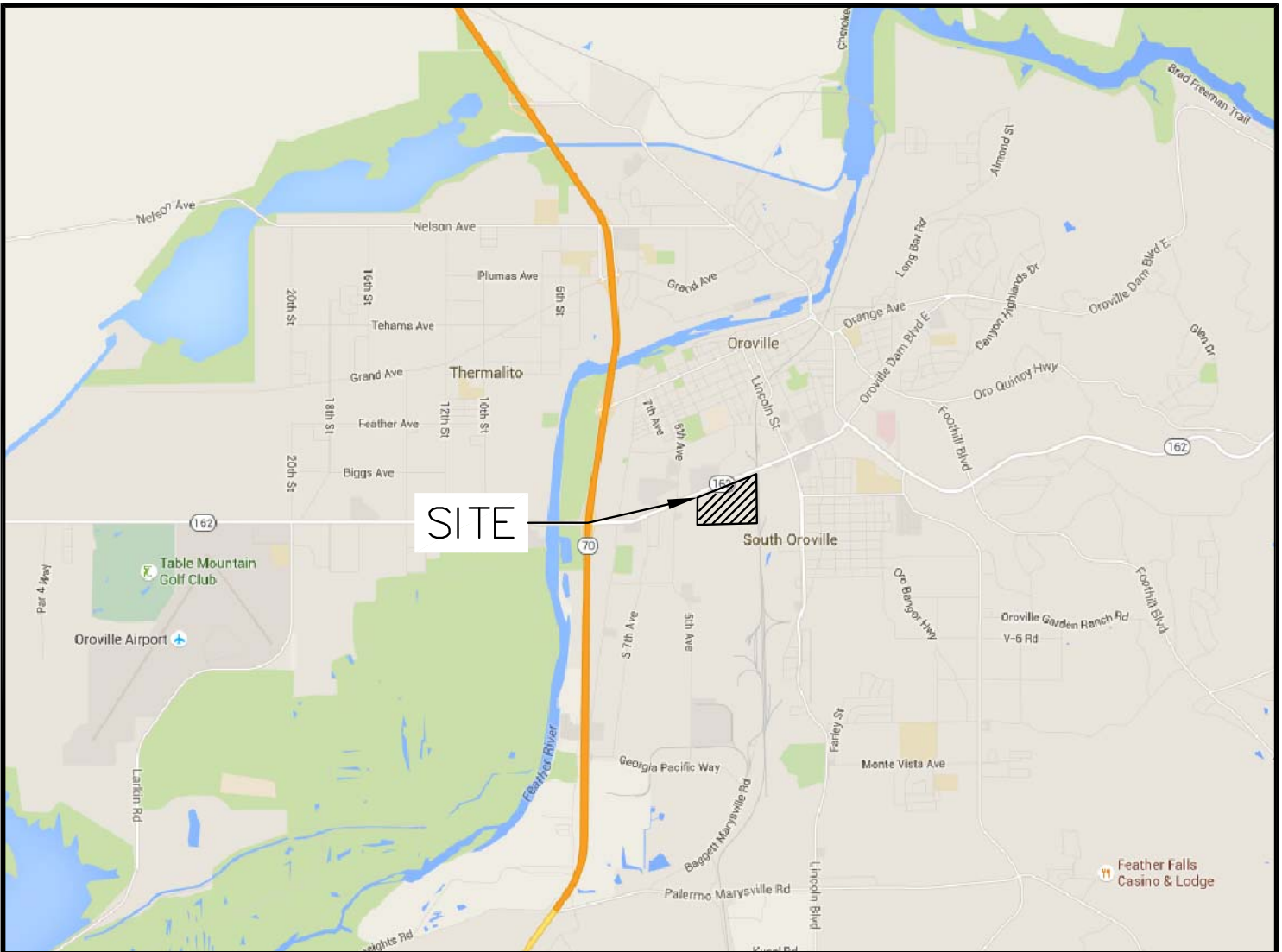
Upon City and EPA approval, SCS is prepared to implement this Work Plan according to the provided schedule. This Work Plan describes a Phase II Subsurface Investigation, intended to characterize existing subsurface conditions. This document is not intended to represent a comprehensive assessment of all possible conditions, and the proposed data collection locations and types are based in part upon information collected by other parties. SCS has relied, in part, upon the validity third party information, and makes not warranty with respect to the veracity of that information.

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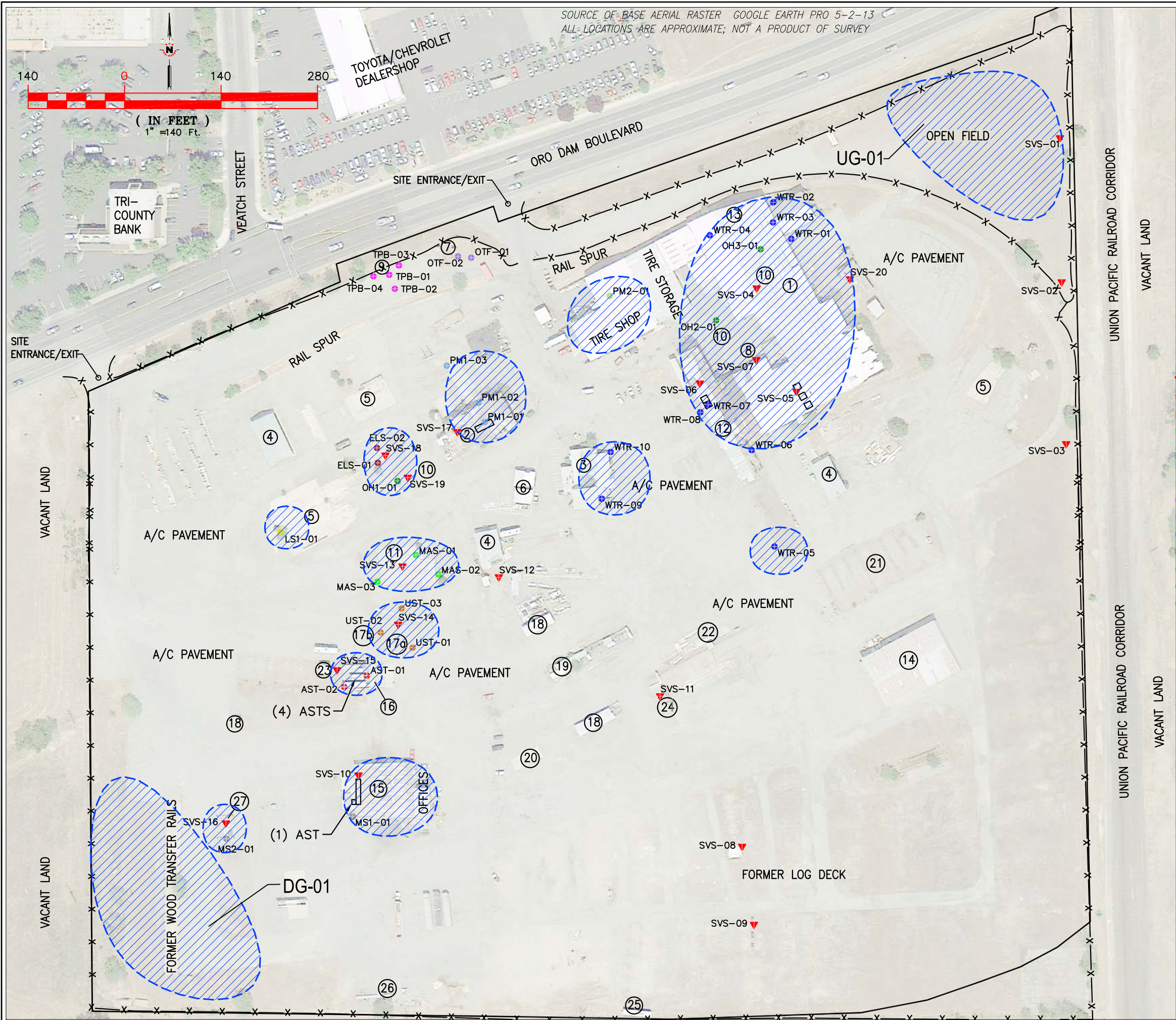
U.S. Geological Survey (USGS), Miscellaneous Field Studies Map MF-1790.

FIGURES



SOURCE OF BASE MAP: GOOGLE MAPS

SCS ENGINEERS ENVIRONMENTAL CONSULTANTS 3843 BRICKWAY BOULEVARD SUITE 208 SANTA ROSA, CALIFORNIA 95403 PH. (707) 546-9461 FAX. (707) 544-5769			SHEET TITLE: SITE LOCATION MAP	SCALE: N.T.S
PROJ. NO. 01215033.00 DATE 7/22/15			PROJECT TITLE: APN: 035-270-016 1245 ORO DAM BOULEVARD OROVILLE, CALIFORNIA	FIGURE NO. 1
DWN. BY: JH CHK. BY: PAW	ACAD. FILE: 01215033.00_ESA-5-15 APP. BY: J. RITCHIE			



GENERAL SITE FEATURES:

—

APPROXIMATE BUTTE COUNTY ASSESSOR'S PARCEL BOUNDARY

□

PIT OR SUMP

—x—x—

CHAIN LINK FENCE

SITE FEATURES AND EXPLANATION:

①

APPROX. 74,000 SQ. FT. WAREHOUSE (FORMER BOX FACILITY/ WOOD TRUSS PLANT)

②

FORMER PLANING MILL

③

VACANT ADMINISTRATIVE OFFICES

④

OPEN STORAGE SHED

⑤

BUILDING FOUNDATION (FORMER LUMBER STORAGE BUILDING)

⑥

ENCLOSED SHEDS

⑦

PG&E TRANSFORMERS

⑧

SEPTIC TANK(S)

⑨

FORMER TEEPEE BURNER

⑩

FORMER OIL HOUSE/STORAGE

⑪

BUILDING FOUNDATION (FORMER TRUCK REPAIR/MACHINE SHOP)

⑫

FORMER LUMBER STORAGE SHED

⑬

FORMER PCP STORAGE

⑭

APPROX. 10,000 SQ. FT. WAREHOUSE

⑮

APPROX. 7,500 SQ. FT. WAREHOUSE (VACANT)

⑯

FUELING AREA/ASTS

⑰

FORMER UST LOCATIONS (a) AND GAS PUMP (b)

⑱

ENCLOSED SHED

⑲

OPEN SHED

⑳

CONCRETE FOUNDATION

㉑

FORMER WAREHOUSE (FORMER LUMBER SHED)

㉒

TRUCK SCALE & SCALE HOUSE

㉓

BATHROOM

㉔

LUMBER MILLING MACHINERY

㉕

SHIPPING CONTAINER

㉖

MATERIALS STORAGE AREA

㉗

FORMER MECHANICS SHOP

HREC SAMPLING LOCATIONS:

▼ SVS

= SOIL VAPOR SURVEY

♦ AST

= ABOVEGROUND STORAGE TANK

⬢ UST

= UNDERGROUND STORAGE TANK

✦ MAS

= MACHINE SHOP

⬢ MS1

= MECHANIC'S SHOP 1

⬢ MS2

= MECHANIC'S SHOP 2

⬢ PM1

= PLANING MILL 1

⬢ PM2

= PLANING MILL 2

✦ TPB

= TEEPEE BURNER

⬢ OTF

= OPEN TRANSFORMER

⬢ WTR

= WOOD TREATMENT

✦ ELS

= ELECTRIC SHOP

✦ OH1

= OIL HOUSE 1

✦ OH2

= OIL HOUSE 2

✦ OH3

= OIL HOUSE 3

✦ LS1

= LUMBER STORAGE 1

APPROXIMATE AREA DESIGNATED FOR POTENTIAL GROUNDWATER SAMPLING

DATE

REVISION

NO.

SHEET TITLE

PROJECT TITLE

CITY OF OROVILLE, CALIFORNIA

CLIENT:

SCS ENGINEERS

ENVIRONMENTAL CONSULTANTS

3843 BRICKWAY BOULEVARD SUITE 208

SANTA ROSA, CALIFORNIA

PH. (707) 546-9461 FAX. (707) 544-5769

PROJ. NO. 01215033.00

PSN. BY: PAW/JUM

CHK. BY: J. RITCHIE

DATE:

7/14/16

SCALE:

(AS SHOWN)

FIGURE

2

APPENDICES

APPENDIX A
FIELD SAMPLING PLAN



Revised Field Sampling Plan

**Seidenglanz Property
1245 Oro Dam Boulevard, Oroville
Butte County, California
(Assessor's Parcel No. 035-270-016)**



Presented to:

CITY OF OROVILLE
1735 Montgomery Street
Oroville, California 95965
(530) 538-2433

Presented by:

SCS ENGINEERS
2167 Montgomery Street, Suite B
Oroville, California 95965
(530) 533-5898

August 17, 2016
Project Number: 01215033.00

Revised Field Sampling Plan

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August 17, 2016
Project Number: 01215033.00

APPROVAL PAGE

Approved by: _____
Grant Manager, City of Oroville

_____ Date

Approved by: _____
Program Manager, SCS Engineers

_____ Date

Approved by: _____
Principal-in-Charge and QA/QC Officer
SCS Engineers

_____ Date

Approved by: _____
Brownfields Project Manager,
USEPA Region IX

_____ Date

Approved by: _____
Quality Assurance Manager, USEPA Region IX

_____ Date

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Figure No.

1	Site Location Map
2	Proposed Sampling Locations

Appendices

A	Risk Based Screening Level Tables
B	SCS Quality Management System
C	XRF Calibration Manual

LIST OF ACRONYMS AND ABBREVIATIONS

ACM	Asbestos Containing Materials
AST	Above Ground Storage Tank
ASTM	American Society for Testing and Materials
APN	Assessor Parcel Number
ARAR	Applicable or Relevant and Appropriate Requirement
BD	Blind Duplicate
bgs	below ground surface
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
CAM	California Assessment Manual
CCR	California Code of Regulations
CDMG	California Department of Mines and Geology
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Levels
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COPC	Constituents of Potential Concern
CWA	Clean Water Act
DLCs	Dioxins and Dioxin-Like Compounds
DOSH	Department of Occupational Safety and Health
DQA	Data Quality Assessment
DQI	Data Quality Indicators
DQO	Data Quality Objectives
DTSC	Department of Toxic Substances Control
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
ESL	Environmental Screening Levels
FOPC	Feature of Potential Concern
FSP	Field Sampling Plan
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HPLC	High Performance Liquid Chromatography
HUD	Housing and Urban Development
IDW	Investigation-Derived Waste
LBP	Lead Based Paint
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/cm ²	Milligrams per Square Centimeter
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per liter
MQO	Measurement Quality Objective
MRL	Method Reporting Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate

µg/L	Micrograms per Liter
µg/m ³	Micrograms per Cubic Meter
NCP	National Contingency Plan
NIST	National Institute of Standards and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
OERR	Office of Emergency and Remedial Response
PAH	Polynuclear Aromatic Hydrocarbons
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCBs	Polychlorinated Biphenyls
PCP	Pentachlorophenol
PE	Performance Evaluation
PID	Photoionization Detector
PLM	Polarized Light Microscopy
PPE	Personal Protective Equipment
ppm	Parts per Million
PRG	Preliminary Remediation Goal
PRQL	Project-Required Quantitation Limit
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
QMS	Quality Management System
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RPD	Relative Percent Difference
RSL	Regional Screening Level
RWQCB	Regional Water Quality Control Board
%R	Percent Recovery
SAP	Sampling and Analysis Plan (an integrated FSP and Revised QAPP)
SCS	SCS Engineers
SOP	Standard Operating Procedures
SOW	Statement of Work
SVOCs	Semi-Volatile Organic Compounds
SWRCB	State Water Resources Control Board
TPHd	Total Petroleum Hydrocarbons as Diesel
TPHg	Total Petroleum Hydrocarbons as Gasoline
TPHmo	Total Petroleum Hydrocarbons as Motor Oil
TTLc	Total Threshold Limit Concentration
UN/DOT	United Nations/Department of Transportation
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
UST	Underground Storage Tank
VOA	Volatile Organic Analysis
VOCs	Volatile Organic Compounds
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

The Site consists of a single parcel of land which formerly included 1255 Oro Dam Boulevard as an address, until the City consolidated the Site addresses to 1245 Oro Dam Boulevard in 2012.

Phase I Environmental Site Assessments (ESAs) were conducted at the Site in 1999 by A/C Industrial Services Corporation (A/C) (A/C, 1999), in 2012 by Brown and Caldwell (Brown and Caldwell, 2012), and in 2015 by SCS Engineers (SCS, 2015). These assessments have revealed that the Site was used extensively by several businesses over an approximately 75 year timeframe from the 1920s until 1997. Historical Site uses during this timeframe included: lumber milling and re-manufacturing, wood treatment and burning, trucking and truck servicing, vehicle and equipment fueling, materials recycling, real estate sales and investment services, prefabricated home construction, and wooden truss construction.

This Field Sampling Plan (FSP) has been prepared for approval by the Environmental Protection Agency (EPA) pursuant to the City of Oroville's EPA Site-Specific Brownfield Assessment Grant for Hazardous Substances and Petroleum Hydrocarbons, Grant No. R09-14-A-003. The purpose of the proposed Site investigation is to address the findings of the Phase I ESAs, through a series of tasks designed to provide subsurface information, upon which we can base recommendation(s) for further Site investigation and/or remediation, if necessary. This information can be used for redevelopment and cleanup planning. Although detailed redevelopment plans are unknown at this time, the Site may be redeveloped for continued commercial and/or industrial use. Pending approval by the EPA, the scope of work (SOW) described in the Work Plan and this FSP will be conducted in August and September of 2016.

1.1 SITE NAME OR SAMPLING AREA

The area to be sampled is referred to as the "Site" throughout this document.

1.2 SITE OR SAMPLING AREA LOCATION

The Site consists of Assessor's Parcel Number (APN) 035-270-016, and is comprised of 38.75 acres (1,687,950 square feet) of land positioned adjacent and to the south of Oro Dam Boulevard (Figure 1). As documented in the SCS Phase I ESA, the Site is bounded by the adjacent property uses listed in the following table.

Direction	Land Use
North	Oro Dam Boulevard, Automobile Dealership (Oro Dam Auto Center – 1250 Oro Dam Blvd), Automobile Parts (Oroville Chevrolet Parts – 1250 Oro Dam Blvd), Automobile Rental (Dollar Rent A Car– 1450 Oro Dam Blvd, Hertz Rent A Car – 1450 Oro Dam Blvd), and Automobile Servicing (Jiffy Lube– 1450 Oro Dam Blvd) (Figure 2)
East	Union Pacific Railroad corridor, vacant land
South	Vacant land, materials Storage

Direction	Land Use
West	Vacant land, commercial properties

The Site is largely paved with asphalt between five (5) Site buildings, as well as numerous sheds, outbuildings, and concrete foundations of former Site buildings that were demolished due to their poor condition (see Figure 2). Current and former buildings were constructed with concrete slab-on-grade foundations.

1.3 RESPONSIBLE AGENCY

The Responsible Agency is the City of Oroville located at 1735 Montgomery Street, Oroville, California 95965.

1.4 PROJECT ORGANIZATION

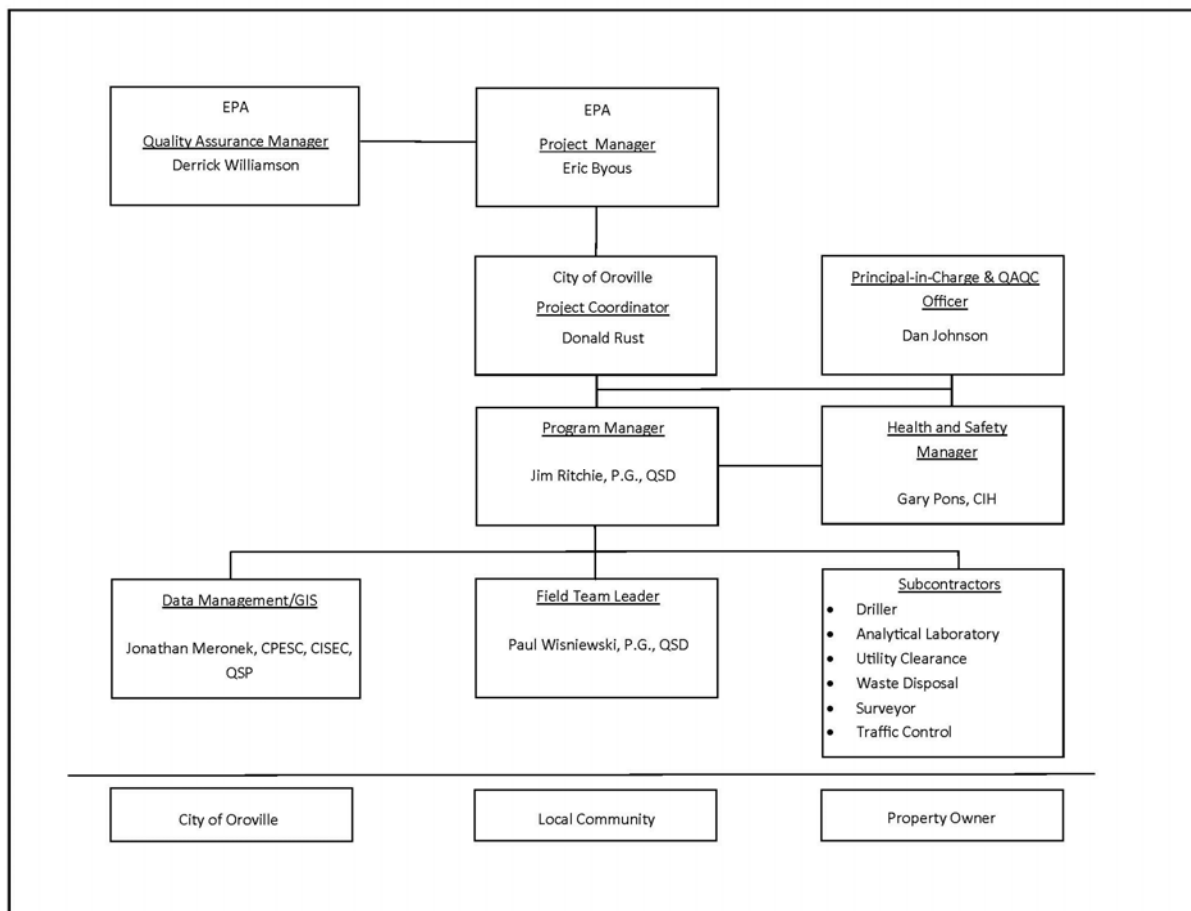
The following table summarizes contact information and responsibilities for key personnel.

Table 1-1 Key Project Personnel Contact Information and Responsibilities

Title	Name	Contact Information	Responsibilities
EPA Project Manager	Eric Byous US EPA Brownfields Coordinator	415-972-3531 byous.eric@epa.gov	Review and approve QA documents Provide technical assistance
EPA Quality Assurance Officer (QAO)	Eugenia McNaughton, PhD EPA, Region 9	415-972-3411 Mcnaughton.Eugenia@epa.gov	Coordinate preparation and review of QA documents Provide technical assistance
Grantee Project Manager	Don Rust City of Oroville	530-538-2408 rustdl@cityoforoville.org	Review and authorize implementation of the scope of work to be completed
Contractor Project Director/Program Manager	James Ritchie SCS Engineers	530-533-5898 jritchie@scsengineers.com	Prepare SAP and oversee overall project implementation
Contractor QAO	Daniel Johnson SCS Engineers	858-571-5500 djohnson@scsengineers.com	Oversee the implementation of the SAP in a QA role and peer reviewer
Contractor Field Team Leader	Paul Wisniewski SCS Engineers	530-533-5898 pwisniewski@scsengineers.com	Prepare Workplan and oversee field sampling and report preparation

Title	Name	Contact Information	Responsibilities
Laboratory QAO	Melanie Ollila Pace Analytical	612-607-6352 melanie.ollila@pacelabs.com	Oversee the implementation of the laboratory Quality Systems Manual

Project Organizational Chart



2.0 BACKGROUND

2.1 SITE OR SAMPLING AREA DESCRIPTION

The Site consists of one parcel of land (APN 035-270-016), with an address of 1245 Oro Dam Boulevard, Oroville, California 95965. The Site is comprised of 38.75 acres (1,687,950 square feet) and is currently used for commercial purposes.

APN	Address	Area	Description
035-270-016	1245 Oro Dam Boulevard	38.75	Land use described as a "commercial lot"

The Site is largely paved with asphalt between five (5) Site buildings, as well as numerous sheds, outbuildings, and concrete foundations of former Site buildings that were demolished due to their

poor condition (see Figure 2). Current and former buildings were constructed with concrete slab-on-grade foundations.

2.2 OPERATIONAL HISTORY

An approximate Site use chronology was developed by SCS, using available records such as topographic maps, aerial photographs, City Directories, building permits and information on file with the City of Oroville, and interviews with persons knowledgeable about the Site. The Site use chronology, as presented in the SCS Phase I ESA is shown below.

Year	Interpreted Site Tenants (Source)	Interpreted Site Use
2015	Used tires sales and service company; a marble and granite contractor	Automobile tire sales and installation; Marble/granite sales and installation
2014	Bettendorf Trucking; Mac's Quality Used Tires, Inc. (Site Owner) (Partner, 2014)	Trucking and truck servicing; sales and recycling of tires
2013	Bettendorf Trucking; Fair Street Recycling (EDR City Directory)	Trucking and truck servicing; materials recycling
2008-2013	Bettendorf Trucking ; Midwest USA, Inc. (EDR City Directory)	Trucking and truck servicing
2003	Better Homes Land of Gold Realty; Butte County Investment Real Estate; Harry Stroud; Midwest USA, Inc. (EDR City Directory)	Real estate sales and investment services
1997-1999	Endeavor Homes (A/C Phase I Report)	Prefabricated home construction
1997	Hampton Lumber (A/C Phase I Report)	Wholesale lumber "reload" business which stored and shipped packaged lumber units to retail outlets
1996-1997	North Valley Lumber and Truss (A/C Phase I Report)	Manufacturing pre-made trusses
1958-1995	Las Plumas Lumber Co. (EDR City Directory; EDR Certified Sanborn® Map Report; A/C Phase I Report) Note: 1968-1995 D'Georgio Corporation operated Site as Las Plumas Lumber	Lumber milling and treatment
1940-1958	High Sierra Pine Mills (A/C Phase I Report)	Lumber milling, re-manufacturing, wood treatment
1920s-1940	Swayne Lumber Company (A/C Phase I Report)	Lumber milling, re-manufacturing, wood treatment

2.3 PREVIOUS INVESTIGATIONS/REGULATORY INVOLVEMENT

Phase I ESAs were conducted at the Site in 1999, 2012 and 2015, however, there have been no subsurface investigations conducted at the Site.

The SCS 2015 Phase I concluded, “*With the possible exception(s) below, this Assessment has revealed no evidence of an REC in connection with the Site.*”

- *Historical Site uses included trucking and truck servicing, lumber milling and remanufacturing, wood treatment and burning, vehicle and equipment fueling, materials recycling, real estate sales and investment services, prefabricated home construction, and wooden truss construction. Current Site uses are for tire sales and service, granite sales and installation, and for equipment and materials storage. In SCS’s opinion, there is a low likelihood that a REC exists as a result of current Site use.*
- *Site reconnaissance revealed the presence of four ASTs that are reportedly empty and no longer in use, located in a former fueling area. One empty AST is also located in the approximately 7,500 square foot warehouse along with a concrete-lined vehicle and equipment service pit. There were no indications of releases or leaks from the ASTs or in the service pit area. In SCS’s opinion, there is a low likelihood that a REC exists due to the presence of the ASTs and service pit.*
- *The Site was historically used extensively by several businesses for lumber milling and re-manufacturing over an approximately 75 year timeframe from the 1920s until 1997. Historical lumber and wood manufacturing Site operators included: Swayne Lumber Company, High Sierra Pine Mills, Las Plumas Lumber, and Endeavor Homes. Wood treatment potentially occurred at the Site over a maximum timeframe of approximately 30 years from the 1930s until the late 1950s, the era during which chlorophenols such as PCP were used as a wood preservative. A dip tank was reportedly used for wood treatment at the Site by these historical operations, but its use reportedly ceased in the late 1950s. The A/C Phase I Report indicated that PCP and/or creosote were used at the Site (A/C, 1999). Several lined and unlined pits and potential former pits were identified in the approximately 74,000 square foot warehouse; the potential former pits may have been dip tanks for wood treatment operations as part of a green chain. A linear pit was also located in the former planing mill, which may have been a machinery pit or a dip tank. A pit overgrown with vegetation was also located in the foundation of a demolished building, located in the northwest portion of the Site. The exact historical usage of these pits is unknown, but in SCS’s opinion, due to the historical use of wood treatment chemicals (e.g., dip tanks), the pits should be further assessed. The historical presence of dip tank(s) and wood chemical treatment, potentially by PCP, at the Site would be considered an HREC that, in SCS’s opinion, should be further assessed.*
- *Historical Sanborn maps reveal the presence of a “40’ high steel burner” (wood waste incinerator or teepee burner) located at the north-central boundary of the Site, circa 1949 through 1962 (See Appendix A). Historical aerial photographs of the Site confirm the presence of a teepee burner at the Site as a circular structure in the same approximate location as shown on Sanborn maps. Due to the often large volume of burned organics, teepee burners are known sources of dioxins and furans at historical lumber mill sites. Dioxins and furans are often concentrated in shallow soil beneath the*

teepee burner and in the downwind direction from the burner platform. The historical presence of a teepee burner at the former lumber mill at the Site is considered to be an HREC that, in SCS's opinion, should be further assessed.

- According to the A/C Report, prior to 1985, three USTs were reportedly removed under oversight of the City of Oroville Fire Chief, but no soil samples were collected from the excavation. Based on an interview with the current Site owner, Mr. Seidenglanz, the former USTs were located to the north of the fueling area. The EDR HIST UST database lists five historical USTs on the Site at the Las Plumas Lumber facility whose sizes do not match those listed in the A/C Phase I report and therefore may represent a different set of USTs, possibly from a different era of operations at the Site. 1926 Sanborn maps also show a 1,000-gallon steel fuel oil tank, oil storage areas, and oil houses at various locations throughout the Site. The presence of historical USTs and oil storage areas constitutes a HREC that, in SCS's opinion, should be further assessed. SCS therefore recommends assessing shallow soil and possibly groundwater in the immediate vicinity of the historical USTs and oil storage areas to evaluate the potential presence of COCs. The Brown and Caldwell Report also identified significant quantities of solvent in various tenant spaces. SCS therefore recommends assessing shallow soil vapor to preliminarily evaluate the potential presence of residual VOCs in the Site subsurface. The historical use of the Site (e.g., potential historical releases from USTs containing gasoline) and a review of nearby regulatory cases suggest a low to moderate likelihood of VI. This determination is based on the lack of evidence of a UST release and the distance of off-Site chemical releases that could cause VI on-Site. Based on the reported use of volatile compounds, which SCS was unable to confirm, we recommend a limited soil vapor survey.
- According to the October 25, 2000 listing obtained by Partner, a facility formerly located at the Site generated several different types of California State and Federal RCRA wastes in 1999 (Partner, 2014). The Site is listed as a generator of wastes described as: "Contaminated Soils from Site Clean-Up," "Blank/Unknown," and "Halogenated Solvents." No records or reports were found showing that investigations were performed at the Site pertinent to the halogenated solvent spill and no history of releases were found. Due to the unknown nature of the contaminated soils and other unidentified substances, Mr. Tim Miller, former Site owner, was considered by Partner to be a potentially responsible party for the PCE contamination in CWS Well #05-01, which is located to the east of the Site. Mr. Tim Miller was ranked by Partner as 6 out of 7 PRPs for the chlorinated solvent impacts to CWS Well #05-01. In SCS's opinion, potential release(s) of halogenated solvents from the Site and lack of documentation regarding assessment or cleanup activities related to the release(s) constitutes a HREC that should be further assessed.
- The City provided a completed AAI Questionnaire as part of this Report with Question (6) "Obvious Indications of Contamination" checked with a "Yes" response, which was explained as follows: "There was a lack of regulatory handling and/or closure documentation for the former reported wood treatment tank, former teepee burner, former oil house, chemical cache, and former sump."
- There is direct evidence that the AST compound, mechanic's shop, area of former USTs, former electrical shop, former oil house, and former machine shop were associated with the use of regulated or unregulated hazardous substances with no closure reports found".

The Phase I ESA for the Veatch Street Extension Easement, 1245 Oro Dam Boulevard, prepared by Brown and Caldwell and dated October 10, 2012 (Brown and Caldwell, 2012), contained the following conclusions and recommendations regarding the Site:

- *“Brown and Caldwell has performed a Phase I Environmental Site Assessment in general conformance with the scope and limitations of ASTM Standard E 1527-05, of the site located at 1245 Oroville Dam Boulevard, Oroville, California. For the purpose of the ESA, Brown and Caldwell evaluated a portion of the property currently being considered by the City of Oroville for a roadway expansion. The subject easement is located on the western portion of the property and transects the site in a north to south orientation, extending south from the intersection of Veatch Street and Oroville Dam Boulevard.*
- *A review of available Sanborn® maps revealed other historical operations outside of the site footprint included a former teepee burner (wood waste incinerator) and former oil house in the former box factory (main building). During the May 30, 2012 site reconnaissance, Brown and Caldwell observed significant quantities of solvent, other unknown chemicals, and an empty drum storage area in various leased spaces. A former sump was also observed in the green chain/planing mill. The former reported wood treatment tank, teepee burner, and oil house were not found during the site reconnaissance*
- *Due to a lack of regulatory handling and/or closure documentation for the former reported wood treatment tank, former teepee burner, former oil house, chemical cache, and former sump, these five findings are considered off-site recognized environmental conditions outside of the site, within the parcel.*
- *During the May 30, 2012 site reconnaissance, Brown and Caldwell observed a compound of ASTs for various fuels and mechanic’s shop currently being leased by a trucking company, within the Site footprint. The ASTs are maintained by the leasee. The mechanic’s shop contained various quantities of petroleum products used for semi-truck maintenance. According to background documentation and an interview with City staff, USTs were once located at the same location as the existing AST fueling compound. The USTs were reportedly removed under the oversight of City of Oroville Fire Department staff.*
- *There is direct evidence that the AST compound, mechanic’s shop, area of former USTs, former electrical shop, former oil house, and former machine shop are associated with the use of regulated or unregulated hazardous substances and considered recognized environmental conditions. There are no closure reports found that indicate that these recognized environmental conditions were properly investigated for the presence or absence of soil or groundwater impacts. Brown and Caldwell advises that an additional environmental assessment is warranted for these areas.”*

The Phase I ESA prepared by A/C and dated December 14, 1999 (A/C, 1999) concluded the following:

“This assessment has revealed no evidence of recognized environmental conditions in connection with the property, except for the following:

- There is an area of the property which has been used in the past for wood treatment activities (i.e., a dip tank). It is unknown which type of preservative(s) were used in the dipping operations. It may be possible that contamination of subsurface soils has occurred from these historical operations which could present an environmental problem to current or future owners of the property. In order to meet full disclosure requirements, limited soil sampling via extraction of a core sample(s) from this area may wish to be considered. Dip tank operations ceased on this site in the late 1950's.*
- It is unknown as to possible contamination of the soil in the area where the former UST's were located. In order to confirm or deny the presence of possible contamination, limited soil sampling via extraction of a core sample(s) from this area may wish to be considered. The tanks were legally removed to the then current standards in 1985.*
- In the building identified as “Planing Mill No. 1” there is an area underneath the old machinery where the soil is exposed. Obvious staining of the soil by presumed lubricating oils is evident. This soil should be removed and the location remediated to acceptable clearance levels between buyer and seller.*
- There are four locations where air compressors have been located in sheds. In these four areas, the ground has been contaminated by residues of oil. This should be cleaned of gross accumulations by scraping and subsequent pressure washing. Accumulated material should be properly disposed of.*
- There are approximately (20) 55 gallon drums scattered around the property which are believed to contain hazardous wastes. These drums should be properly disposed of. There are also approximately (22) 5 gallon pails scattered around the property which are believed to contain hazardous wastes. These drums should be properly disposed of.”*

SCS did not observe any 55-gallon drums, hazardous waste or other chemical waste containers at the Site at the time of our reconnaissance. Mr. Steven Seidenglanz indicated that hazardous wastes and chemicals generated and stored by previous Site owners and/or tenants at the Site were properly transported and disposed at approved off-Site facilities by the current Site owner after taking ownership. The historical locations of the drums were not documented and so specific potential impacts to the Site are unknown.

2.4 PROJECT SCOPING

Based upon the conclusions and recommendations in the SCS Phase I as well as the prior Phase I ESA documents, the Client agreed to proceed with a Phase II investigation at the Site and authorized SCS to prepare the SAP (combined Revised QAPP and FSP) on September 14, 2015. SCS submitted the Draft Revised QAPP, FSP, Work Plan and related documents to the EPA on March 8, 2016. The EPA subsequently provided comments on April 26, 2016.

2.5 GEOLOGICAL/HYDROGEOLOGICAL INFORMATION

The Work Plan contains a more detailed description of Site and vicinity Geology and Hydrogeology. However, the following is a summary of the Site subsurface conditions.

2.5.1 Geology and Soil Conditions

The Site is located on the northeastern edge of the Sacramento Valley, within the northern portion of the Great Valley Geomorphic Province of California. The Site gently slopes down to the northwest and ranges in elevation from approximately 164 to 190 feet above mean sea level (msl). The topography in the Site and vicinity were modified in the late 1800's early 1900s by gold mining dredge operations which removed materials from the nearby Feather River. The dredging resulted in placement of sand and gravel with cobbles and occasional boulders derived from the Feather River onto the adjacent flood plain, including the Site. As a result, the Site ground surface is approximately 20 to 30 feet higher than property located to the north, across Oro Dam Boulevard (California Department of Mines and Geology [CDMG], 1976).

The Site is underlain by fluvial deposits of the ancestral and modern Feather River flood plain about the foothills of the Sierra Nevada atop sediments composed of interbedded volcanoclastic deposits of gravel, sand, and tuff. Sediments of the Laguna Formation overlie the Mehrten Formation and are truncated by the Red Bluff formation above. Undivided Quaternary basin deposits from the Feather and ancestral Feather River systems are present in the Feather River flood plain, with thickly and thinly bedded and interbedded clay, sand, and gravel deposits of fluvial origin.

2.5.2 Hydrogeology

Data regarding depth to groundwater and flow direction for the Site are not readily available. The State Water Resources Control Board (SWRCB) GeoTracker database includes reported groundwater depths for a nearby property located at 890 Oro Dam Boulevard at 6 to 14 feet below ground surface (bgs) (E2C Remediation, 2009), with a reported groundwater flow direction west-southwesterly, towards Feather River. This property is approximately 35 feet lower in elevation relative to the Site, which would result in depths to water beneath the Site ranging from approximately 41 to 49 feet bgs.

A shallow aquitard, consisting primarily of clay, is present in the Site vicinity at approximately 110 feet bgs. The Feather River is a groundwater discharge feature that is expected to impart a west-southwesterly flow influence on local groundwater.

2.5.3 Water Quality Survey

The Basin Plan prepared by the SWRCB and the Central Valley Regional Water Quality Control Board (CVRWQCB) describes current and future beneficial uses of groundwater beneath the Site and vicinity (CVRWQCB, 1998). The Site is located in the Upper Sacramento River Basin (5A) hydrologic area and Feather River (18020106) hydrologic unit. The Basin Plan designates

groundwater within the Site basin as having existing beneficial use for Municipal, Agricultural, Recreational, Freshwater and Wildlife Habitat.

2.6 IMPACT ON HUMAN HEALTH AND/OR THE ENVIRONMENT

Based on the available information, it is unclear whether residual concentrations of chemicals are present at the Site. The Site is currently used for commercial purposes, and the majority of the property is paved, so it is unlikely that there is an immediate risk to either human or ecological health. Site redevelopment for more productive commercial and light industrial use is desired.

Historical Site activities used hazardous constituents, which, if released to the environment, could threaten human and/or ecological health. To assess whether or not the historical Site activities present either a human health or ecological health risk, near surface and subsurface assessment should be conducted, and the results of sampling should be compared to applicable or relevant and appropriate requirements (ARARs) for the Site, which likely include commercial land use screening levels. The constituents of potential concern (COPC) associated with historical Site use, as well as the areas or features of potential concern (FOPC) are further discussed in the following text, as well as in the Work Plan for Phase II Subsurface Investigation (SCS, 2016).

3.0 PROJECT AND DATA QUALITY OBJECTIVES

3.1 PROJECT TASK AND PROBLEM DEFINITION

Historical Site operations may have resulted in the release of hazardous chemicals at the Site as identified in the Work Plan for Phase II Subsurface Investigation (SCS, 2016). In particular, the Phase I ESAs prepared for the Site identified the following FOPC associated with the Site including:

- Former Wood Treatment Areas (Dip Tanks and Green Chain Areas);
- Wood Waste Incinerator or “Teepee” Burner;
- Vehicle and Equipment Maintenance Areas;
- Above Ground and Underground Storage Tank (AST and UST) Areas;
- Electrical Transformers;
- Septic Systems;
- Miscellaneous Chemical Use and Storage Areas; and,
- Structures with Suspected Lead Based Paint (LBP) and Asbestos Containing Materials (ACM).

Although no subsurface investigations have been performed at the Site, SCS has identified the following COPC most commonly associated with the noted FOPC:

- Metals, particularly arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. The presence of metals in the Site subsurface would most likely be associated with vehicle and equipment maintenance operations, wood treatment areas, and miscellaneous chemical use and storage areas;
- Petroleum compounds such as gasoline, diesel fuel, motor oil, fuel oil, and waste oil. The primary use or storage areas for these compounds include the former USTs, ASTs, vehicle and equipment maintenance operations, septic systems and miscellaneous chemical use and storage areas;
- Volatile organic compounds (VOCs) including chlorinated solvents, solvent stabilizers, and thinners. The presence of VOCs in the Site subsurface would most likely be associated with vehicle and equipment operations, septic systems, and miscellaneous chemical use and storage areas;
- Semi-volatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs). The presence of SVOCs at the Site would most likely be associated with former wood treatment areas, vehicle and equipment maintenance operations, wood disposal/burning areas (Teepee Burner), and miscellaneous chemical use and storage areas;
- Creosote, pentachlorophenol (PCP), dioxins, and furans. The presence of creosote, PCP, dioxins and furans at the Site would most likely be associated with former wood treatment areas, vehicle and equipment maintenance operations, wood disposal/burning areas (Teepee Burner) and miscellaneous chemical use and storage areas;
- The presence of polychlorinated biphenyls (PCBs) at the Site would most likely be associated with electrical transformers present at the northern Site boundary.
- LBP and ACM would most likely be present on the surfaces, insulation, roofing tar, and as mastic on Site buildings.

Based upon the available information, SCS proposes a series of tasks, implemented in two primary phases, to evaluate the potential presence and extent of COPC in Site media including soil vapor, shallow and deeper soils and groundwater. Soil vapor, soil and/or shallow groundwater containing Site-related constituents of concern or COPC that pose a threat to human health or the environment must be appropriately characterized, and remediated.

Investigation is therefore proposed to characterize chemical use areas at the Site. Based upon the Investigation results, it may be necessary and advisable to then evaluate the potential risk(s) to human health and the environment, evaluate cleanup alternatives, and develop an approach toward mitigating unacceptable risks posed by residual COPC. As part of the Investigation, SCS will preliminarily evaluate risks posed by residual chemicals through comparison of analytical results with screening level, risk-based guidance criteria published by the USEPA (EPA, 2016), SFBRWQCB (SFBRWQCB, 2016), and/or the Office of Environmental Health Hazard Assessment (OEHHA, 2016), in the form of Regional Screening Levels (RSLs), Environmental Screening Levels (ESLs), and California Human Health Screening Levels (CHHSLs), respectively (see Appendix A).

In the event residual COPC are present at levels which exceed corresponding ESLs or CHHSLs for commercial/industrial Site use, SCS will then conduct further, specific evaluation of the potential risk(s) posed. Should soil vapor, soil, and/or groundwater impact(s) by residual COPC not exceed corresponding guidance criteria, SCS will recommend no further investigation or remediation occur. In either case, the recommended action will be presented to the City of Oroville, the USEPA and other involved regulatory agencies.

Based on the available data regarding historical Site activities and use, shallow soil vapor, surface and deeper soil sampling, and shallow groundwater sampling are planned for this investigation to evaluate whether surface or shallow releases of COPC have occurred. In addition, deeper soil and groundwater sampling is planned for areas of suspected use of more mobile chemicals, including the suspected/actual location(s) of ASTs, USTs, vehicle and machinery maintenance areas, and VOC and SVOC use areas.

All media sampling will be performed under the supervision of a California-licensed Professional Engineer or Professional Geologist.

3.1.1 Rationale

Table 3-1 below summarizes the sampling location, the rationale for sampling, the number of sample locations and samples to collect, and the intended analyses for each sample. The rationale is based on the identified FOPC, historical Site and/or chemical use, Site reconnaissance, and review of historical documents related to the Site. In some cases, additional information is needed to better evaluate the COPC associated with known or suspected use areas of concern, and this information will be ascertained during field visits for utility location and clearance.

Table 3-1: Site Areas or Features of Potential Concern, and Proposed Media Sampling Program

Site Location	Recommended Number of Sample Locations and Samples	Recommended Sample Depths	Sampling Media and Rationale	Recommended Analyses
Site-Wide VOC Survey	20 to 25 locations 22 to 27 Vapor Samples dependent upon initial sample results.	5 feet bgs	Soil Vapor – Direct push. Evaluate potential presence and extent of VOCs in shallow soil vapor. Use to help guide subsequent soil and groundwater investigation.	EPA Method 8260B, atmospheric gases, and leak detection compound
ASTs	2 locations Shallow and Deeper Soil and Groundwater Samples if	0.5 to 45 feet bgs	Soil – Hollow Stem Auger rig. Evaluate potential presence and vertical extent of	EPA Method 8015C with silica gel preparation and 8260B

	Warranted. Minimum of 3 soil Minimum of 1 groundwater (note, each deep boring may not have coincident grab water sample, depending upon field indicators)		TPH/VOCs. Water – Temporary Wells. Evaluate potential presence of TPH/VOCs in groundwater	
Former USTs	3 locations Shallow and Deeper Soil and Groundwater Samples if Warranted. Minimum of 6 soil Minimum of 2 groundwater (note, each deep boring may not have coincident grab water sample, depending upon field indicators)	5.0 to 45 feet bgs	Soil – Hollow Stem Auger rig. Evaluate potential presence and vertical extent of COPC. Water – Temporary Wells. Evaluate potential presence of COPC in groundwater	EPA Method 8015C with silica gel preparation and 8260B
Vehicle and Equipment Maintenance Areas	5 locations Shallow and Deeper Soil and Groundwater Samples if Warranted. Minimum of 10 soil Minimum of 2 groundwater	0.5 to 5.0 feet bgs.	Soil – Backhoe and Hollow Stem Auger rig as needed. Evaluate potential presence and vertical extent of COPC. Water – Temporary Well(s). Evaluate potential presence of COPC in groundwater.	EPA Method 8015C with silica gel preparation and 8260B, 8270, and 6010B/7400
Former Planing Mill Buildings and Lumber Storage Areas	5 locations Shallow and Deeper Soil and Groundwater Samples if Warranted. Minimum of 10 soil Minimum of 1 groundwater	0.5 to 5.0 feet bgs	Soil – Backhoe and Hollow Stem Auger rig as needed. Evaluate potential presence and vertical extent of COPC. Water – Temporary Well(s).	EPA Method 8015C with silica gel preparation and 8260B, 8270, and 6010B/7400

			Evaluate potential presence of SVOCs COPC in groundwater.	
Former "Teepee" Burner	4 locations Shallow Locations. Minimum of 4 soil	0.5 to 2.0 feet bgs	Soil - Backhoe or hand auger. Evaluate potential presence of residual dioxin and SVOCs.	EPA Methods 1613 and 8270
Former "Open" Electrical Transformers	2 locations Shallow Locations. Minimum of 2 soil	0.5 to 2.0 feet bgs	Soil - Backhoe or hand auger. Evaluate potential presence of residual PCBs and SVOCs.	EPA Methods 8082 and 8270
Former Wood Treatment and PCP Storage Areas	10 locations Shallow and Deeper Samples if Warranted. Minimum of 20 soil Minimum of 1 groundwater (note, one or more deep boring may be co-located with Oil House boring depending upon field indicators)	0.5 to 5.0 feet bgs.	Soil – Backhoe and Hollow Stem Auger rig as needed. Evaluate potential presence of residual PCBs, VOCs, and SVOCs. Water – Temporary Well(s). Evaluate potential presence and vertical extent of COPC in groundwater.	EPA Method 8015C with silica gel preparation and 8082, 8260B, 8270, and 6010B/7400
Former Electric Shop and Oil Houses	5 locations Shallow and Deeper Samples if Warranted. Minimum of 10 soil Minimum of 1 groundwater (note, one or more deep boring may be co-located with Wood Treatment boring depending upon field indicators)	0.5 to 45 feet bgs.	Soil – Backhoe and Hollow Stem Auger rig as needed. Evaluate potential presence and vertical extent of COPC. Water – Temporary Well(s). Evaluate potential presence of COPC in groundwater.	EPA Method 8015C with silica gel preparation and 8260B, 8270, and 6010B/7400
Hydraulically Up- and Downgradient Locations	2 locations Shallow and Deeper Samples if Warranted.	0.5 to 45 feet bgs	Soil – Hollow Stem Auger rig. Evaluate potential presence and vertical extent of	EPA Method 8015C with silica gel preparation and 8260B, 8270, and 6010B/7400

	Minimum of 6 soil Minimum of 2 groundwater		COPC. Water – Temporary Wells. Evaluate potential presence of COPC in groundwater.	
Structures with Suspected ACM and LBP; UW Survey	ACM: 200 LBP: 30 Universal Waste: observations only (no samples)	Surface and accessible building material sampling only	ACM: surfaces, insulation, roofing tar, mastic LBP: painted surfaces	ACM: PLM with Dispersion Staining. LBP: EPA Prep. Method 3050 and analysis by EPA Method 6010C

A minimum of 38 soil sample locations are proposed for this Investigation in the specific areas of interest mentioned above, with a minimum of 71 primary soil and 10 primary grab groundwater samples submitted for analysis (not including soil vapor and ACM/LBP samples). The work will also include analysis of approximately 27 soil vapor samples, 200 ACM samples, and 30 LBP samples. The sample program will also include collection and analysis of QA/QC samples in accordance with the protocol specified later in this FSP. IDW will also be sampled for disposal characterization purposes. The actual number of sample locations and collected samples will likely vary, based upon results from the shallow soils investigation and soil vapor survey, and the available budget for additional assessment work.

Soil vapor samples collected during this Investigation will be analyzed for the COPC identified in the above table. Each vapor sample will be chemically analyzed for:

- The complete suite of VOCs and TPHg by EPA Method 8260B using low method detection limits;
- Atmospheric gases including oxygen, carbon dioxide, and methane; and,
- The leak detection compound, 1,1-difluoroethane.

Soil samples will be analyzed as identified on the Sample Matrix Table above for one or more of the following analytes:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- BTEX compounds and naphthalene by EPA Method 8260B;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

The first phase of soil sampling and analysis will be performed immediately following the soil vapor survey, and will target near surface and shallow soils, to maximum depths of five feet bgs. The results of these two tasks will be used to guide and/or modify the subsequent phase of deeper soil sampling work, and grab groundwater sample collection and analysis.

During the second phase of field work, grab groundwater samples will be collected and analyzed as identified on the Sample Matrix Table above for one or more of the following analytes:

- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B; and
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation.
-

Concurrent with the second phase of field work, grab building material samples will be collected and analyzed as identified Sample Matrix Table above for one or more of the following analytes:

- Lead by XRF using EPA preparation Method 3050B and EPA Method 6010C; and,
- Asbestos by PLM with Dispersion Staining.

3.2 DATA QUALITY OBJECTIVES

The purpose of the proposed sampling program is to assess the presence, or possible presence, and concentration of COPC associated with known and potential releases from historical Site use activities as noted in Section 3.1 above. The collected data will be used to facilitate Site redevelopment and cleanup planning.

Tables 3-2 through 3-4 include the lists of target soil vapor, soil and groundwater COPC to be analyzed and their respective laboratory analytical methods, laboratory reporting limits, and action levels. SCS identified and applied the following hierarchy to the appropriate matrix: ESLs, CHHSLs, California-modified RSLs (lower of cancer or non-cancer based value) then USEPA RSL (lower of cancer or non-cancer based value) will be used as screening criteria for suspected COPC for each medium. RSLs¹ may also be considered as screening criteria for potential VOCs in soil and for those COPC without a corresponding ESL or CHHSL value. Copies of ESL, CHHSL, California-modified RSL and US EPA RSL tables are included in Appendix A with a determination (in bold) spreadsheet for matrixes based on the aforementioned hierarchy and criteria.

In addition, Total Threshold Limit Concentration (TTLC) values may be used as a characterization tool in case soils must be exported from the Site for disposal. If one or more of the COPC are reported to be present at concentrations above their action levels, then recommendations for further action, including additional assessment or remediation, will be made.

¹ *Regional Screening Levels (RSLs) Summary Table*, by Environmental Protection Agency (EPA), dated May 2016

**Table 3-2: Soil Vapor Matrix
Constituents of Potential Concern, Laboratory Reporting Limits, and Action Levels**

Constituents of Concern	Analytical Method	Laboratory Reporting Limits (µg/m³)	Action Levels (CHHSLs/ESLs) (µg/m³)
Dichlorodifluoromethane	EPA Method 8260B	100	100 ¹
Vinyl Chloride		100	44.8/160
Chloroethane		100	--/130,000,000
Trichlorofluoromethane		100	100 ¹
1,1-Dichloroethene		100	--/880,000
1,1,2-Trichloro-trifluoroethane		100	100 ¹
Methylene Chloride		100	--/26,000
trans-1,2-Dichloroethene		100	88,700 /260,000
1,1-Dichloroethane		100	--/7,700
cis-1,2-Dichloroethene		100	44,400/31,000
Chloroform		100	--/2,300
1,1,1-Trichloroethane		100	2,790,000/22,000,000
Carbon Tetrachloride		100	84.6/290
1,2-Dichloroethane		100	167/580
Benzene		80	122/420
Trichloroethene		100	1,770/3,000
Toluene		200	378,000/1,300,000
1,1,2-Trichloroethane		100	--/770
Tetrachloroethene		100	603/2,100
Ethylbenzene		100	--/4,900
1,1,1,2-Tetrachloroethane		100	-- /1,600
m,o,p-Xylene		200/100	879,000/440,000
1,1,2,2-Tetrachloroethane		100	--/210
Naphthalene		100	106/360
TPH as Gasoline		100	--/2,500,000
1,1-Difluoroethane (1, 1 DFA)		10,000	N/A

Notes:¹ RL = Laboratory Reporting Limit

N/A = Not Applicable

**Table 3-3: Soil Matrix
Constituents of Potential Concern, Laboratory Reporting Limits, and Action Levels**

Constituents of Concern	Analytical Methods	Laboratory Reporting Limits (in mg/kg)	Action Levels (ESL ¹ / CHHSL ² / DTSC ³ /EPA RSL ⁴ /RL ⁵ (in mg/kg)
Antimony	EPA Method 6010B/7400	0.75	4.70E+02 ^{1,4}
Arsenic		0.75* (MDL 0.3979205)	3.10E-01 ¹
Barium		0.50	2.20E+05 ¹
Beryllium		0.25	2.20E+03 ¹
Cadmium		0.50	5.80E+02 ¹
Chromium		0.25	n/a
Cobalt		0.25	3.50E+02 ^{1,4}
Copper		0.50	4.70E+04 ^{1,4}
Lead		0.50	3.20E+02 ^{1,4}
Mercury		0.05	1.90E+02 ¹
Molybdenum		0.25	5.80E+03 ¹
Nickel		0.25	1.10E+04 ¹
Selenium		0.75	5.80E+03 ^{1,4}
Silver		0.25	5.8E+03 ^{1,4}
Thallium		0.75	1.2E+01 ¹
Vanadium		0.25	6.0E+05 ¹
Zinc		1.00	3.5E+05 ¹
TPH-Diesel Range Organics (C10-C28)		1	1.1E+03 ¹
TPH (C10-C40)		1	1.0+00 ⁵
TPH-Motor Oil		10	1.4E+05 ¹
1,2,4-Trichlorobenzene	EPA Method 8270	0.330	1.1E+02 ¹
1,2-Dichlorobenzene		0.330	1.1E+04 ¹
1,2-Diphenylhydrazine		0.330	2.9E+00 ⁴
1,3-Dichlorobenzene		0.330	3.3E-01 ⁵
1,4-Dichlorobenzene		0.330	1.3E+01 ¹
1-Methylnaphthalene		0.330	3.3E-01 ⁵
2,4,5-Trichlorophenol		0.330	1.2E+05 ¹
2,4,6-Trichlorophenol		0.330	4.7E+01 ¹
2,4-Dichlorophenol		0.330	3.5E+03 ¹
2,4-Dimethylphenol		0.330	2.3E+04 ¹
2,4-Dinitrophenol		0.330	2.3E+03 ¹

2,4-Dinitrotoluene	0.330	1.1E+01 ¹
2,6-Dinitrotoluene	0.330	1.5E+00 ⁴
2-Chloronaphthalene	0.330	3.3E-01 ⁵
2-Chlorophenol	0.330	5.8E+03 ¹
2-Methylnaphthalene	0.330	3.0E+03 ¹
2-Methylphenol(o-Cresol)	0.330	3.3E-01 ⁵
2-Nitroaniline	0.330	8.0E+03 ⁴
2-Nitrophenol	0.330	3.3E-01 ⁵
3&4-Methylphenol	0.660	n/a 6.6E-01 ⁵
3,3-Dichlorobenzidine	0.330	2.7E+00 ¹
3-Nitroaniline	0.330	3.3E-01 ⁵
4,6-Dinitro-2-methylphenol	1.700	1.7E+00 ⁵
4-Bromophenylphenyl ether	0.330	3.3E-01 ⁵
4-Chloro-3-methylphenol	0.330	3.3E-01 ⁵
4-Chloroaniline	0.330	1.1E+01 ⁴
4-Chlorophenylphenyl ether	0.330	3.3E-01 ⁵
4-Nitroaniline	0.330	1.1E+02 ⁴
4-Nitrophenol	0.330	3.3E-01 ⁵
Acenaphthene	0.330	4.5E+04 ¹
Acenaphthylene	0.330	3.3E-01 ⁵
Anthracene	0.330	2.3E+05 ¹
Benzo(a)anthracene	0.330	2.9E+00 ¹
Benzo(a)pyrene	0.330	1.30E-01 ²
Benzo(b)fluoranthene	0.330	2.9E+00 ¹
Benzo(g,h,i)perylene	0.330	3.3E-01 ⁵
Benzo(k)fluoranthene	0.330	2.9E+01 ¹
Butylbenzylphthalate	0.330	1.2E+03 ⁴
Carbazole	0.330	3.3E-01 ⁵
Chrysene	0.330	2.6E+02 ¹
Di-n-butylphthalate	0.330	3.3E-01 ⁵
Di-n-octylphthalate	0.330	3.3E-01 ⁵
Dibenz(a,h)anthracene	0.330	2.9E-01 ¹
Dibenzofuran	0.330	3.3E-01 ⁵
Diethylphthalate	0.330	6.6E+05 ¹
Dimethylphthalate	0.330	3.3E-01 ⁵
Fluoranthene	0.330	3.0E+04 ¹
Fluorene	0.330	3.0E+04 ¹
Hexachloro-1,3-butadiene	0.330	5.3E+00 ³
Hexachlorobenzene	0.330	3.3E-01 ⁵

Hexachloroethane		0.330	3.3E-01 ⁵
Indeno(1,2,3-cd)pyrene		0.330	3.3E-01 ⁵
Isophorone		0.330	2.4E+03 ⁴
N-Nitroso-di-n-propylamine		0.330	3.3E-01 ⁴
N-Nitrosodimethylamine		0.330	3.4E-02 ⁴
N-Nitrosodiphenylamine		0.330	4.7E+02 ⁴
Naphthalene		0.330	7.9E+00 ¹
Nitrobenzene		0.330	2.2E+01 ⁴
Pentachlorophenol		0.670	4.0E+00 ¹
Phenanthrene		0.330	3.3E-01 ⁵
Phenol		0.330	3.5E+05 ¹
Pyrene		0.330	2.3E+04 ¹
bis(2-Chloroethoxy)methane		0.330	2.5E+03 ⁴
bis(2-Chloroethyl) ether		0.330	5.3E-01 ¹
bis(2-Chloroisopropyl)ether		0.330	1.6E+01 ¹
bis(2-Ethylhexyl)phthalate		0.330	1.6E+02 ¹
1,1,1,2-Tetrachloroethane	EPA Method 8260B	0.25	1.8E+01 ¹
1,1,1-Trichloroethane		0.25	8.9E+03 ¹
1,1,2,2-Tetrachloroethane		0.25	2.3E+00 ¹
1,1,2-Trichloroethane		0.25	4.2E+00 ¹
1,1,2-Trichlorotrifluoroethane		0.25	2.5E-01 ⁵
1,1-Dichloroethane		0.25	1.7E+01 ¹
1,1-Dichloroethene		0.25	4.0E+02 ¹
1,1-Dichloropropene		0.25	1.2E+00 ¹
1,2,3-Trichlorobenzene		0.25	3.1E+02 ³
1,2,3-Trichloropropane		0.25	2.1E-02 ³
1,2,4-Trichlorobenzene		0.25	1.1E+02 ¹
1,2,4-Trimethylbenzene		0.25	2.1E+02 ⁴
1,2-Dibromo-3-chloropropane		0.25	7.2E-02 ¹
1,2-Dibromoethane (EDB)		0.25	1.6E-01 ^{1,4}
1,2-Dichlorobenzene		0.25	1.1E+04 ¹
1,2-Dichloroethane		0.25	1.6E+00 ¹
1,2-Dichloroethene (Total)		0.25	2.5E-01 ⁵
1,2-Dichloropropane		0.25	3.9E+00 ¹
1,3,5-Trimethylbenzene		0.25	1.1E+03 ³
1,3-Dichlorobenzene		0.25	2.5E-01 ⁵
1,3-Dichloropropane		0.25	2.2E+03 ³

1,4-Dichlorobenzene	0.25	1.3E+01 ¹
2,2-Dichloropropane	0.25	2.5E-01 ⁵
2-Butanone (MEK)	2.5	2.5E-01 ⁵
2-Chloroethylvinyl ether	1	1.0E+00 ⁵
2-Chlorotoluene	0.25	2.5E-01 ⁵
2-Hexanone	2.5	2.5E+00 ⁵
4-Chlorotoluene	0.25	2.5E-01 ⁵
4-Methyl-2-pentanone (MIBK)	2.5	1.0E+00 ⁵
Acetone	2.5	6.3E+05 ¹
Acrolein	1	6.0E-01 ⁴
Acrylonitrile	2.5	3.0-01 ³
Benzene	0.25	1.0E+00 ¹
Bromobenzene	0.25	1.8E+03 ⁴
Bromochloromethane	0.25	6.3E+02 ⁴
Bromodichloromethane	0.25	2.3E+00 ¹
Bromoform	0.25	3.0E+02 ¹
Bromomethane	1	3.6E+01 ¹
Carbon tetrachloride	0.25	5.4E-01 ¹
Chlorobenzene	0.25	1.2E+03 ¹
Chloroethane	0.25	5.3E+04 ¹
Chloroform	0.25	1.3E+00 ¹
Chloromethane	0.25	4.3E+02 ¹
cis-1,2-Dichloroethene	0.25	9.0E+01 ¹
cis-1,3-Dichloropropene	0.25	2.5E-01 ⁵
Dibromochloromethane	0.25	3.9E+01 ¹
Dibromomethane	0.25	2.5E-01 ⁵
Dichlorodifluoromethane	0.25	2.5E-01 ⁵
Diisopropyl ether	0.25	9.4E+03 ⁴
Ethanol	2.5	2.5E+00 ⁵
Ethyl-tert-butyl ether	0.25	2.5E-01 ⁵
Ethylbenzene	0.25	2.2E+01 ¹
Gasoline Range Organics	50	5.0E+01 ⁵
Hexachloro-1,3-butadiene	0.25	5.3E+00 ³
Isopropylbenzene (Cumene)	0.25	2.5E-01 ⁵
m&p-Xylene	0.25	2.4E+03 ⁴
Methyl-tert-butyl ether	0.25	1.8E+02 ¹
Methylene Chloride	0.25	2.5E+01 ¹
Naphthalene	0.25	7.9E+00 ¹

n-Butylbenzene	0.25	6.4E+03 ⁴
n-Propylbenzene	0.25	2.5E-01 ⁵
o-Xylene	0.25	2.8E+03 ⁴
p-Isopropyltoluene	0.25	2.5E-01 ⁵
sec-Butylbenzene	0.25	1.2E+04 ⁴
Styrene	0.25	4.0E+04 ¹
tert-Amylmethyl ether	0.25	2.5E-01 ⁵
tert-Butyl Alcohol	0.25	2.5E-01 ⁵
tert-Butylbenzene	0.25	1.2E+05 ⁴
TPH as Gasoline	50	5.0E+01 ⁵
Tetrachloroethene	0.25	2.7E+00 ¹
Tetrahydrofuran	5	5.0E+00 ⁵
Toluene	0.25	4.6E+03 ¹
trans-1,2-Dichloroethene	0.25	2.5E-01 ⁵
trans-1,3-Dichloropropene	0.25	2.5E-01 ⁵
Trichloroethene	0.25	8.0E+00 ¹
Trichlorofluoromethane	0.25	5.4E+03 ³
Vinyl acetate	1	3.8E+03 ⁴
Vinyl chloride	0.25	1.5E-01 ¹
Xylene (Total)	0.5	2.4E+03 ¹

Notes:

¹ ESL = Environmental Screening Levels, San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), February 2016

² CHHSL = Soil- and Soil-Gas Screening Numbers (California Human Health Screening Levels or CHHSLs) Table 1 - Soil-Screening Numbers (mg/kg soil) for Nonvolatile Chemicals Based on Total Exposure to Contaminated Soil: Inhalation, Ingestion and Dermal Absorption; Table 3 - Soil-Gas-Screening Numbers for Volatile Chemicals below Buildings Constructed Without Engineered Fill below Sub-slab Gravel. Office of Environmental Health Hazard Assessment (OEHHA), accessed May, 2016.

³ DTSC = California Department of Toxic Substances Control (DTSC) DTSC-Modified Screening (Lower of cancer/non-cancer endpoint values) (Levels (DTSC-SLs) for Commercial/Industrial Soils, Based on The Human and Ecological Risk Office (HERO) Human Health and Risk Assessment Levels used first (; if none listed then, then US EPA Region Screening Levels (May 2016) for Industrial Soil (Column 4).

⁴ RSL = Environmental Protection Agency (EPA) Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) May 2016, Industrial Soil Screening Levels

⁵ RL = Laboratory Reporting Limit

* indicates that for those COPC for which the laboratory reporting limit exceeds the action level, SCS will request the laboratory use the MDL rather than the reporting limit in the final analytical report and "J" flag the result. Please note, even using the MDL, the arsenic results may still exceed the CHHSL.

**Table 3-4: Water Matrix
Constituents of Potential Concern, Laboratory Reporting Limits and Action Levels**

Constituents of Concern	Analytical Methods	Laboratory Reporting Limits (in µg/L)	Action Levels (ESL ¹ /DTSC ² /RSL ³ /RL ⁴)
Antimony	EPA Method 6010B/7400	15	7.8E+00 ³
Arsenic		15	8.2E-03 ²
Barium		10	3.8E+03 ³
Beryllium		1	1.0E+00 ⁴
Cadmium		1	9.2E+00 ³
Chromium		5	5.0E+00 ⁴
Cobalt		5	6.0E+00 ³
Copper		5	8.0E+02 ³
Lead		5	1.5E+01 ³
Mercury		0.2	6.3E-01 ³
Molybdenum		5	1.0E+02 ³
Nickel		5	5.0E+00 ⁴
Selenium		15	1.0E+02 ³
Silver		5	9.4E+01 ³
Thallium		15	1.5E+01 ⁴
Vanadium		5	5.0E+00 ⁴
Zinc		10	6.0E+03 ³
TPH-Diesel Range Organics (C10-C28)	EPA Method 8015C	50	5.0E+01 ⁴
TPH (C10-C40)		50	5.0E+01 ⁴
TPH-Motor Oil		100	1.0E+02 ⁴
1,2,4-Trichlorobenzene	EPA Method 8270	10* (MDL=2.25E+00)	1.2E+00 ³
1,2-Dichlorobenzene		10	3.0E+02 ³
1,2-Diphenylhydrazine		10* (MDL=2.72E+00)	7.8E-02 ³
1,3-Dichlorobenzene		10	1.0E+01 ⁴
1,4-Dichlorobenzene		10* (MDL=2.15E+00)	4.8E-01 ³
1-Methylnaphthalene		10	1.0E+01 ⁴
2,4,5-Trichlorophenol		10	1.2E+05 ³
2,4,6-Trichlorophenol		10	6.3E-01 ²
2,4-Dichlorophenol		10	1.0E+01 ⁴
2,4-Dimethylphenol		10	3.6E+02 ³

2,4-Dinitrophenol	10	3.9E+00 ³
2,4-Dinitrotoluene	10	2.4E-01 ³
2,6-Dinitrotoluene	10	4.9E-02 ³
2-Chloronaphthalene	10	1.0E+01 ⁴
2-Chlorophenol	10	2.9+01 ²
2-Methylnaphthalene	10	1.0E+01 ⁴
2-Methylphenol(o-Cresol)	10	1.0E+01 ⁴
2-Nitroaniline	10	1.9E+02 ³
2-Nitrophenol	50	5.0E+01 ⁴
3&4-Methylphenol	10	1.0E+01 ⁴
3,3-Dichlorobenzidine	50	1.3E-01 ³
3-Nitroaniline	10	1.0E+01 ⁴
4,6-Dinitro-2-methylphenol	10	1.0E+01 ⁴
4-Bromophenylphenyl ether	10	1.0E+01 ⁴
4-Chloro-3-methylphenol	10	1.0E+01 ⁴
4-Chloroaniline	10	3.8E+00 ⁴
4-Chlorophenylphenyl ether	10	1.0E+01 ⁴
4-Nitroaniline	10	3.8E+00 ³
4-Nitrophenol	10	1.0E+01 ⁴
Acenaphthene	10	1.0E+01 ⁴
Acenaphthylene	10	1.0E+01 ⁴
Anthracene	10	1.0E+01 ⁴
Benzo(a)anthracene	10	1.0E+01 ⁴
Benzo(a)pyrene	10	1.0E+01 ⁴
Benzo(b)fluoranthene	10	1.0E+01 ⁴
Benzo(g,h,i)perylene	10	1.0E+01 ⁴
Benzo(k)fluoranthene	10	1.0E+01 ⁴
Butylbenzylphthalate	10	1.0E+01 ⁴
Carbazole	10	1.0E+01 ⁴
Chrysene	10	1.0E+01 ⁴
Di-n-butylphthalate	10	1.0E+01 ⁴
Di-n-octylphthalate	10	1.0E+01 ⁴
Dibenz(a,h)anthracene	10	1.0E+01 ⁴
Dibenzofuran	10	1.0E+01 ⁴
Diethylphthalate	10	1.0E+01 ⁴
Dimethylphthalate	10	1.0E+01 ⁴
Fluoranthene	10	1.0E+01 ⁴
Fluorene	10	1.2E+03 ³
Hexachloro-1,3-butadiene	10	1.0E+01 ⁴
Hexachlorobenzene	10	1.0E+01 ⁴
Hexachloroethane	10	1.0E+01 ⁴

Indeno(1,2,3-cd)pyrene		10	1.0E+01 ⁴
Isophorone		10	1.0E+01 ⁴
N-Nitroso-di-n-propylamine		10	1.1E-02 ³
N-Nitrosodimethylamine		10	1.1E-04 ³
N-Nitrosodiphenylamine		10	1.2E+01 ³
Naphthalene		10	1.0E+01 ⁴
Nitrobenzene		10	1.4E-01 ³
Pentachlorophenol		20	4.1E-02 ³
Phenanthrene		10	1.0E+01 ⁴
Phenol		10	5.8E+03 ³
Pyrene		10	1.2E+02 ³
bis(2-Chloroethoxy)methane		10	5.9E+01 ³
bis(2-Chloroethyl) ether		10	1.4E-02 ³
bis(2-Chloroisopropyl)ether		10	1.0E+01 ⁴
bis(2-Ethylhexyl)phthalate		10	5.6E+00 ³
1,1,1,2-Tetrachloroethane	EPA Method 8260B	0.50	5.7E-01
1,1,1-Trichloroethane		0.50	2.0E+03 ²
1,1,2,2-Tetrachloroethane		0.50	7.6E-02 ³
1,1,2-Trichloroethane		0.50	2.8E-01 ³
1,1,2-Trichlorotrifluoroethane		0.50	5.0E-01 ⁴
1,1-Dichloroethane		0.50	1.8E+02 ¹
1,1-Dichloroethene		0.50	1.4E+03 ¹
1,1-Dichloropropene		0.50	5.0E-01 ⁴
1,2,3-Trichlorobenzene		0.50	2.0E+03 ¹
1,2,3-Trichloropropane		0.50	2.0E-04 ²
1,2,4-Trichlorobenzene		0.50	1.2E+00 ³
1,2,4-Trimethylbenzene		0.50	1.5E+01 ³
1,2-Dibromo-3-chloropropane		0.50	5.0E-01 ⁴
1,2-Dibromoethane (EDB)		0.50	7.4E+00 ¹
1,2-Dichlorobenzene		0.50	1.0E+05 ¹
1,2-Dichloroethane		0.50	5.3E+01 ¹
1,2-Dichloroethene (Total)		0.50	5.0E-01 ⁴
1,2-Dichloropropane		0.50	5.0E-01 ⁴
1,3,5-Trimethylbenzene		0.50	1.2E+02 ³
1,3-Dichlorobenzene		0.50	5.0E-01 ⁴
1,3-Dichloropropane		0.50	3.7E+02 ³
1,4-Dichlorobenzene		0.50	4.8E-01 ³
2,2-Dichloropropane		0.50	5.0E-01 ⁴

2-Butanone (MEK)	5.0	5.0E+00 ⁴
2-Chloroethylvinyl ether	5.0	5.0E+00 ⁴
2-Chlorotoluene	1.0	1.0E+00 ⁴
2-Hexanone	5.0	3.8E+01 ³
4-Chlorotoluene	1.0	3.8E+01 ³
4-Methyl-2-pentanone (MIBK)	5.0	5.0E+00 ⁴
Acetone	5.0	2.90E+08 ¹
Acrolein	5.0	4.2E-02 ³
Acrylonitrile	5.0	1.5E-02 ²
Benzene	0.50	9.7E+00 ¹
Bromobenzene	0.50	6.2E+01 ³
Bromochloromethane	0.50	8.3E+01 ³
Bromodichloromethane	0.50	1.3E-01 ³
Bromoform	0.50	2.9E+00 ²
Bromomethane	20.0	3.0E+02 ¹
Carbon tetrachloride	0.50	1.0E-01 ²
Chlorobenzene	0.50	1.2E+04 ¹
Chloroethane	0.50	5.0E-01 ⁴
Chloroform	0.50	2.0E+01 ¹
Chloromethane	0.50	3.7E+03 ¹
cis-1,2-Dichloroethene	0.50	5.0E-01 ⁴
cis-1,3-Dichloropropene	0.50	5.0E-01 ⁴
Dibromochloromethane	0.50	2.0E-01 ²
Dibromomethane	0.50	5.0E-01 ⁴
Dichlorodifluoromethane	0.50	2.0E+02 ³
Diisopropyl ether	0.50	1.5E+03 ³
Ethanol	5.0	5.0E-01 ⁴
Ethyl-tert-butyl ether	0.50	5.0E-01 ⁴
Ethylbenzene	0.50	1.5E+00 ³
Gasoline Range Organics	50.0	5.0E+01 ⁴
Hexachloro-1,3-butadiene	0.50	5.0E-01 ⁴
Isopropylbenzene (Cumene)	0.50	5.0E-01 ⁴
m&p-Xylene	0.50	1.9E+02 ³
Methyl-tert-butyl ether	0.50	1.1E+04
Methylene Chloride	5.0	4.2E+02 ¹
Naphthalene	0.50	1.7E+02 ¹
n-Butylbenzene	0.50	5.0E-01 ⁴
n-Propylbenzene	0.50	6.6E+02 ³
o-Xylene	0.50	1.9E+02 ³
p-Isopropyltoluene	0.50	5.0E-01 ⁴
sec-Butylbenzene	0.50	5.9E+02 ²

Styrene		0.50	2.5E+05 ¹
tert-Amylmethyl ether		0.50	5.0E-01 ⁴
tert-Butyl Alcohol		5.0	5.0E+00 ⁴
tert-Butylbenzene		0.50	6.9E+02 ³
TPH as Gas		50.0	5.0E+01 ⁴
Tetrachloroethene		0.50	2.6E+01 ¹
Tetrahydrofuran		5.0	5.0E+01 ⁴
Toluene		0.50	3.0E+04 ¹
trans-1,2-Dichloroethene		0.50	7.9E+03 ¹
trans-1,3-Dichloropropene		0.50	5.0E-01 ⁴
Trichloroethene		0.50	4.9E+01 ¹
Trichlorofluoromethane		0.50	1.7E+03 ²
Vinyl acetate		5.0	4.1E+02 ³
Vinyl chloride		0.50	5.3E-01 ¹
Xylene (Total)		1.0	1.1E+04 ¹

Notes:

¹ ESL = Environmental Screening Levels, San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), February 2016

² DTSC = California Department of Toxic Substances Control (DTSC) Human and Ecological Risk (HERO) Human Health Risk Assessment (HHRA) Note, Number: 3. DTSC-modified Screening Levels (DTSC-SLs); Lower of cancer/non-cancer endpoint values, January 2016, Screening Levels for Tap Water.

³ RSL = Environmental Protection Agency (EPA) Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) May 2016, Tap Water Screening Levels

⁴ RL = Laboratory Reporting Limit

* indicates that for those COPCs for which the laboratory reporting limit exceeds the action level, SCS will request the laboratory use the MDL rather than the reporting limit in the final analytical report and "J" flag the result

3.3 MEASUREMENT QUALITY OBJECTIVES

Measurement Quality Objectives or MQOs are criteria established to assess the viability and usability of data. These are based on both field and laboratory protocols that examine whether the data quality indicators (DQIs) (i.e., precision, accuracy, representativeness, completeness, comparability, and sensitivity [PARCCS]) meet criteria established for various aspects of data gathering, sampling, or analysis activity. In defining the MQOs, the level of uncertainty associated with each measurement is defined.

The values assigned to the quantitative data quality indicators (precision, accuracy, completeness and sensitivity) and statements concerning the qualitative indicators (representativeness and comparability) are based upon the DQOs established in Section 3.2. Project-specific requirements for PARCCS are discussed below. Laboratory standard operating procedures (SOPs) are also included in the QAPP and are referenced below.

3.3.1 Precision

Precision is a quantitative measure of how reproducible a specific set of data may be. Precision is addressed in Section 10.5 and in the Pace Quality Systems Manual that is included in the QAPP.

Also, refer to the SOPs in the Revised QAPP Appendix for each analytical procedure proposed for the specific Matrix Spike and Blank Spike/Laboratory Control Sample percent recovery acceptance limits and acceptable relative percent differences (RPD).

The following laboratory quality control (QC) samples are to be utilized:

- A method blank will be performed with each analytical batch of samples.
- At least one Matrix Spike (MS) and one Matrix Spike Duplicate (MSD) will be analyzed per analytical batch (if not enough sample is available for a matrix spike, then a Laboratory Control Sample or LCS and a Laboratory Control Sample Duplicate or LCSD will be used as QC samples).
- Surrogates will be run on all organic analysis including spikes and blanks. If surrogate recoveries are outside their specified control limits, corrective action will be implemented as specified in the individual method SOPs.

The following field QC samples are to be utilized:

- A blind duplicate sample will be collected for each media at a frequency of one blind duplicate (BD) for every 10 samples (each medium) submitted for chemical analysis. Blind duplicates will be labeled with a unique sample number.
- Equipment blanks will be collected at a frequency of one blank per matrix per day or one blank per matrix per 20 samples, whichever is more frequent.

3.3.2 Accuracy

Accuracy is quantitative measure of how well measurements reflect what is actually in the sample. Accuracy is addressed in the Pace Quality Systems Manual. Also, refer to the Pace SOPs in Appendix for each analytical procedure to be performed, including the specific Matrix Spike and Blank Spike/Laboratory Control Sample percent recovery acceptance limits. The laboratory QC samples to be utilized are discussed above.

QC samples to assess potential sample contamination from the field activities or laboratory contaminants will be addressed by the use of equipment blanks to be collected at the Site and a method blank will be analyzed with each batch of samples as discussed in the Pace Quality Systems Manual. The acceptance of the equipment blank and the method blank will be set at equal or less than the method reporting limit or MRL.

3.3.3 Representativeness

Representativeness is the measure that can be both qualitative and quantitative of how well the sample data reflect the environmental conditions. Because the Site is a former wood treatment facility, the potential presence of COPC associated with this use, if present, are expected to be present primarily in those historic use areas, rather than being distributed across the entire Site. Similarly, the other COPC associated with historical Site activities (Teepee Burner, transformers, septic system, USTs and ASTs and vehicle and machine maintenance areas), if present, are expected to be located near the historic use areas or FOPC.

The physical characteristics of each COPC also affects their likely distribution in the subsurface. The FOPC which historically stored or used gasoline and VOCs will be evaluated by first conducting soil vapor sampling, followed by soil and/or grab groundwater sampling as needed to characterize the potential presence of these constituents in deeper soil and groundwater. The methods for collecting soil vapor, shallow and deeper soil, and grab groundwater samples are described in the SOPs attached at the conclusion of the Revised QAPP.

Those FOPC which historically used or stored less mobile constituents will be evaluated through near surface and shallow soils investigations to depths of approximately three feet bgs, and only deeper as warranted by the resulting analytical data.

To collect samples representative of shallow Site soil conditions, SCS will collect soil samples will from four depths (0.5, 1.5, 3, and 4.5 feet bgs) from 21 locations and from depths of 0.5 to 2 feet from six locations in proximity to particular FOPC.

Those FOPC which represent areas of elevated residual COPC (based upon the first phase of field work) and/or which may have been subject to use and release of more mobile COPC will be investigated, assuming sufficient Grant funding is available, in a second phase of investigation targeting collection of soil and grab groundwater samples, to estimated depths of 45 feet bgs.

SCS did not observe stockpiled soil at the Site, and therefore does not anticipate conducting selecting systematic random sampling locations and depths. However, samples of IDW will be collected and chemically analyzed for waste profiling purposes to facilitate appropriate handling and disposal of IDW.

Soil vapor, shallow soil, deeper soil, grab groundwater, and IDW materials will be sampled as described in the SOPs included as part of the Revised QAPP. The SCS field personnel will follow COC procedures described in the SOP included in the Revised QAPP for sample preservation, handling and tracking.

As previously discussed, a blind duplicate sample will be collected at a frequency of one blind duplicate for every 10 samples, and equipment blanks will be collected at a frequency of one blank per matrix per day or one blank per matrix per twenty samples, whichever is more frequent.

Representativeness is addressed in the Pace Quality Systems Manual. Also, refer to the Pace SOPs for each proposed analysis for the method sample containers, preservation methods, and holding times.

3.3.4 Completeness

Completeness is a measure of the amount of data to be collected that is essential to meet the project objectives. Since there are no subsurface analytical data available for the Site, the proposed sampling will need to yield sufficient, useable data to adequately assess the presence, or possible presence, and concentration of COPC associated with potential releases from historical land use.

Given that no data are available to date for the Site, a completeness of 90 percent will be acceptable. No specific sample locations are considered more critical than any of the others; therefore, if for some reason a proposed location cannot be sampled and/or relocated to an area near the originally proposed locations, this will not require remobilization to the Site for additional sampling.

3.3.5 Comparability

Comparability is a qualitative measurement of how similar project data need to be to those collected from other studies, similar locations within the same study, same sampling locations at different times of the year, etc. The purpose of the proposed sampling is to assess the presence, or possible presence, and concentration of COPC associated with potential releases from historical land uses, and to collect sufficient data for redevelopment and cleanup planning. Since there are no available and useable data for the Site, the measure of comparability will be focused on the proposed sampling to yield sufficient, useable data necessary to meet the sampling objectives. Since all the samples will be collected over the course of a few weeks by SCS and analyses will be conducted by the same laboratories, the data will have a very high level of comparability.

3.3.6 Sensitivity

Sensitivity is a quantitative measure of field and/or laboratory methods used to assess if the resulting data are of a quality (low enough quantitation limits) that will be sensitive enough to quantify COPC at or below regulatory standards or action levels. Sensitivity is addressed in the Pace Quality Systems Manual. Also, refer to the Pace method sheets for each analytical procedure proposed for the method detection limits and reporting limits.

Where appropriate, COPC will be reported below the laboratory reporting limits, and these data will be “J Flagged” to note the results are below the reporting limit and above the MDLs. The previous Accuracy and Precision sections discuss QC samples to be collected and acceptance limits.

3.4 DATA REVIEW AND VALIDATION

Pursuant to the Pace Quality Systems Manual, data processing and validation within the analytical laboratory ensure that the reported results will correctly represent the analyses performed. This function has two primary activities:

- The processing of QC sample results to demonstrate that analyses are within laboratory prescribed bounds for accuracy, precision, and completeness.
- Sample reduction and validation to demonstrate that numerical computation of data is correct and that it is correctly reported.

Pace will review sample management, analysis, and reporting pursuant to the Pace Quality Systems Manual in order to meet the DQIs as presented in Section 3.3. Results and variances from the DQIs will be reported with the laboratory reports.

The SCS Program Manager and QA Officer will review staff field notes of field sampling methodologies and laboratory reports for compliance with SCS SOPs and those reviews will be documented in the project file.

Data that do not meet DQOs will be flagged and discussed in the Summary Report prepared at the conclusion of field work. The actions taken to address the data that do not meet DQOs will be presented, including the rejection of the data and exclusion from consideration during the preparation of the Summary Report; a description of reasoning why the data may still be used even though they do not meet DQOs; or steps taken to re-analyze samples or return to the Site to re-sample.

3.5 DATA MANAGEMENT

Pace will follow the procedures in the Pace Quality Systems Manual for proper data management from receipt of samples with a properly completed COC to reporting of final laboratory data and QA/QC control data in its final Report.

The SCS Program Manager and QA Officer will review staff field notes of field sampling methodologies, COC documentation, and laboratory reports for compliance with SCS SOPs. Reviews will be documented in the project file. Transfer of data from laboratory reports to tables, figures, and report text will be reviewed by the SCS technical editor for accuracy and documented on a standard SCS review form. A final review of the Phase II ESA Summary Report, including data, will be performed by the Program Manager and documented on a standard SCS review form.

3.6 ASSESSMENT OVERSIGHT

A pre-mobilization meeting will be held prior to fieldwork. During this meeting, the Program Manager, Field Team Leader and Field Team will review the Revised FSP, Revised QAPP, HASP, unanticipated discovery plan (UDP), and project objectives. The SCS Program Manager and Field Team Leader will both supervise field activities, while the Program Manager and QA Officer will review staff field notes of field sampling methodologies, COC documents, and laboratory reports for compliance with SCS SOPs. Reviews will be documented in the project file.

Transfer of data from laboratory reports to tables, figures, and Summary Report text will be reviewed by the SCS technical editor for accuracy and documented on a standard SCS review form. A final review of the Summary Report, including data, will be performed by the Program Manager and documented on a standard SCS review form. At any time during the project, the Program Manager or QA Officer has the authority to direct that corrective actions be taken if it is deemed necessary.

SCS has implemented a Quality Management System (QMS). As part of the QMS, selected completed projects are audited for compliance with SCS procedures, including health and safety procedures and quality control protocols. During the auditing process, the QA Officer or

designee randomly selects completed projects for a detailed review for adherence to the QMS. The following is a short description of the QMS.

3.6.1 SCS Quality Management System

SCS has implemented a QMS that conforms to *EPA Requirements for Quality Management Plans*, EPA QA/R-2, EPA/240/B-01/002, reissued May 2006 (EPA, 2006). The purpose of the QMS is to provide the framework to plan, implement, and assess the effectiveness of QA and QC operations within SCS. The QMS addresses all aspects of work performed by SCS and is fundamental to SCS' vision of being the environmental firm of choice for clients and employees.

Our overall objective is to provide quality solutions to environmental problems in an ethical manner. Briefly summarized, the QMS requires that SCS staff and subcontractors have the necessary training and skills, use the proper tools, and employ sound procedures to conduct work safely and appropriately. SCS continuously seeks to improve the quality of the services we deliver by checking our work, considering new technologies and work processes, and documenting compliance with the QMS.

In accordance with EPA guidance, the QMS specifies standards and procedures regarding the following quality management plan elements:

1. Quality Policy
2. Organization and Authority
3. Quality System Components
4. Personnel Qualifications and Training
5. Procurement of Items and Services
6. Documents and Records
7. Computer Hardware and Software
8. Planning
9. Implementation
10. Assessment and Response
11. Quality Improvement

A copy of the SCS 2015 QMS program description is included as Appendix A to this FSP.

4.0 SAMPLING DESIGN AND RATIONALE

The following sections describe the specifics of and rationale for the proposed media sampling.

4.1 SOIL VAPOR SAMPLING

The purpose of the proposed soil vapor sampling is to assess the presence, or possible presence, and concentration of COPC associated with historic Site use, which included the use, storage and

handling of VOCs. To accomplish this, SCS will collect shallow soil vapor samples from depths of five feet bgs across the Site to assess potential impacts from historical land use involving volatile compounds, primarily solvents and petroleum hydrocarbons. The proposed soil vapor sampling locations are shown on Figure 2.

Vapor samples will be analyzed for the following:

- The complete suite of VOCs and TPHg by EPA Method 8260B using low method detection limits;
- Atmospheric gases including oxygen, carbon dioxide, and methane; and,
- The leak detection compound, 1,1-difluoroethane.

The soil vapor sampling task will include analysis of collected vapor samples by an on-Site mobile laboratory, to allow assessment of shallow soil vapor conditions in real time. The resulting data will be used to evaluate the need for and location of possible additional or step-out vapor samples in areas where the primary soil vapor sample yields COPC at or above applicable human health risk-based screening levels.

**Table 4-1: Soil Vapor Matrix
Sampling Design and Rationale**

Sampling Location/ID Number	Depth (ft bgs)	COPC and Analytical Methods	Rationale
SVS-01 through SVS-27	5.0*	VOCs 8260B, oxygen, carbon dioxide, methane, 1,1-difluoroethane	To assess potential impacts from historical Site operations, soil vapor samples will be collected from FOPC. Results will be compared with risk based screening values to determine whether step out vapor sample locations are warranted.

Notes:

ft bgs = feet below ground surface

* = approximate target depth; actual depths may vary slightly due to soil pore water and pressure conditions.

4.2 SOIL SAMPLING

The purpose of the proposed soil sampling is to assess the presence, or possible presence, and concentration of COPC associated with historic Site activities. The work will include collecting near surface and shallow soil samples from FOPC, followed by collection and analysis of soil samples from greater depths, based upon the results of the shallow soil sampling and soil vapor sampling activities described in Section 4.1. The proposed shallow soil sampling locations are shown on Figure 2.

Near surface and shallow soil samples will be analyzed as identified on the Sample Matrix Table below for one or more of the following analytes:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;

- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

The first phase of soil sampling and analysis will be performed immediately following the soil vapor survey, and will target near surface and shallow soils, to maximum depths of five feet bgs. The results of these two tasks will be used to guide and/or modify the subsequent phase of deeper soil sampling work, and grab groundwater sample collection and analysis.

Deeper soil samples will be collected for analysis based upon the results of the near surface and shallow soil sampling program, assuming sufficient Grant budget. The deeper soil samples will be analyzed as identified on the Sample Matrix Table below for one or more of the following analytes:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

**Table 4-2: Soil Matrix
Sampling Design and Rationale**

FOPC	Sampling Location/ID Number of Primary Samples	Depth (ft bgs)	COPC and Analytical Methods	Rationale
Vehicle and Equipment Maintenance Areas	5 locations 10 soil Deeper Samples if warranted. MS1-01 MS2-01 MAS-01 MAS-02 MAS-03	0.5, 1.5, 3.0, and 4.5 feet bgs using backhoe with narrow bucket.	TPHd and TPHmo by EPA Method 8015C with silica gel preparation, VOCs by 8260B, SVOCs by EPA Method 8270, and CAM 17 metals by 6010B/7400.	To evaluate potential presence of residual metals, TPH, VOCs, SVOCs and metals from past vehicle and equipment use/maintenance operations. Initially, only the samples collected from 0.5- and 1.5-ft bgs will be analyzed, and the 3.0- and 4.5-ft bgs samples will be held. If the 0.5- and 1.5-foot samples from a location contain COPC concentrations above applicable screening values, then the 3.0- and 4.5-foot samples will be analyzed. In the event the 4.5-foot samples yield elevated COPC, then the Project Officer shall be consulted to discuss the feasibility of further investigation.
Former Planing Mill Buildings and Lumber	5 locations 10 soil Deeper Samples if	0.5, 1.5, 3.0, and 4.5 feet bgs using	TPHd and TPHmo by EPA Method 8015C with	To evaluate potential presence of residual metals, TPH, VOCs, SVOCs, and metals from past planing mill/wood treatment operations. Initially, only the samples collected from 0.5- and 1.5-ft bgs will be analyzed, and the 3.0- and

FOPC	Sampling Location/ID Number of Primary Samples	Depth (ft bgs)	COPC and Analytical Methods	Rationale
Storage Areas	warranted. PM1-01 PM1-02 PM1-03 PM2-01 LS1-01	backhoe with narrow bucket.	silica gel preparation, VOCs by EPA Method 8260B, SVOCs by EPA Method 8270, and CAM 17 metals by EPA Method 6010B/7400	4.5-ft bgs samples will be held. If the 0.5- and 1.5-foot samples from a location contain COPC concentrations above applicable screening values, then the 3.0- and 4.5-foot samples will be analyzed. In the event the 4.5-foot samples yield elevated COPC, then the Project Officer shall be consulted to discuss the feasibility of further investigation.
Former "TeePee" Burner	4 locations 4 soil TPB-01 TPB-02 TPB-03 TPB-04	0.5 and 1.5 feet bgs using hand auger.	DLCs by EPA Method 1613 and SVOCs by EPA Method 8270.	To evaluate potential presence of residual dioxin, furans and PAH compounds from past wood disposal/burning operations. Initially, only the samples collected from 0.5-ft bgs will be analyzed, and the 1.5-ft bgs samples will be held. If the 0.5-foot sample from a location contains COPC concentrations above applicable screening values, then the 1.5-foot sample will be analyzed.
Former "Open" Electrical Transformers	2 locations 2 soil OTF-01 OTF-02	0.5 and 1.5 feet bgs using hand auger.	PCBs EPA Method 8082 and SVOCs by EPA Method 8270.	Evaluate potential presence of residual PCBs and PAH compounds from past transformer operation. Initially, only the samples collected from 0.5-ft bgs will be analyzed for the noted COPC, and the 1.5-ft bgs samples will be held. If the 0.5-foot sample from a location contains COPC concentrations above applicable screening values, then the 1.5-foot samples will be analyzed. In the event the 1.5 foot samples yield elevated COPC, then the Project Officer shall be consulted to discuss the feasibility of further investigation.
Former Wood Treatment and Lumber Storage Areas	10 locations 20 soil Deeper Samples if warranted. WTR-01 WTR-02 WTR-03 WTR-04 WTR-05 WTR-06 WTR-07 WTR-08	0.5, 1.5, 3.0, and 4.5 feet bgs using backhoe with a narrow bucket.	TPHd and TPHmo by EPA Method 8015C with silica gel preparation, VOCs by EPA Method 8260B, SVOCs by EPA Method 8270, PCBs by EPA Method	To evaluate potential presence of residual metals, TPH, VOCs, SVOCs and metals from past wood treating operations. Initially, only the samples collected from 0.5- and 1.5-ft bgs will be analyzed, and the 3.0- and 4.5-ft bgs samples will be held. If the 0.5- and 1.5-foot samples from a location contain COPC concentrations above applicable screening values, then the 3.0- and 4.5-foot samples will be analyzed. In the event the 4.5-foot samples yield elevated COPC, then the Project Officer shall be consulted to discuss the feasibility of further investigation. ..

FOPC	Sampling Location/ID Number of Primary Samples	Depth (ft bgs)	COPC and Analytical Methods	Rationale
	WTR-09 WTR-10 LS1-01		8082, and CAM 17 metals by EPA Method 6010B/7400	
Former Electric Shop and Oil Houses	5 locations 10 Soil Deeper Samples if Warranted ELS-01 ELS-02 OH1-01 OH2-01 OH3-01	0.5, 1.5, 3.0, and 4.5 feet bgs using backhoe with a narrow bucket.	EPA Method 8015C with silica gel preparation, VOCs by EPA Method 8260B, SVOCs by EPA Method 8270, and CAM 17 metals by EPA Method 6010B/7400	To evaluate potential presence of residual metals, TPH, VOCs, SVOCs, PCBs, and metals from past electric shop and oil house operations. Initially, only the samples collected from 0.5- and 1.5-ft bgs will be analyzed, and the 3.0- and 4.5-ft bgs samples will be held. If the 0.5- and 1.5-foot samples from a location contain COPC concentrations above applicable screening values, then the 3.0- and 4.5-foot samples will be analyzed. In the event the 4.5-foot samples yield elevated COPC, then the Project Officer shall be consulted to discuss the feasibility of further investigation..
ASTs	2 locations 3 soil Analyze Samples as Warranted. AST-01 AST-02	0.5, to 45 feet bgs.	TPHd and TPHmo by EPA Method 8015C with silica gel preparation and VOCs by EPA Method 8260B.	To evaluate the potential presence of residual hydrocarbons (TPHg, TPHd, TPHmo) from use of ASTs. Conduct investigation during second phase of work using Hollow Stem Auger Methods to assess soil and groundwater. Select soil samples for analysis based upon field indicators including soil staining, odors, and photoionization detector readings.
Former USTs	3 locations 6 soil samples Analyze Samples as Warranted. UST-01 UST-02 UST-03	5.0 to 45 feet bgs	TPHd and TPHmo by EPA Method 8015C with silica gel preparation and VOCs by EPA Method 8260B.	To evaluate the potential presence of residual hydrocarbons (TPHg, TPHd, TPHmo) from use of former USTs. Conduct investigation based upon results from soil vapor survey, during second phase of work. Select soil samples for analysis based upon field indicators including soil staining, odors, and photoionization detector readings. Perform deeper investigation using Hollow Stem Auger Methods to assess underlying soil and groundwater.

FOPC	Sampling Location/ID Number of Primary Samples	Depth (ft bgs)	COPC and Analytical Methods	Rationale
Hydraulically Up- and Downgradient Locations	2 locations 6 samples Analyze Samples as Warranted UG-01 DG-01	5.0 to 45 feet bgs	TPHd and TPHmo by EPA Method 8015C with silica gel cleanup, VOCs by EPA Method 8260, SVOCs by EPA Method 8270, CAM 17 by EPA Method 6010B/7400	To evaluate the potential presence of residual COPC at hydraulically up- and downgradient on-Site locations. Conduct investigation based upon results from soil vapor survey, during second phase of work. Select soil samples for analysis based upon field indicators including soil staining, odors, and photoionization detector readings. Perform deeper investigation using Hollow Stem Auger Methods to assess underlying soil and groundwater.

Due to the potential for misidentification of TPHg with oxygenates, EPA Method 8206B is preferred over EPA Method 8015C for TPHg analysis. In addition, due to potential matrix interference from organic compounds, which are likely to occur in the subsurface of a former lumber mill site, EPA Method 8015C will be used for TPHd and TPHmo analysis in conjunction with silica gel cleanup.

4.3 SEDIMENT SAMPLING

Not applicable.

4.4 WATER SAMPLING

The purpose of the proposed grab groundwater sampling is to assess the presence, or possible presence, and concentration of COPC associated with historic Site activities. The work will be performed coincident with the deeper soil sampling activities, with locations selected based upon the results of the initial phase of Site investigation. The currently proposed grab groundwater sampling locations are shown on Figure 2.

During the second phase of field work grab groundwater samples will be collected and analyzed as identified on the Sample Matrix Table above for one or more of the following analytes:

- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation; and
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270.

**Table 4-3: Water Matrix
Sampling Design and Rationale**

FOPC	Sampling Location/ID Number	Depth (ft bgs)	COPC and Analytical Methods	Rationale
Vehicle and Equipment Maintenance Areas	Minimum of 2 locations. Actual number of locations and samples determined based on field indicators and Vapor Survey. MS1-01W MS2-01W MAS-01W MAS-02W and/or MAS-03W.	Estimated at 45 feet bgs using Hollow Stem Auger Methods.	TPHd and TPHmo by EPA Method 8015C with silica gel preparation, VOCs by EPA Method 8260B, and/or SVOCs by EPA Method 8270 using Temporary Wells.	To evaluate potential presence of residual metals, TPH, VOCs, SVOCs, and metals from past vehicle and equipment use/maintenance operations if warranted based upon initial shallow soils investigation work and/or results from soil vapor survey.
Former Planing Mill Buildings and Lumber Storage Areas	Minimum of 1 location. Actual number of locations and samples to be determined based on field indicators and Vapor Survey PM1-01W PM1-02W PM1-03W PM2-01W and/or LS1-01W.	Estimated at 45 feet bgs using Hollow Stem Auger Methods.	EPA Method TPHd and TPHmo by EPA Method 8015C with silica gel preparation, VOCs by EPA Method 8260B and/or SVOCs by EPA Method 8270 using Temporary Wells.	To evaluate potential presence of residual TPH, VOCs, and SVOCs in groundwater if warranted based upon initial shallow soils investigation work and/or results from soil vapor survey.
Former Wood Treatment	Minimum of 1 location. Actual	Estimated at 45 feet bgs using	TPHd and TPHmo by EPA Method	To evaluate potential presence of residual TPH, VOCs, and SVOCs in groundwater if warranted based upon initial shallow soils investigation work and/or results from soil

FOPC	Sampling Location/ID Number	Depth (ft bgs)	COPC and Analytical Methods	Rationale
and PCP Storage Areas	number of locations and samples determined based on field indicators and Vapor Survey. WTR-01W WTR-02W WTR-03W WTR-04W WTR-05W WTR-06W WTR-07W WTR-08W WTR-09W and/or WTR-10W.	Hollow Stem Auger Methods.	8015C with silica gel preparation, VOCs by EPA Method 8260B and/or SVOCs by EPA Method 8270 using Temporary Wells.	vapor survey.
Former Electric Shop and Oil Houses	Minimum of 1 location. Actual number of locations and samples determined based on field indicators and Vapor Survey. ELS-01W ELS-02W OH1-01W OH2-01W and/or OH3-01W.	Estimated at 45 feet bgs using Hollow Stem Auger Methods.	TPHd and TPHmo by EPA Method 8015C with silica gel preparation, VOCs by EPA Method 8260B, SVOCs by EPA Method 8270, PCBs by EPA Method 8082, and CAM 17 metals by EPA Method 6010B/7400 using Temporary Wells. Filter samples for metals analysis.	To evaluate potential presence of residual TPH, VOCs, SVOCs, PCBs and/or metals in groundwater if warranted based upon initial shallow soils investigation work and/or results from soil vapor survey.
ASTs	Minimum of 1 location. Actual	Estimated at 45 feet bgs using	TPHd and TPHmo by EPA Method	To evaluate potential presence of residual TPH, VOCs, and SVOCs in groundwater if warranted based upon initial shallow soils investigation work and/or results from soil

FOPC	Sampling Location/ID Number	Depth (ft bgs)	COPC and Analytical Methods	Rationale
	number of locations and samples determined based on field indicators and Vapor Survey.. AST-01W and/or AST-02W.	Hollow Stem Auger Methods.	8015C with silica gel preparation, VOCs by EPA Method 8260B, and SVOCS by EPA Method 8270 using Temporary Wells.	vapor survey.
Former USTs	Minimum of 2 locations. Actual number of locations and samples determined based on field indicators and Vapor Survey. UST-01W UST- 02W and/or UST-03W.	Estimated at 45 feet bgs using Hollow Stem Auger Methods.	TPHd and TPHmo by EPA Method 8015C with silica gel preparation and VOCs by EPA Method 8260B using Temporary Wells.	To evaluate potential presence of residual TPH, VOCs, and SVOCS in groundwater if warranted based upon initial shallow soils investigation work and/or results from soil vapor survey.
Hydraulically Up and Downgradient Locations	Minimum of 2 locations. Actual number of locations and samples determined based on field indicators and Vapor Survey. UG-01W and DG-01W.	Estimated at 45 feet bgs using Hollow Stem Auger Methods.	TPHd and TPHmo by EPA Method 8015C with silica gel preparation and VOCs by EPA Method 8260B using Temporary Wells.	To evaluate potential presence of residual COPC in groundwater from off-site locations and/or migrating off-site from on-site source areas.

4.5 ACM AND LBP SAMPLING

4.5.1 ACM Sampling

Bulk samples collected from the structures will be placed in plastic zip-loc bags, labeled, and transported under COC to Pace, a NVLAP accredited laboratory for analysis of asbestos content. Bulk samples will be analyzed using Polarized Light Microscopy (PLM) and Dispersion Staining in accordance with the EPA Interim Method for the Determination of Asbestos in Bulk Samples (40 CFR 763, Subpart F) (CFR, 2016a).

By Federal definition, any substance that contains more than one percent (1%) asbestos is classified as an ACM. Within the State of California, DOSH defines an ACM as any manufactured material which contains greater than one tenth of one percent (0.1%) asbestos by weight. Pace's Method Reporting Limit (MRL) is 0.005% asbestos based on a 0.25 gram sample. The designation of "trace" indicates the presence of asbestos below the MRL.

4.5.2 LBP Sampling

A limited lead survey will be conducted of the five major Site structures with an objective to identify and characterize major paint systems and suspect glazed components for the presence of lead. Only major paint systems and suspect glazed components at the time of the inspection will be targeted for sampling. Readily accessible painted surfaces of the interiors and exteriors of the structures, as well as other suspect glazed building components (like ceramic floor tile, ceramic wall tile, porcelain sinks, porcelain toilets, and porcelain urinals) will be tested for lead in general accordance with HUD Title 10, 40 CFR Part 745 and Title 24 Part 35 using an XRF instrument (CFR, 2016b).

XRF Readings Summary Logs will provide descriptions and identify locations of paint, ceramic tile, and porcelain fixture readings collected from the structures.

4.5.3 Universal Waste

A surveillance-level effort will be made to identify/quantify "universal wastes" (UW) (e.g., fluorescent tubes/bulbs, batteries, mercury switches/gauges, etc.) that may be present within the five (5) main Site structures. The effort will consist of an inspection of the interior and exterior of the structures and field logs detailing the approximate location and estimated quantities of suspected universal wastes.

**Table 4-4: ACM, LBP, and UW
Sampling Design and Rationale**

Sampling Location/ID Number	COPC and Analytical Methods	Rationale
One sample per suspected ACM media, identified as ACM01, ACM02, ACM03, and so on. Approximately 200 samples will be collected for analysis.	ACM: EPA Method 600 by PLM with Dispersion Staining.	To evaluate each suspected ACM for asbestos content greater than 1%. Assume one sample per suspected ACM in each of the five structures.
One sample per suspected LBP media, identified as LBP01,	LBP: XRF as field screening tool and approximately 10% of samples above MRL submitted for	To evaluate each suspected LBP surface or material for lead content greater than 0.5 percent by weight (or 1.0 mg/cm ²).

Sampling Location/ID Number	COPC and Analytical Methods	Rationale
LBP02, LBP03, and so on. Approximately 30 samples will be collected for analysis.	EPA Preparation Method 3050B and analysis by EPA Method 6010C.	Assume six samples in each of the five (5) structures.
Inventory only (no sampling)	UW: visual survey only (no analysis)	To identify and log suspected UW in each of the five structures.

4.6 STOCKPILE AND INVESTIGATION DERIVED WASTE SAMPLING

SCS does not anticipate that soil stockpiles will be generated during the proposed field activities. However, decontamination and field investigation may generate residual waste streams or IDW. These materials will be contained and secured in United Nations/Department of Transportation (UN/DOT)-approved 55 gallon drums.

The purpose of the proposed sampling is to assess the presence, or possible presence, and concentration of COPC and enable profiling for appropriate waste disposal. The anticipated analytical suite for decontamination and IDW solids and liquids includes:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

The analytical suite for decontamination and IDW liquids may be modified based upon the findings of the two phases of assessment work, with approval from the EPA.

To accomplish this, SCS will collect soil and water samples from containment drums for analysis. The sample frequency and analytical suite(s) will be dictated by waste profiling and disposal requirements provided by the waste disposal facility or facilities. For the purpose of this FSP, SCS assumes collection of one sample per each drum of material for discreet sample analysis, unless composite sample analysis is approved by the contracted receiving facility.

**Table 4-5: IDW
Sampling Design and Rationale**

Sampling Location/ID Number	COPC and Analytical Methods	Rationale
One sample per drum,	Potential analytes include CAM 17	To evaluate each drum of residual

Sampling Location/ID Number	COPC and Analytical Methods	Rationale
identified as D01S, D02S, D03S, and so on for drums containing soil, and D01W, D02W, D03W, and so on for drums containing water.	metals by EPA Method 6010B/7400; VOCs by EPA Method 8260B; TPHg by EPA Method 8260B; TPHd and TPHmo by EPA Method 8015C with silica gel preparation; SVOCs by EPA Method 8270; DLCs by EPA Method 1613; and/or PCBs by EPA Method 8082.	materials from field investigation for disposal profiling, following analytical requirements issued by potential receiving facility/facilities. Assume one sample per drum.

5.0 REQUEST FOR ANALYSES

5.1 ANALYSES NARRATIVE

Soil and grab groundwater samples will be sent to Pace Analytical Services, LLC (Pace), a state-certified, fixed-based laboratory, for analysis. As previously noted, soil vapor samples will be analyzed on-Site by TEG's state-certified mobile laboratory. Building materials suspected of containing LBP will be sampled (for lead) in the field using a calibrated, hand-held XRF instrument and by Pace for any samples detected above RPLs using the XRF instrument. Approximately ten percent (10%) of all XRF samples will be sent to Pace for laboratory additional analysis. Suspected ACMs will be sampled and sent to Pace for analysis.

5.1.1 Soil Vapor Samples

Soil vapor samples collected from locations SVS-01 through SVS-20 will be collected using a syringe to withdraw vapor from Nylaflow tubing affixed to a Geoprobe drive rod. The soil vapor samples will be analyzed for the following:

- The complete suite of VOCs and TPHg by EPA Method 8260B using low method detection limits;
- Atmospheric gases including oxygen, carbon dioxide, and methane; and,
- The leak detection compound, 1,1-difluoroethane.

The first sample location will include samples collected following purging of one, three and ten sample train volumes of air. Those samples will be chemically analyzed, and the purge volume which yields the most elevated analytical results will be used in subsequent vapor sample collection locations. The results of the vapor sampling will be compared with risk based screening values (CHHSLs and ESLs), and those locations yielding elevated analytical results (COPC in excess of CHHSLs or ESLs) will be subject to step-out soil vapor sampling at approximate distances of 20 feet in each compass direction.

Table 5-1: Soil Vapor Matrix Analytical Services

Sample Number	Sample Location	Sample Depth (ft. bgs)	Special Designation	VOCs (EPA 8260B)	Atmospheric Gases (ASTM D-1946)	Leak Check Compound (EPA 8260B)
SVS-01-1*	SVS-01	5	---	X	X	X
SVS-01-3*	SVS-01	5	---	X	X	X
SVS-01-10*	SVS-01	5	---	X	X	X
SVS-02	SVS-02	5	---	X	X	X
SVS-03	SVS-03	5	---	X	X	X
SVS-04	SVS-04	5	---	X	X	X
SVS-05	SVS-05	5	---	X	X	X
SVS-06	SVS-06	5	---	X	X	X
SVS-07	SVS-07	5	---	X	X	X
SVS-08**	SVS-08	5	BD	X	X	X
SVS-09	SVS-09	5	---	X	X	X
SVS-10	SVS-10	5	---	X	X	X
SVS-11	SVS-11	5	---	X	X	X
SVS-12	SVS-12	5	---	X	X	X
SVS-13	SVS-13	5	---	X	X	X
SVS-14	SVS-14	5	---	X	X	X
SVS-15	SVS-15	5	---	X	X	X
SVS-16	SVS-16	5	---	X	X	X
SVS-17	SVS-17	5	---	X	X	X
SVS-18**	SVS-18	5	BD	X	X	X
SVS-19	SVS-19	5	---	X	X	X
SVS-20**	SVS-20	5	BD	X	X	X
SVS-21	SVS-08	5	Duplicate	X	X	X
SVS-22	SVS-18	5	Duplicate	X	X	X
SVS-23	SVS-20	5	Duplicate	X	X	X

Total estimated number of samples, excluding QC samples: 20*

Total estimated number of samples, including QC samples: 26

* - 3 samples will be analyzed from the first soil vapor sample collected, presumably SVS-01. The three samples analyzed will consist of 1, 3, and 10 purge volumes to determine the appropriate purge volume for the remaining soil vapor samples analyzed.

** - Blind Duplicate (BD) samples will be collected from the noted locations and analyzed by the on-Site mobile laboratory.

5.1.2 Near Surface, Shallow and Deeper Soil Samples

As noted earlier, the proposed field investigation will include two phases of work including collection of near surface and shallow soil samples during the first phase of work, followed by collection of deeper soil samples (and grab groundwater samples) during the second phase of work.

The near surface and shallow soil samples will be collected with a hand auger and/or drive sampler and analyzed for one or more of the following:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

In all but the vicinity of the former Teepee Burner and Open Transformer areas, soil samples will be collected from each shallow soil sampling location at depths of 0.5, 1.5, 3, and 4.5 feet bgs. The 0.5- and 1.5-foot samples will be analyzed for analytes appropriate to each FOPC. The samples collected from 3.0 and 4.5 feet will be held pending the analytical results for the 1.5-foot sample, and the results of the analyses will be compared to corresponding CHSSL and ESL values. If detectable concentrations of COPC exceed the CHSSL or ESL, then the samples from 3.0 and 4.5 feet will be analyzed.

In the former Teepee Burner and Open Transformer areas, soil samples will be collected from each shallow soil sampling location at depths of 0.5 and 1.5 feet bgs. The 0.5-foot samples will be analyzed for analytes appropriate to each FOPC. The samples collected from 1.5 feet will be held pending the analytical results for the 0.5-foot sample, and the results of the analyses will be compared to corresponding CHSSL and ESL values. If detectable concentrations of COPC exceed the CHSSL or ESL, then the samples from 1.5 feet will be analyzed.

During the second phase of investigation, deeper soil samples will be collected for possible analysis from borings advanced to approximate depths of 45 feet bgs. Budget permitting, the samples will be collected in approximate five foot increments, and selected for possible chemical analysis based upon field observations (odors and staining), field screening results using a photoionization detector (PID), and following receipt of analytical results from the near surface and shallow soil sampling phase of work. As with the near surface and shallow soil sampling program, deeper soil samples may be analyzed for one or more of the following:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

Table 5-2 presents a summary of the analytical program for soil samples, and Table 5-3 presents a summary of the containers, preservation, and holding times for each analytical method proposed for soil samples.

Table 5-2: Soil Matrix Analytical Services

Sample Area and Number		Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
					TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPHg (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
Maintenance Shop Areas*	MS1-01-0.5	MS1-01	0.5	---	X	X	X	---	X	---
	MS1-01-1.5	MS1-01	1.5	---	X	X	X	---	X	---
	MS1-01-3.0	MS1-01	3.0	BD	---	---	---	---	---	---
	MS1-01-4.5	MS1-01	4.5	---	---	---	---	---	---	---
	MS2-01-0.5	MS2-01	0.5	---	X	X	X	---	X	---
	MS2-01-1.5	MS2-01	1.5	---	X	X	X	---	X	---
	MS2-01-3.0	MS2-01	3.0	--	---	---	---	---	---	---
	MS2-01-4.5	MS2-01	4.5	---	---	---	---	---	---	---
	MAS-01-0.5	MAS-01	0.5	---	X	X	X	---	X	---
	MAS-01-1.5	MAS-01	1.5	---	X	X	X	---	X	---
	MAS-01-3.0	MAS-01	3.0	---	---	---	---	---	---	---
	MAS-01-4.5	MAS-01	4.5	---	---	---	---	---	---	---
	MAS-02-0.5	MAS-02	0.5	BD	X	X	X	---	X	---
	MAS-02-1.5	MAS-02	1.5	---	X	X	X	---	X	---
	MAS-02-3.0	MAS-02	3.0	---	---	---	---	---	---	---
	MAS-02-4.5	MAS-02	4.5	---	---	---	---	---	---	---
	MAS-03-0.5	MAS-03	0.5	---	X	X	X	---	X	---
	MAS-03-1.5	MAS-03	1.5	---	X	X	X	---	X	---
	MAS-03-3.0	MAS-03	3.0	---	---	---	---	---	---	---
	MAS-03-4.5	MAS-03	4.5	BD	---	---	---	---	---	---

Sample Area and Number		Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
					TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPHg (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
Planing Mill Building and Lumber Storage Areas*	PM1-01-0.5*	PM1-01	0.5	MS/MSD	X	X	X	---	X	---
	PM1-01-1.5	PM1-01	1.5	---	X	X	X	---	X	---
	PM1-01-3.0	PM1-01	3.0	---	---	---	---	---	---	---
	PM1-01-4.5	PM1-01	4.5	---	---	---	---	---	---	---
	PM1-02-0.5	PM1-02	0.5	---	X	X	X	---	X	---
	PM1-02-1.5	PM1-02	1.5	BD	X	X	X	---	X	---
	PM1-02-3.0	PM1-02	3.0	---	---	---	---	---	---	---
	PM1-02-4.5	PM1-02	4.5	---	---	---	---	---	---	---
	PM1-03-0.5	PM1-03	0.5	---	X	X	X	---	X	---
	PM1-03-1.5	PM1-03	1.5	---	X	X	X	---	X	---
	PM1-03-3.0	PM1-03	3.0	---	---	---	---	---	---	---
	PM1-03-4.5	PM1-03	4.5	---	---	---	---	---	---	---
	PM2-01-0.5	PM2-01	0.5	BD	X	X	X	---	X	---
	PM2-01-1.5	PM2-01	1.5	---	X	X	X	---	X	---
	PM2-01-3.0	PM2-01	3.0	---	---	---	---	---	---	---
	PM2-01-4.5	PM2-01	4.5	---	---	---	---	---	---	---
	LS1-01-0.5	LS-01	0.5	---	X	X	X	---	X	---
	LS1-01-1.5	LS-01	1.5	---	X	X	X	---	X	---
	LS1-01-3.0	LS-01	3.0	BD	---	---	---	---	---	---
	LS1-01-4.5	LS-01	4.5	---	---	---	---	---	---	---

Sample Area and Number		Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
					TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPHg (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
Teepee Burner	TPB-01-0.5	TPB-01	0.5	---	---	---	X	X	---	---
	TPB-01-1.5	TPB-01	1.5	---	---	---	---	---	---	---
	TPB-02-0.5	TPB-02	0.5	BD	---	---	X	X	---	---
	TPB-02-1.5	TPB-02	1.5	---	---	---	---	---	---	---
	TPB-03-0.5	TPB-03	0.5	---	---	---	X	X	---	---
	TPB-03-1.5	TPB-03	1.5	---	---	---	---	---	---	---
	TPB-04-0.5	TPB-04	0.5	---	---	---	X	X	---	---
	TPB-04-1.5	TPB-04	1.5	---	---	---	---	---	---	---
Open Transformers	OTF-01-0.5	OTF-01	0.5	---	---	---	X	---	---	X
	OTF-01-1.5	OTF-01	1.5	---	---	---	X	---	---	X
	OTF-01-3.0	OTF-01	3.0	---	---	---	---	---	---	---
	OTF-02-0.5	OTF-02	0.5	---	---	---	X	---	---	X
	OTF-02-1.5	OTF-02	1.5	---	---	---	X	---	---	X
	OTF-02-3.0	OTF-02	3.0	BD	---	---	---	---	---	---

Sample Area and Number		Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
					TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPH g (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
Wood Treatment Areas*	WTR-01-0.5	WTR-01	0.5	---	X	X	X	---	X	X
	WTR-01-1.5	WTR-01	1.5	---	X	X	X	---	X	X
	WTR-01-3.0	WTR-01	3.0	---	---	---	---	---	---	---
	WTR-01-4.5	WTR-01	4.5	---	---	---	---	---	---	---
	WTR-02-0.5	WTR-02	0.5	---	X	X	X	---	X	X
	WTR-02-1.5	WTR-02	1.5	---	X	X	X	---	X	X
	WTR-02-3.0	WTR-02	3.0	---	---	---	---	---	---	---
	WTR-02-4.5	WTR-02	4.5	---	---	---	---	---	---	---
	WTR-03-0.5	WTR-03	0.5	---	X	X	X	---	X	X
	WTR-03-1.5	WTR-03	1.5	---	X	X	X	---	X	X
	WTR-03-3.0	WTR-03	3.0	---	---	---	---	---	---	---
	WTR-03-4.5	WTR-03	4.5	---	---	---	---	---	---	---
	WTR-04-0.5	WTR-04	0.5	---	X	X	X	---	X	X
	WTR-04-1.5	WTR-04	1.5	---	X	X	X	---	X	X
	WTR-04-3.0	WTR-04	3.0	---	---	---	---	---	---	---
	WTR-04-4.5	WTR-04	4.5	BD	---	---	---	---	---	---
	WTR-05-0.5	WTR-05	0.5	---	X	X	X	---	X	X
	WTR-05-1.5	WTR-05	1.5	---	X	X	X	---	X	X
	WTR-05-3.0	WTR-05	3.0	---	---	---	---	---	---	---
	WTR-05-4.5	WTR-05	4.5	---	---	---	---	---	---	---
	WTR-06-0.5	WTR-06	0.5	BD	X	X	X	---	X	X
	WTR-06-1.5	WTR-06	1.5	---	X	X	X	---	X	X
	WTR-06-3.0	WTR-06	3.0	---	---	---	---	---	---	---

Sample Area and Number	Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
				TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPHg (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
Wood Treatment Areas*	WTR-06-4.5	WTR-06	4.5	---	---	---	---	---	---
	WTR-07-0.5	WTR-07	0.5	X	X	X	---	X	X
	WTR-07-1.5	WTR-07	1.5	BD	X	X	---	X	X
	WTR-07-3.0	WTR-07	3.0	---	---	---	---	---	---
	WTR-07-4.5	WTR-07	4.5	---	---	---	---	---	---
	WTR-08-0.5	WTR-08	0.5	X	X	X	---	X	X
	WTR-08-1.5	WTR-08	1.5	X	X	X	---	X	X
	WTR-08-3.0	WTR-08	3.0	---	---	---	---	---	---
	WTR-08-4.5	WTR-08	4.5	---	---	---	---	---	---
	WTR-09-0.5	WTR-09	0.5	X	X	X	---	X	X
	WTR-09-1.5	WTR-09	1.5	X	X	X	---	X	X
	WTR-09-3.0	WTR-09	3.0	---	---	---	---	---	---
	WTR-09-4.5	WTR-09	4.5	---	---	---	---	---	---
	WTR-10-0.5	WTR-10	0.5	X	X	X	---	X	X
	WTR-10-1.5	WTR-10	1.5	X	X	X	---	X	X
	WTR-10-3.0	WTR-10	3.0	---	---	---	---	---	---
	WTR-10-4.5	WTR-10	4.5	---	---	---	---	---	---

Sample Area and Number		Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
					TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPHg (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
Oil Houses and Electrical Shops*	ELS-01-0.5	ELS-01	0.5	---	X	X	X	---	X	---
	ELS-01-1.5	ELS-01	1.5	---	X	X	X	---	X	---
	ELS-01-3.0	ELS-01	3.0	---	---	---	---	---	---	---
	ELS-01-4.5	ELS-01	4.5	---	---	---	---	---	---	---
	ELS-02-0.5	ELS-02	0.5	BD	X	X	X	---	X	---
	ELS-02-1.5	ELS-02	1.5	---	X	X	X	---	X	---
	ELS-02-3.0	ELS-02	3.0	---	---	---	---	---	---	---
	ELS-02-4.5	ELS-02	4.5	---	---	---	---	---	---	---
	OH1-01-0.5	OH1-01	0.5	---	X	X	X	---	X	---
	OH1-01-1.5	OH1-01	1.5	---	X	X	X	---	X	---
	OH1-01-3.0	OH1-01	3.0	---	---	---	---	---	---	---
	OH1-01-4.5	OH1-01	4.5	BD	---	---	---	---	---	---
	OH2-01-0.5	OH2-01	0.5	---	X	X	X	---	X	---
	OH2-01-1.5	OH2-01	1.5	---	X	X	X	---	X	---
	OH2-01-3.0	OH2-01	3.0	---	---	---	---	---	---	---
	OH2-01-4.5	OH2-01	4.5	---	---	---	---	---	---	---
	OH3-01-0.5	OH3-01	0.5	---	X	X	X	---	X	---
	OH3-01-1.5	OH3-01	1.5	---	X	X	X	---	X	---
	OH3-01-3.0	OH3-01	3.0	---	---	---	---	---	---	---
	OH3-01-4.5	OH3-01	4.50	---	---	---	---	---	---	---
	OH3-01-0.5	OH3-01	0.5	---	X	X	X	---	X	---

Sample Area and Number		Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
					TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPHg (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
ASTs*	AST-01-0.5 to AST-01-45 and/or AST-02-0.5 to AST-02-45	AST-01 and/or AST-02	0.5 to 45	---	Minimum of 3	Minimum of 3	---	---	---	---
USTs*	UST-01-5 to UST-01-45 UST-02-5 to UST-02-45 and/or UST-03-5 to UST-03-45	UST-01 UST-02 and/or UST-03	5 to 45	BD	Minimum of 6	Minimum of 6	---	---	---	---
Up- and Downgradient	UG-01-0.5 to 45	UG-01	0.5 to 45	---	Minimum of 3	Minimum of 3	---	---	---	---
	DG-01-0.5 to 45	DG-01	0.5 to 45	Duplicate	Minimum of 3	Minimum of 3	---	---	---	---

Sample Area and Number	Sample Location	Depth (ft. bgs)	Special Designation	Analytical Methods					
				TPH-d and TPH-mo (EPA 8015CB)	VOCs;TPHg (EPA 8260B)	SVOCS (EPA 8270)	Dioxin (EPA 1613)	CAM 17 Metals (EPA 6010/7400)	PCBs (EPA 8082)
QA/QC*	ELS-03-0.5	ELS-02	Duplicate	X	X	X	---	X	
	PM1-04-1.5	PM1-02	Duplicate	X	X	X	---	X	---
	PM3-01-0.5	PM-02	Duplicate	X	X	X	---	X	---
	MAS-04-0.5	MAS-02	Duplicate	X	X	X	---	X	---
	TPB-05-0.5	TPB-02	Duplicate	---	---	X	X	---	---
	WTR-12-0.5	WTR-06	Duplicate	X	X	X	---	X	---
	WTR-13-1.5	WTR-07	Duplicate	X	X	X	---	X	---
	MS1-06-3.0	MS1-01	Duplicate Hold	---	---	---	---	---	---
	OTF-05-3.0	OTF-02	Duplicate Hold	---	---	---	---	---	---
	LS2-01-3.0	LS1-01	Duplicate Hold	---	---	---	---	---	---
	MAS-03-4.5	MAS-03	Duplicate Hold	---	---	---	---	---	---
	WTR-04-4.5	WTR-04	Duplicate Hold	---	---	---	---	---	---
	OH1-01-4.5	OH1-01	Duplicate Hold	---	---	---	---	---	---
	AST-01 and AST-02 various	AST-01 and AST-02	Duplicate Hold	---	---	---	---	---	---
	UST-01, UST-02, and UST-3 various	UST-01, UST-02, and UST-3	Duplicate Hold	---	---	---	---	---	---

Notes:

Estimated Total number of primary samples collected, excluding QC samples: 164

Estimated Total number of primary samples to be initially analyzed, excluding QC samples: 71

Note that additional QA/QC Samples will be analyzed according to number of subsequent Primary samples analyzed.

Duplicate samples will be collected from deep borings for USTs, ASTs, and other locations at a rate of 10% for analysis, with the actual duplicate sample depths determined by field observations.

*Deeper soils investigations of FOPC will depend upon results of Shallow soils investigation and Soil Vapor Survey, using 5 foot sampling intervals to total depth of each boring. Additional QA/QC Samples will be collected and analyzed accordingly.

In addition to the above, the laboratory will perform the following additional analyses:

- A method blank will be performed with each analytical batch of samples.
- Surrogates will be run on all organic analysis including spikes and blanks.
- A temperature blank will be included with the sample shipment for Pace to verify temperature upon acceptance of the samples.

Table 5-3: Soil Analytical Method, Containers, Preservation, and Holding Times Requirements

Parameter	Method	Matrix	Container	Preservative	Max Hold Time	Additional Volume for MS/MSD
Aromatic and Halogenated Volatiles (see note 1)	8021	Solid	5035 vial kit	See note 1	14 days	Yes
Acid Volatile Sulfide	Draft EPA 1629	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	14 Days	No
Base/Neutrals and Acids and SVOCs	8270	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	14/40 Days	No
Diesel Range Organics- TPHd	8015C	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	14/40 Days	No
Dioxins and Furans	1613B	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	1 year	Yes
Dioxins and Furans	8290	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	30/45 Days	Yes
Gasoline Range Organics – TPHg	8260B	Solid	5035 vial kit	See note 1	14 days	No
Hexavalent Chromium	7196 (with 3060A)	Solid		$< 6^{\circ}\text{C}$	24 Hours after extraction	No
Mercury	7471	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	28 Days	No
Metals (ICP/ICPMS)	6010B/7400	Solid	8oz Glass Jar	None	180 Days	No
Oil and Grease/HEM	9071	Solid	Glass	$\leq 6^{\circ}\text{C}$	28 Days	No
PCBs (Aroclors)	8082	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	1 Year/1 Year	No
PCB Congeners	1668A	Solid	4-8oz Glass Jar	$< 6^{\circ}\text{C}$ but above freezing	1 Year/1 Year	No
Oil Range Organics-ORO – TPHmo	8015C	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	14/40 Days	No
PAH (SVOCs)	8270 SIM	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	14/40 Days	No
VOCs	8260B	Solid	5035 vial kit	See note 1	14 days	Yes

Notes:

- 1 5035/5035A Note: 5035 vial kit typically contains 2 vials water, preserved by freezing or, 2 vials aqueous sodium bisulfate preserved at 4°C , and one vial methanol preserved at $< 6^{\circ}\text{C}$ and one container of unpreserved sample stored at $< 6^{\circ}\text{C}$. Prior to use of this preservation method, an additional soil sample will be tested for reaction by calcareous soil with sodium bisulfate. In the event no reaction occurs, sodium

bisulfate preservative will be used. In the event a reaction occurs, three vials of methanol and one container of unpreserved sample will be stored at $<6^{\circ}\text{C}$.

5.1.3 Grab Groundwater Samples

Grab groundwater samples will be collected from temporary wells installed during the second phase of investigation, with sample locations selected based upon the results of the initial phase of investigation (soil vapor survey and shallow soil sampling investigation).

The water samples will be collected using dedicated disposable bailers and analyzed for one or more of the following:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

At present, SCS estimates collecting grab groundwater samples from a minimum of ten locations; however, the number and locations of grab groundwater samples is subject to revision, based upon field indicators, laboratory results, and availability of funding. In the event that grab groundwater samples are collected from each FOPC, the number of samples and proposed analytes would be as shown on Table 5-4 below, with sample containers, preservatives, and holding times as shown on Table 5 -5.

Table 5-4: Water Matrix Analytical Services
(actual sample selection subject to prior field investigation results)

Sample Number	Sample Location	Special Designation	Analytical Methods					
			TPH (EPA 8015C)	VOCs (EPA 8260B)	SVOCs (EPA 8270)	CAM 17 Metals (EPA 6010B/7400)	Dioxin (EPA1613) **	PCBs (EPA 8082) **
AST-01W and/or AST-02W (minimum of 1)	AST-01 and/or AST-02	---	X	X	---	---	---	---
UST-01W UST-02W and/or UST-03W (minimum of 2)	UST-01 UST-02 and/or UST-03	---	X	X	---	---	---	---
ELS-01W ELS-02W	ELS-01 ELS-02	Include 1 BD and 1	X	X	X	X	---	---

Sample Number	Sample Location	Special Designation	Analytical Methods					
			TPH (EPA 8015C)	VOCs (EPA 8260B)	SVOCs (EPA 8270)	CAM 17 Metals (EPA 6010B/7400)	Dioxin (EPA1613) **	PCBs (EPA 8082) **
OH1-01W OH2-01W and/or OH3-01W (minimum of 1)	OH1-01 OH2-01 and/or OH3-01	MS/MSD						
MS1-01W MS2-01W MAS-01W MAS-02W and/or MAS-03W (minimum of 2)	MS1-01 MS2-01 MAS-01 MAS-02 MAS-03	---	X	X	X	X	---	---
PM1-01-W PM1-02W PM1-03W PM2-01W and/or LS1-01W (minimum of 1)	PM1-01 PM1-02 PM1-03 PM2-01 and/or LS1-01	Include 1 BD and 1 MS/MSD	X	X	X	X	---	---
WTR-01W WTR-02W WTR-03W WTR-04W WTR-05W WTR-06W WTR-07W WTR-08W WTR-09W and/or WTR-10W (minimum of 1)	WTR-01 WTR-02 WTR-03 WTR-04 WTR-05 WTR-06 WTR-07 WTR-08 WTR-09 and/or WTR-10	Include 1 BD and 1 MS/MSD	X	X	X	X	---	---
UG-01W	UG-01	---	X	X	X	X	---	---
DG-01W	DG-01	---	X	X	X	X	---	---

Total number of samples, excluding QC samples:
minimum 10

Notes:

* indicates blind duplicate will be collected for respective sample

** Sample collection and analysis as warranted based upon shallow soils investigation results.

In addition to the above, the laboratory will perform the following additional analyses:

- A method blank will be performed with each analytical batch of samples.
- Surrogates will be run on all organic analysis including spikes and blanks.
- A temperature blank will be included with the sample shipment for Pace to verify temperature upon acceptance of the samples.

**Table 5-5: Water Matrix
Analytical Method, Containers, Preservation, and Holding Times Requirements**

Parameter	Method	Matrix	Container	Preservative	Max Hold Time	Additional Volume for MS/MSD
Aromatic and Halogenated Volatiles	602/8021	Water	40mL vials	pH<2 HCl; ≤6°C; Na ₂ S ₂ O ₃ if Cl present	14 Days (7 Days for aromatics if unpreserved)	No
Base/Neutrals and Acids	625/8270	Water	1L Amber Glass	≤6°C; Na ₂ S ₂ O ₃ if Cl present	7/40 Days	Yes
Base/Neutrals, Acids & Pesticides	525.2	Water	1L Amber Glass	pH<2 HCl; <6°C; Na sulfite if Cl present	14/30 Days	Yes
Diesel Range Organics- TPH DRO	8015C	Water	1L Amber Glass	<6°C; Na ₂ S ₂ O ₃ if Cl present	7/40 Days	Yes
Dioxins and Furans	1613B	Water	1L Amber Glass	<6°C; Na ₂ S ₂ O ₃ if Cl present	1 year	No
Dioxins and Furans	8290	Water	1L Amber Glass	<6°C; Na ₂ S ₂ O ₃ if Cl present	30/45 Days	Yes
Gasoline Range Organics	8260B	Water	40mL vials	pH<2 HCl	14 Days	Yes
Parameter	Method	Matrix	Container	Preservative	Max Hold Time	Additional Volume for MS/MSD
Hexavalent Chromium	7196/218.6/ SM3500Cr-B, C, D	Water	Plastic/Glass	Ammonium Buffer pH 9.3-9.7	28 Days (see note 3)	Yes
Mercury	7470/245.1/ 245.2	Water	Plastic/Glass	pH<2 HNO ₃	28 Days	Yes
Metals (GFAA)	7000/200.9	Water	Plastic/Glass	pH<2 HNO ₃	180 Days	No
Metals (ICP/ICPMS)	6010B/6020/ 200.7/200.8	Water	Plastic/Glass	pH<2 HNO ₃	180 Days	No

Oil and Grease/HEM	1664A/ SM5520B/ 9070	Water	Glass	pH<2 H ₂ SO ₄ or HCl; $\leq 6^{\circ}\text{C}$	28 Days	Yes
PCBs and Pesticides, Organochlorine (OC)	608	Water	1L Amber Glass		Pest: 7/40 Days; PCB: 1 Year/1 Year	No
PCBs, Pesticides (OC), Herbicides	508.1	Water	Glass	Na ₂ S ₂ O ₃ ; pH<2 HCl; $< 6^{\circ}\text{C}$	14/30 Days	No
PCB Congeners	1668A	Water	1L Amber Glass	$< 6^{\circ}\text{C}$ but above freezing	1 Year/1 Year	Yes
PCBs (Aroclors)	8082	Water	1L Amber Glass	$< 6^{\circ}\text{C}$; Na ₂ S ₂ O ₃ if Cl present	1 Year/1 Year	Yes
Oil Range Organics- ORO		Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$; Na ₂ S ₂ O ₃ if Cl present	7/40 Days	Yes
PAH (SVOCs)	8270 SIM	Water	1L Amber Glass	$< 6^{\circ}\text{C}$; Na ₂ S ₂ O ₃ if Cl present	7/40 Days	Yes
Volatiles (see note 1)	8260B	Water	40mL vials	pH<2 HCl; $\leq 6^{\circ}\text{C}$; Na ₂ S ₂ O ₃ if Cl present	14 Days	Yes
Volatiles	624	Water	40mL vials	pH<2 HCl; $\leq 6^{\circ}\text{C}$; Na ₂ S ₂ O ₃ if Cl present	14 Days (7 Days for aromatics if unpreserve d)	Yes
Volatiles (see note 2)	524.2	Water	40mL vials (in duplicate)	pH<2 HCl; $\leq 6^{\circ}\text{C}$; Ascorbic acid or Na ₂ S ₂ O ₃ if Cl present ²	14 Days	Yes

Notes:

1 Acrolein, acrylonitrile, and 2-chloroethylvinyl ether must have the pH value documented to within one pH unit when preservation pH has not been met. Ensure case narrative of the laboratory reports properly identifies when a sample is received at a pH outside of that specified within SW-846.

2 Method 524.2 lists ascorbic acid as the preservative when residual chlorine is suspected, unless gases or Table 7 compounds are NOT compounds of interest and then sodium thiosulfate is the preservative recommended.

3 The holding time for hexavalent chromium may be extended by the addition of the ammonium buffer listed in EPA 218.6 per the 2012 EPA Method Update Rule. Although Method 218.6 stipulates a different pH range (9.0 to 9.5) for buffering, this method requirement was modified in the Method Update Rule to a pH range of 9.3 to 9.7. For non-potable waters, adjust the pH of the sample to 9.3 to 9.7 during collection with the method required ammonium sulfate buffer to extend the holding time to 28 days. For potable waters, addition of the buffer during collection will extend the holding time for 14 days per EPA 218.7 and the EPA UCMR3 program.

5.1.4 Stockpile and IDW Samples

SCS does not anticipate that soil stockpiles will be generated during the proposed field activities. Where possible, soils and materials removed from the subsurface during Site investigation

activities will be replaced into the excavated pit or borehole, followed by repair of the ground surface to match prior conditions. In the event materials replacement is not possible, and where groundwater, purge water, and decontamination fluid has been generated, those materials will be stored and secured in UN/DOT-approved 55-gallon drums, affixed with labels identifying the drum contents, date of generation, and indicating the contents are under analysis for possible disposal. SCS will collect representative samples of the investigation derived waste (IDW) for analysis to facilitate materials profiling and disposal.

The purpose of the proposed sampling is to assess the presence, or possible presence, and concentration of COPC and enable profiling for appropriate waste disposal. The anticipated analytical suite for decontamination and IDW solids and liquids includes:

- CAM 17 metals by EPA Method 6010B/7400;
- VOCs including BTEX compounds and naphthalene by full scan using EPA Method 8260B;
- TPHg by EPA Method 8260B;
- TPHd and TPHmo by EPA Method 8015C with silica gel preparation;
- SVOCs, including PAHs and chlorophenols, by EPA Method 8270;
- DLCs by EPA Method 1613; and/or,
- PCBs by EPA Method 8082.

The analytical suite for decontamination and IDW liquids may be modified based upon the findings of the two phases of assessment work, with approval from the EPA.

To accomplish this, SCS will collect soil and water samples from containment drums for analysis. The sample frequency and analytical suite(s) will be dictated by waste profiling and disposal requirements provided by the waste disposal facility or facilities. For the purpose of this FSP, SCS assumes collection of one sample per each drum of material for discreet sample analysis, unless composite sample analysis is approved by the contracted receiving facility.

The IDW sampling and analysis plan will be developed based upon the requirements of the receiving facility, with the analytical methods, sample containers, preservatives, and holding times following those identified in Tables 5-1 and 5-2 for IDW solids, and Tables 5-3 and 5-4 for IDW liquids.

5.2 ANALYTICAL LABORATORY

Vapor samples will be analyzed by TEG's on-Site mobile laboratory. Soil, grab groundwater and IDW samples will be sent to Pace, a state-certified, fixed-based laboratory. A copy of the Pace Quality Systems Manual is included in the Revised QAPP along with copies of the Pace SOPs for each proposed analytical method. MQOs for work performed by the laboratory can be found in the Pace Quality Systems Manual. The TEG SOPs and QMS may also be found in the Revised QAPP.

6.0 FIELD METHODS AND PROCEDURES

The field methods and procedures to be followed during each phase of subsurface investigation are described in the following sections, as well as in the SOPs provided in the Revised QAPP.

Personnel will wear disposable nitrile gloves and safety glasses while collecting samples and handling sample containers. Detailed information about sample containers, preservation, packaging, and shipping are provided in Section 7.0.

6.1 FIELD EQUIPMENT

6.1.1 List of Equipment Needed

The following equipment and supplies will be used at the Site for sample collection:

- PIDs
- XRF instrument
- Hand auger
- Drive sampler
- Stainless steel or brass sample sleeves with Teflon sheets and plastic end caps
- Shovel
- Single-use disposable trowels
- Glass jars
- UN/DOT 55-gallon drums and appropriate drum labels
- Decontamination kit (buckets, brushes, Alconox, and tap and deionized water)
- Camera
- Walking wheel and measuring tapes
- Scale
- Sharpies/pens
- Site plan
- Daily field log and boring log forms
- Labels
- COC forms
- Ice and Coolers
- Visqueen sheeting
- Paper towels
- PPE, including hard hat, boots, safety glasses, nitrile gloves, and ear plugs
- Sunscreen, sun hat, and water

In case of equipment failure, some supplies will be kept on hand to attempt fixes in the field (e.g., spare batteries, extra lamps and filters for the PID, etc.). In addition, two PIDs will be used at the Site, so in case of failure, at least one PID would still be available.

6.1.2 Calibration of Field Equipment

Initial calibration and maintenance are performed per the manufacturer's recommendations by Enviro Supply, a field supply and equipment provider. SCS will include copies of the calibration and maintenance records in the project field notes and placed in the project file.

The PIDs will be zeroed to ambient air and recalibrated with isobutylene standard gas at the beginning of each day. Documentation of calibration completed in the field will be included in the field notes for the project and placed in the project file.

The XRF will be calibrated according to manufacturer's instructions, a copy of which is provided in Appendix C.

6.2 FIELD SCREENING

Field screening of soil will be conducted with a PID. In addition to the soil samples collected in stainless steel sleeves, a portion of each soil sample will be placed in sealable plastic baggies. The sample will be left to sit in the baggie for at least 10 minutes, and then the PID will be used to take a headspace reading. If any soil samples have headspace readings that exceed ambient air measurements, these samples will also be analyzed for VOCs.

Field screening of building materials for LBP will be conducted with a XRF spectrometer. A portable XRF Spectrometer manufactured by Innov-X Systems, Inc. (Serial No. 11911) will be used to test for lead. The XRF analyzer is equipped with non-isotope x-ray tubes and was manufactured in March of 2012. The analyzer will be calibrated pursuant to the manufacturer's specifications against pre-determined lead paint samples produced by the National Institute of Standards and Testing (NIST). These quality control measures produce a 95% confidence level that XRF readings accurately reflect the actual level of lead in the tested surfaces. By conducting a random sampling of the building's interiors and exteriors, and statistically analyzing the results of the XRF data, the existence and location of lead (paint and glazed components with lead) in the building is identified.

It should be noted, due to interference from the painted substrate, paint thickness, the number of paint applications, etc., XRF analyzers do not provide results that are directly comparable to those from paint chip samples and the laboratory. XRF results are reported in milligrams of lead per square centimeter (mg/cm^2) of paint. Federal Housing and Urban Development (HUD) Guidelines define LBP as positive if: 1) XRF measurements are greater than or equal to $1.0 \text{ mg}/\text{cm}^2$, or 2) laboratory results for paint samples are greater than or equal to 5,000 ppm (parts per million) by weight or 0.5% by dry weight.

DOSH guidelines (Title 8, California Code of Regulations or CCR, Section 1532.1), are applicable to occupational exposures to potential lead-containing materials during renovation or demolition activities. DOSH guidelines indicate that coatings or materials containing lead may constitute a health hazard to employees engaged in lead-related construction work. Poisonings may occur if workers or visitors ingest or inhale lead-containing materials or paint.

6.3 SOIL VAPOR SAMPLING

Soil vapor samples will be collected by a C-57 licensed driller, using a hydraulically-driven probe equipped with detachable drive points. Once the drive point has reached the target sample depth, Nylaflow (or equivalent) tubing encased with polyethylene tubing will be inserted through the top of the geo rod and screwed into the bottom. A saturated bentonite seal will be placed around the geo rod at ground surface to prevent ambient air from entering the sample system. A leak test will be performed by spraying 1,1-difluoroethane (tracer gas) on top of the bentonite seal and underneath a container (e.g., 5-gallon polyethylene bucket) prior to purging the geo rod of vapor. After applying the tracer gas, the drive point will be retracted to provide a void space where soil vapor can accumulate. During the sampling of the first soil vapor boring, a purge test will be completed with one (1), three (3), and ten (10) tubing volumes of soil vapor sampled and analyzed. The purge test result yielding the most elevated VOC concentration will dictate the purge volume used for subsequent soil vapor samples.

Soil vapor samples will be collected through 1/4-inch Nylaflow (or equivalent) tubing attached to the drive point using a calibrated syringe connected to a sampling port at the top end of the tubing. Immediately following sample collection, the sample containers (i.e., syringes) will be labeled with sample-point identification, date, and time of collection and recorded into a field log book as further described in the Revised QAPP. The collected samples will be immediately submitted to the TEG State of California certified on-Site mobile laboratory where they will be logged onto the COC form and assigned a laboratory identification number.

The samples will be analyzed for the complete suite of VOCs and TPHg by EPA Method 8260B using low method detection limits, as well as 1,1-difluoroethane and atmospheric gases (see Appendix A).

To minimize the potential for cross-contamination between sampling locations, soil vapor sampling equipment will be decontaminated prior to initiating work at each drilling location. The drop off point, nylon 1/8-inch tubing, and sampling syringes are all disposable, and new equipment will be used for each sample. The threaded point holder will be decontaminated by Liquinox (or similar) wash and potable water rinse.

6.4 SOIL SAMPLING

6.4.1 Near Surface Soil Sampling

Near surface soil samples (from sample locations OTF-1 and -2, TPB-01 through -04 as shown on Figure 2) will be collected with a hand auger and drive sampler at depths of 0.5 and 1.5 feet bgs. The drive sampler will be equipped with a 1½-inch diameter stainless steel sampling sleeve.

Upon sample collection, the sample and sleeve will be removed from the drive sampler, the ends will be covered with Teflon sheets and plastic ends caps, and the samples will be labeled. The samples will be placed in sealable plastic bags and placed in an ice-filled cooler pending pick-up by the Pace courier.

6.4.2 Shallow Subsurface Soil Sampling

Subsurface soil samples will be collected from the locations presented on Figure 2 using a backhoe equipped with a narrow bucket, hand auger and drive sampler. SCS field personnel will collect soil samples at depths of 0.5, 1.5, 3.0, and 4.5 feet bgs using a drive sampler equipped with a 1½-inch diameter stainless steel sampling sleeve. The shallow samples will be collected directly from the exposed soil, and the deeper samples will be collected from soils exposed by the backhoe bucket excavation.

Upon sample collection, the sample and sleeve will be removed from the drive sampler, the ends will be covered with Teflon sheets and plastic ends caps, and the samples will be labeled. The samples will be placed in sealable plastic bags and placed in an ice-filled cooler pending pick-up by the Pace courier.

Sample locations are shown on Figure 2 and were selected based on review of Site use history and identified FOPC. If any changes are made to sampling locations, in case of drilling refusal for instance, then the changed location will be measured and mapped on the Site plan. See Section 7.1 for preservation and shipping procedures.

6.4.3 Deeper Subsurface Soil Sampling

At the locations of proposed deeper soil sample collection and budget permitting, Clear Heart Drilling, Inc. (Clear Heart) will first use a hand auger to clear the upper five feet of soils with respect to utilities and collect soil samples for lithologic description. Clear Heart, a C-57 licensed driller will advance soil borings using a CME-75 hollow stem auger drilling rig equipped with a split-spoon sampler lined with stainless steel sleeves. Clear Heart will use a drive hammer or pneumatic air hammer to advance the split sampler in increments of 18 inches. Borings located inside Site buildings will be advanced using a DR-8K limited access drilling rig equipped as described above for sampling.

Undisturbed soil samples will be collected at five foot intervals from depths of between five and 45 feet bgs as part of the second phase of subsurface assessment. The proposed deeper sample locations are presented on Figure 2, subject to modification based upon the results of the first phase of subsurface investigation.

Following each sampler drive interval, Clear Heart will retrieve the sampler, and the SCS field staff will retrieve the sample tubes from the drive sampler, field screen and log the samples, and the cover each end with Teflon sheets and plastic ends caps, label the samples, and place the samples in sealable plastic bags in an ice-filled cooler pending pick-up by the Pace courier. Upon completion of sampling activities, the soil borings will be backfilled with soil cuttings and the ground surface grouted or repaired as needed to match surrounding conditions. See Section 7.1 for preservation and shipping procedures.

6.5 SEDIMENT SAMPLING

Sediment sampling is not proposed for the Site.

6.6 WATER SAMPLING

6.6.1 Surface Water Sampling

Surface water sampling is not proposed for the Site.

6.6.2 Grab Groundwater Sampling

At those locations of deeper soil sample collection, Clear Heart will advance each borehole to approximately five feet beyond the first encountered water, expected to occur at approximately 45 feet bgs. Upon reaching the target depth, Clear Heart will install temporary well screen in the borehole to facilitate groundwater sample collection. Clear Heart and SCS personnel will sound each borehole to gauge the depth to water using a water level indicator capable of measurements to an accuracy of 0.01 feet.

Each borehole and temporary screen will be purged of water to remove sediment laden water using a disposable bailer and/or downhole pump. Following purging, SCS will collect representative water samples using a disposable bailer. The collected water will be decanted into clean laboratory supplied containers according to the intended analytical suite, as presented on Table 5-5. After advancing each soil boring and collecting the soil and grab groundwater samples, Clear Heart will decommission each boring by backfilling with cuttings and cement grout to ground surface.

The collected grab groundwater samples will be labeled, recorded on a COC form and placed in and ice-chilled cooler for preservation during transport to Pace. See Section 7.1 for preservation and shipping procedures.

6.7 STOCKPILE AND IDW SAMPLING

Stockpile sampling is not anticipated for the Site.

However, IDW (other than PPE and used sampling equipment) generated during field activities will be sampled for chemical analysis to facilitate materials profiling and disposal.

IDW will be stored and secured in UN/DOT-approved 55 gallon drums. SCS will collect representative samples of materials stored in each drum. Soil samples will be collected using stainless steel tubes driven into the drum's contents with a slide hammer. Each tube will be retrieved from the drive sampler, screened using a PID, logged, and then covered at each end with Teflon sheets and plastic ends caps, labeled, and placed in sealable plastic bags in an ice-filled cooler pending pick-up by the Pace courier. See Section 7.1 for preservation and shipping procedures.

Drums containing water will be sampled by lowering a disposable bailer into each drum. The collected water will be decanted into clean laboratory supplied containers according to the intended analytical suite, as presented on Table 5-5. The collected water samples will be labeled, recorded on a COC form and placed in and ice-chilled cooler for preservation during transport to the Pace. See Section 7.1 for preservation and shipping procedures.

6.8 DECONTAMINATION PROCEDURES

Decontamination of sampling equipment must be conducted consistently to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated soil will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated but will be packaged for appropriate disposal.

Decontamination will occur prior to and after a piece of equipment is used. All sampling devices used (including hand augers and drive samplers) will be decontaminated according to EPA Region 9 recommended procedures. The following, to be carried out in sequence, is an EPA Region 9 recommended procedure for the decontamination of sampling equipment.

- Non-phosphate detergent and tap water wash, using a brush if necessary
- Tap-water rinse
- Deionized/distilled water rinse (first rinse)
- Deionized/distilled water rinse (second rinse)

Equipment will be decontaminated in a predesignated area on visqueen (plastic sheeting), and clean bulky equipment will be stored in their cases or on visqueen in uncontaminated areas. Cleaned small equipment will be stored in their cases or in plastic bags. Materials to be stored more than a few hours will also be covered. Liquids and solids resulting from the decontamination process will be stored and secured in UN/DOT-approved 55 gallon drums pending characterization sampling, analysis, and disposal profiling.

Table 6-1: Field and Sampling Equipment

Description of Equipment	Material (if applicable)	Dedicated (Yes/No)
Hand auger	NA	No
Drive sampler	NA	No
Stainless steel sleeves	Teflon sheets and end caps	Yes
Shovel	NA	No
PID(s)	NA	No
XRF	NA	No

Notes:

PID = photoionization detector

XRF = X-Ray fluorescence

NA = not applicable

7.0 SAMPLE CONTAINERS, PRESERVATION, PACKAGING, AND SHIPPING

The number and type of sample containers, volumes, and preservatives are listed in Tables 5-2 and 5-4. The containers are pre-cleaned and will not be rinsed prior to sample collection.

7.1 SOIL VAPOR SAMPLES

Soil vapor samples will be collected using clean syringes provided by TEG, a State-certified analytical laboratory. The vapor samples collected using syringes will be transferred immediately from each sample location to the on-Site mobile laboratory, without use of a preservative or special packaging. Each syringe (sample) will be logged at the mobile laboratory with sample identification number, date, and time of collection. Once delivered to the mobile laboratory, the contents of each syringe will be injected into the Gas Chromatograph/Mass Spectrometer (GC/MS) located in the mobile laboratory structure, and the syringe will be placed in a container for later appropriate disposal.

7.2 SOIL SAMPLES

Soil samples will be collected in stainless steel sampling sleeves or glass jars. The ends of sampling sleeves will be covered with Teflon sheets and plastic end caps. Those samples to be analyzed for VOCs will be collected in their sealed Encore samplers (or similar hermetically-sealed sampling devices). Samples for will be placed in an ice-filled cooler and chilled to 4 degrees Celsius immediately upon collection pending pickup by the Pace courier.

7.3 WATER SAMPLES

Grab groundwater samples will be collected using disposable bailers with the contents decanted into laboratory-supplied glassware. Depending upon the intended analysis, the containers may be prepared with preservatives such as acid. Smaller glassware, namely the volatile organic analysis (VOA) vials, will be placed in Ziploc baggies and then placed in an ice-filled cooler and chilled to 4 degrees Celsius immediately upon collection pending pickup by the Pace courier. All other containers will be placed directly into the ice-filled cooler upon collection and pending pickup by a Pace courier.

8.0 DISPOSAL OF IDW

In the process of collecting environmental samples, the sampling team will generate different types of potentially contaminated IDW that may include the following:

- Used PPE
- Disposable sampling equipment
- Decontamination fluids
- Soil cuttings from soil borings
- Water from temporary monitoring wells

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with ARARs to the extent practicable. The FSP follows the *Office of*

Solid Waste and Emergency Response (OSWER) 9345.3-03FS, NTIS: PB92-963353INX Guide Management of Investigation-Derived Wastes (OSWER, 1992), which provides guidance for the management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of and can still be reused will be rendered inoperable before disposal in the refuse dumpster.

Decontamination fluids generated from the activities will be stored and secured in UN/DOT 55-gallon drums, which will be properly labeled and left on Site pending receipt of analytical results and evaluation of disposal options. SCS shall perform all necessary testing and submit all necessary documentation to a licensed disposal facility to properly characterize the waste. The waste will be properly labeled as Hazardous Waste or Non-Hazardous Waste following state and federal regulations, as is appropriate, and will be transported according to the applicable federal, state, and local regulations.

Soil cuttings will be used to backfill the hand auger borings. If excess soil cuttings are generated during the subsurface sampling that cannot be put back into the borings, they will be stored and secured in UN/DOT 55-gallon drums and disposed of at a waste disposal facility licensed and approved to accept the waste.

9.0 SAMPLE DOCUMENTATION

9.1 FIELD NOTES

9.1.1 Field Log Forms

Daily field log forms will be used to document field activities. Each day's field log forms will be dated, and the pages will be consecutively numbered. The log forms will be completed in ink and signed by the individual recording the information. Field log forms will be supplemented with detailed boring logs and field-edited Site plans.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description
- Site plan showing sample location and measured distances
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (soil, groundwater, or soil vapor)
- Type of sampling equipment used
- Field instrument readings and calibration

- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for water: clear water with strong ammonia-like odor)
- Sample preservation
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and COC form numbers
- Shipping arrangements (overnight air bill number)
- Name(s) of recipient laboratory(ies)

In addition to the sampling information, the following specific information will also be recorded in the field notes for each day of sampling:

- Team members and their responsibilities
- Time of arrival/entry on Site and time of Site departure
- Other personnel on Site
- Summary of any meetings or discussions Agency, contractor, or federal agency personnel
- Deviations from sampling plans, Site safety plans, and FSP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

9.1.2 Photographs

Photographs will be taken at the sampling locations and at other areas of interest on the Site. They will serve to verify information entered in the daily field log forms. For each photograph taken, the following information will be written in the daily field log forms:

- Time, date, location, and weather conditions
- Description of the subject photographed
- Name of person taking the photograph

9.2 SAMPLE LABELING

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: station location, date of collection, analytical parameter(s), and method of preservation, if any. Every sample will be assigned a unique sample number.

9.3 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

All sample shipments for analyses will be accompanied by a COC record. The COC records will be completed and provided to the laboratories along with the samples collected each day. If multiple coolers are sent to a single laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The COC form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are provided to the laboratory, the custody of the samples will be the responsibility SCS. The sampling team leader or designee will sign the COC form in the "relinquished by" box and note the date and time.

A self-adhesive custody seal will be placed across the lid of each sample. For VOC samples, if collected, the seal will be wrapped around the cap. The shipping containers in which samples are stored (usually a sturdy plastic cooler or ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

9.4 PACKAGING AND SHIPPING

Soil samples will be placed in a sturdy, ice-filled, plastic cooler pending pickup by the Pace courier. The following outlines the packaging procedures that will be followed for low concentration samples.

1. When ice is used, it will be packed in zip locked, double plastic bags. The drain plug of the cooler will be sealed with fiberglass tape to prevent melting ice from leaking out of the cooler.
2. The bottom of the cooler will be lined with bubble wrap to prevent breakage during shipment.
3. Screw caps of containers will be tested for tightness.
4. Container tops will be secured with clear tape and custody sealed.
5. Sample labels will be affixed onto the containers.
6. All glass sample containers will be wrapped in bubble wrap to prevent breakage..
7. Sample containers will be sealed in heavy duty plastic zip-lock bags, and the sample numbers will be written on the outside of the plastic bags with indelible ink.
8. Samples will be placed in a sturdy cooler(s). The appropriate COC documents will be enclosed in a zip-lock plastic bag affixed to the underside of the cooler lid.
9. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment.
10. Ice used to cool samples will be double sealed in two zip lock plastic bags and placed on top and around the samples to chill them to the correct temperature.

10.0 QUALITY CONTROL

10.1 FIELD QUALITY CONTROL SAMPLES

10.1.1 Assessment of Field Contamination (Blanks)

10.1.1.1 Equipment Blanks

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring High Performance Liquid Chromatography (HPLC) organic-free (for organics) or deionized water (for inorganics) over the decontaminated sampling equipment. Equipment blanks will be collected at a frequency of one blank per matrix per day or one blank per matrix per twenty samples, whichever is more frequent. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day (the hand auger and drive sampler).

The equipment rinsate blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.

10.1.1.2 Field Blanks

To assess contamination from field conditions during sampling, field blanks will be collected when preservatives are used in the field. A sample of analyte free water will be poured into the container in the field, preserved, and shipped to the laboratory with field samples. Field blanks will be collected at a frequency of one blank per day per matrix or one blank per 20 samples per matrix, whichever is more frequent.

10.1.1.3 Trip Blanks

Trip blanks will be not be collected since equipment, field, and temperature blanks will be collected.

10.1.1.4 Temperature Blanks

For each cooler that is shipped or transported to an analytical laboratory, a 40 milliliter (ml) VOA vial will be included and marked “temperature blank.” This blank will be used by the sample custodian to check the temperature of samples upon receipt.

10.1.1.5 Assessment of Field Variability (Field Duplicate or Co-located Samples)

Duplicate near surface and shallow soil samples will be collected at select sample locations identified on Table 5-2, and analyzed. In addition, duplicate shallow soil samples will also be collected from 3 and 4.5 feet bgs in select locations for possible analysis. These duplicate samples will be held pending the results of the initial analyses of the 0.5- and 1.5-foot samples. If initial analyses contain detectable concentrations of pesticides or elevated concentrations of metals, and it is necessary to analyze the deeper samples (from 3 and 4.5 feet bgs), then a sufficient number of duplicate samples (to maintain a frequency of at least 1 duplicate per every 10 samples) will be analyzed.

Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. A separate sample number and station number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

10.2 BACKGROUND SAMPLES

No background samples will be collected as part of this assessment.

10.3 FIELD SCREENING, INCLUDING CONFIRMATION SAMPLES AND SPLIT SAMPLES

10.3.1 Field Screening Samples

Not applicable to soil vapor, soil, or groundwater samples. However, paint chip samples will be field screened for LBP.

10.3.2 Confirmation Samples (Field Screening)

Not applicable to soil vapor, soil, or groundwater samples. However, paint chip samples will be field screened for LBP.

10.4 LABORATORY QUALITY CONTROL SAMPLES

A routinely collected soil sample (a full brass or stainless steel sampling sleeve or glass jar) for metals and pesticides analysis contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.

At a minimum, one laboratory QC sample is required per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated.

For this sampling event, samples collected at the following locations will be the designated laboratory QC samples:

- For shallow soil, sample PM1-01-0.5.
- For drum samples, sample D01S.

These sample locations have been selected based on geographic distribution, anticipated order of collection, and/or requirements for the number of duplicate samples collected.

11.0 FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this FSP. When appropriate, the QA Officer will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

The only modifications currently anticipated are the potential analysis of samples for additional COPC based on PID readings, staining, odors, etc.

12.0 FIELD HEALTH AND SAFETY PROCEDURES

A Site-Specific HASP for work conducted at the Site and workers within the “exclusion zone” is required pursuant to the regulations found in 29 CFR Part 1910.120, CCR, Title 8, Section 5192, and CCR, Title 22, Section 66261.24 (CCR, 2016a; CCR, 2016b; CFR, 2016c). Therefore, a HASP has been prepared for the proposed work scope and outlines the potential chemical and physical hazards that may be encountered during the sampling activities. The appropriate PPE and emergency response procedures for the anticipated Site-specific chemical and physical hazards are detailed in the HASP including the route to the nearest hospital emergency room. SCS and contracted personnel involved with the proposed field work will be required to read and sign this document in order to encourage proper health and safety practices.

13.0 REFERENCES

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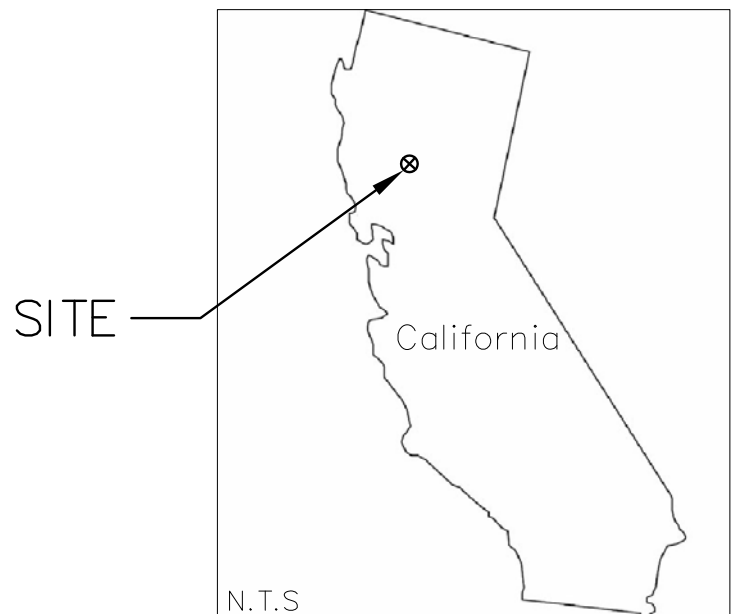
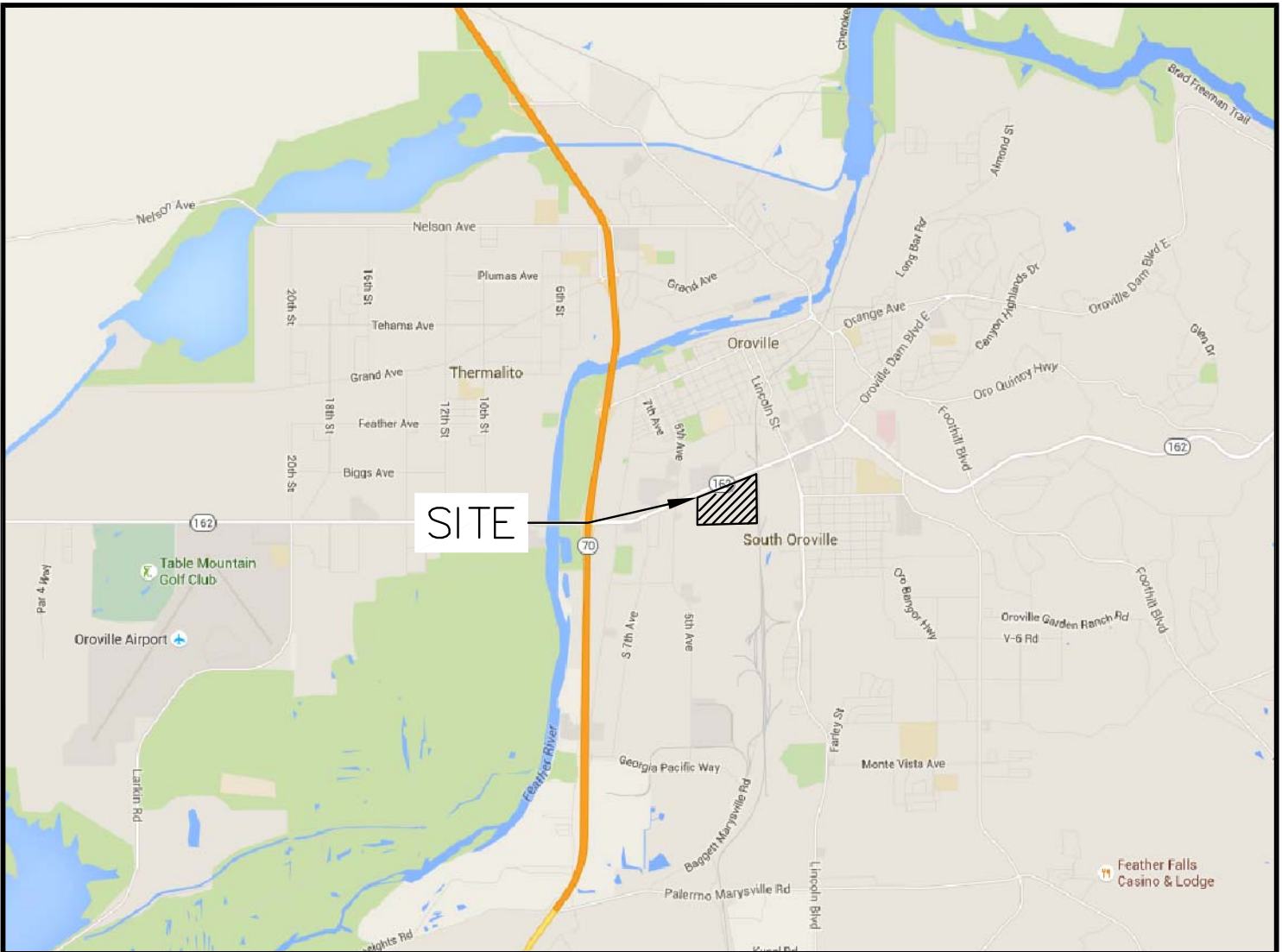
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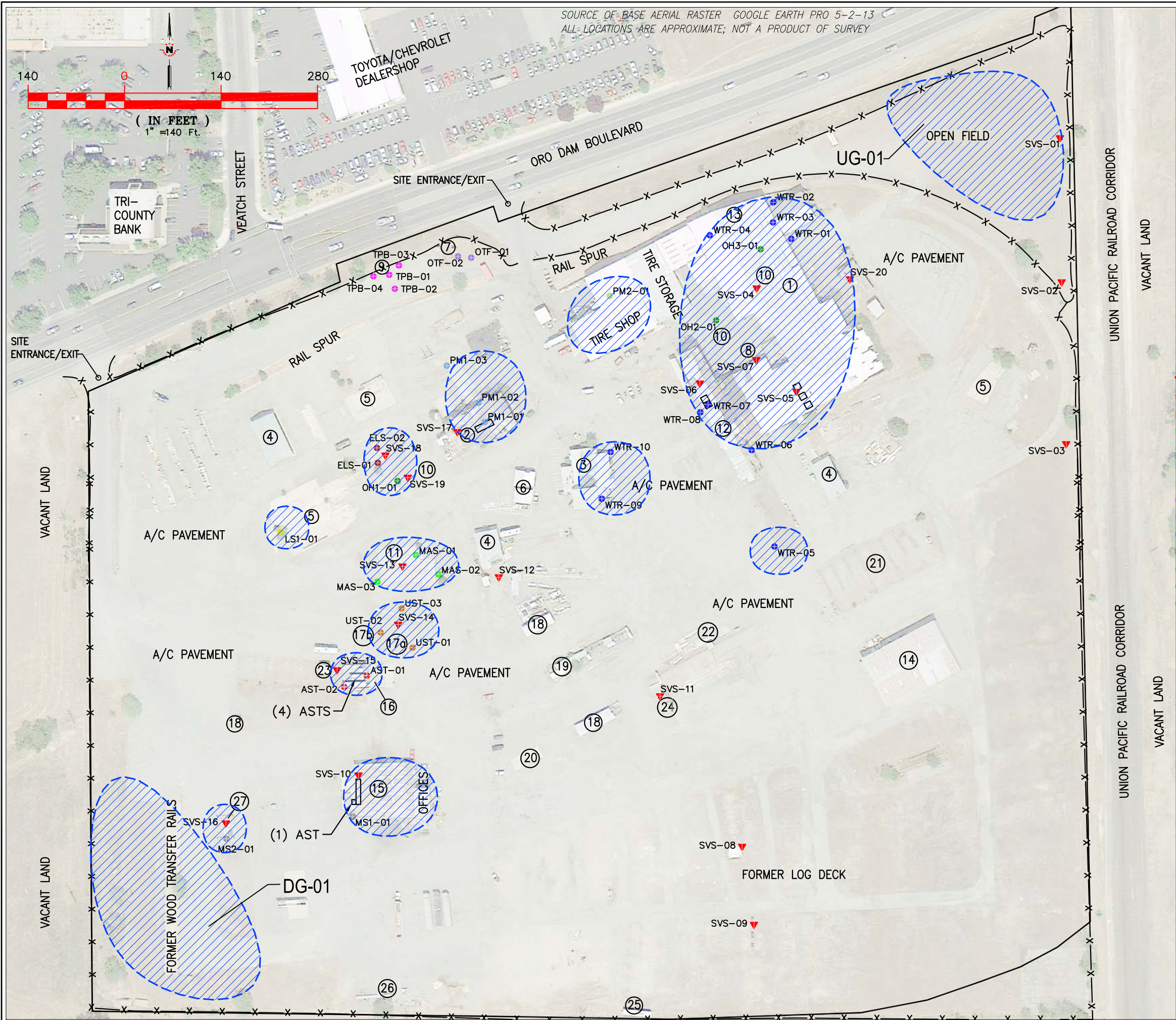
FIGURES



SOURCE OF BASE MAP: GOOGLE MAPS

SCS ENGINEERS		
ENVIRONMENTAL CONSULTANTS		
3843 BRICKWAY BOULEVARD SUITE 208 SANTA ROSA, CALIFORNIA 95403 PH. (707) 546-9461 FAX. (707) 544-5769		
PROJ. NO. 01215033.00	DWN. BY: JH	ACAD. FILE: 01215033.00_ESA-5-15
DATE 7/22/15	CHK. BY: PAW	APP. BY: J. RITCHIE

SHEET TITLE: SITE LOCATION MAP	SCALE: N.T.S
PROJECT TITLE: APN: 035-270-016 1245 ORO DAM BOULEVARD OROVILLE, CALIFORNIA	FIGURE NO. 1



GENERAL SITE FEATURES:

—

APPROXIMATE BUTTE COUNTY ASSESSOR'S PARCEL BOUNDARY

□

PIT OR SUMP

—x—x—

CHAIN LINK FENCE

SITE FEATURES AND EXPLANATION:

①

APPROX. 74,000 SQ. FT. WAREHOUSE (FORMER BOX FACILITY/ WOOD TRUSS PLANT)

②

FORMER PLANING MILL

③

VACANT ADMINISTRATIVE OFFICES

④

OPEN STORAGE SHED

⑤

BUILDING FOUNDATION (FORMER LUMBER STORAGE BUILDING)

⑥

ENCLOSED SHEDS

⑦

PG&E TRANSFORMERS

⑧

SEPTIC TANK(S)

⑨

FORMER TEEPEE BURNER

⑩

FORMER OIL HOUSE/STORAGE

⑪

BUILDING FOUNDATION (FORMER TRUCK REPAIR/MACHINE SHOP)

⑫

FORMER LUMBER STORAGE SHED

⑬

FORMER PCP STORAGE

⑭

APPROX. 10,000 SQ. FT. WAREHOUSE

⑮

APPROX. 7,500 SQ. FT. WAREHOUSE (VACANT)

⑯

FUELING AREA/ASTS

⑰

FORMER UST LOCATIONS (a) AND GAS PUMP (b)

⑱

ENCLOSED SHED

⑲

OPEN SHED

⑳

CONCRETE FOUNDATION

㉑

FORMER WAREHOUSE (FORMER LUMBER SHED)

㉒

TRUCK SCALE & SCALE HOUSE

㉓

BATHROOM

㉔

LUMBER MILLING MACHINERY

㉕

SHIPPING CONTAINER

㉖

MATERIALS STORAGE AREA

㉗

FORMER MECHANICS SHOP

HREC SAMPLING LOCATIONS:

▼ SVS

SVS = SOIL VAPOR SURVEY

♦ AST

AST = ABOVEGROUND STORAGE TANK

⬢ UST

UST = UNDERGROUND STORAGE TANK

✱ MAS

MAS = MACHINE SHOP

⬢ MS1

MS1 = MECHANIC'S SHOP 1

⬢ MS2

MS2 = MECHANIC'S SHOP 2

⬢ PM1

PM1 = PLANING MILL 1

⬢ PM2

PM2 = PLANING MILL 2

✱ TPB

TPB = TEEPEE BURNER

⬢ OTF

OTF = OPEN TRANSFORMER

⬢ WTR

WTR = WOOD TREATMENT

✱ ELS

ELS = ELECTRIC SHOP

✱ OH1

OH1 = OIL HOUSE 1

✱ OH2

OH2 = OIL HOUSE 2

✱ OH3

OH3 = OIL HOUSE 3

✱ LS1

LS1 = LUMBER STORAGE 1

APPROXIMATE AREA DESIGNATED FOR POTENTIAL GROUNDWATER SAMPLING

DATE

REVISION

NO.

SHEET TITLE

PROJECT TITLE

CITY OF OROVILLE, CALIFORNIA

CLIENT:

SCS ENGINEERS

ENVIRONMENTAL CONSULTANTS

3843 BRICKWAY BOULEVARD SUITE 208

SANTA ROSA, CALIFORNIA

PH. (707) 546-9461 FAX. (707) 544-5769

PROJ. NO. 01215033.00

PSN. BY: PAW/JUM

CHK. BY: J. RITCHIE

DATE:

7/14/16

SCALE:

(AS SHOWN)

FIGURE

2

APPENDIX A
RISK BASED SCREENING LEVEL TABLES

Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) November 2015

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																												
Toxicity and Chemical-specific Information											Contaminant		Screening Levels											Protection of Ground Water SSLs				
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (ug/m ³) ⁻¹	RTD _o (mg/kg-day)	k _e (ug/m ³) ⁻¹	RF _{C1} (mg/m ³) ⁻¹	k _e (ug/m ³) ⁻¹	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)	
8.7E-03		2.2E-06	I	4.0E-03	I	9.0E-03	I	V	1	0.1	1.1E+05	Acephate	30560-19-1	6.2E+01	c**	2.6E+02	c**		1.3E+00	c**	5.6E+00	c**	8.9E+00	c**		2.0E-03	c**	
				2.0E-02	I				1	0.1		Acetaldehyde	75-07-0	1.1E+01	c**	4.9E+01	c**					2.6E+00	c**		5.2E-04	c**		
									1			Acetochlor	34256-82-1	1.3E+03	n	1.6E+04	n					3.5E+02	n		2.8E-01	n		
				9.0E-01	I	3.1E+01	A	V	1		1.1E+05	Acetone	67-64-1	6.1E+04	n	6.7E+05	nms	3.2E+04	n	1.4E+05	n	1.4E+04	n		2.9E+00	n		
				2.0E-03	X				1	0.1		Acetone Cyanohydrin	75-86-5	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n							
				6.0E-02	I	V			1		1.3E+05	Acetonitrile	75-05-8	8.1E+02	n	3.4E+03	n	6.3E+01	n	2.6E+02	n	1.3E+02	n		2.6E-02	n		
				1.0E-01	I		V		1		2.5E+03	Acetophenone	98-86-2	7.8E+03	ns	1.2E+05	nms					1.9E+03	n		5.8E-01	n		
3.8E+00	C	1.3E-03	C	5.0E-04	I	2.0E-05	I	V	1	0.1	2.3E+04	Acetylaminofluorene, 2-	53-96-3	1.4E-01	c	6.0E-01	c	2.2E-03	c	9.4E-03	c	1.6E-02	c		7.2E-05	c		
									1			Acrolein	107-02-8	1.4E-01	n	6.0E-01	n	2.1E-02	n	8.8E-02	n	4.2E-02	n		8.4E-06	n		
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I	M	1	0.1		Acrylamide	79-06-1	2.4E-01	c	4.6E+00	c	1.0E-02	c	1.2E-01	c	5.0E-02	c		1.1E-05	c		
				5.0E-01	I	1.0E-03	I	V	1		1.1E+05	Acrylic Acid	79-10-7	9.9E+01	n	4.2E+02	n	1.0E+00	n	4.4E+00	n	2.1E+00	n		4.2E-04	n		
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V	1		1.1E+04	Acrylonitrile	107-13-1	2.5E-01	c*	1.1E+00	c*	4.1E-02	c*	1.8E-01	c*	5.2E-02	c*		1.1E-05	c*		
				6.0E-03	P				1	0.1		Adiponitrile	111-69-3	8.5E+06	nm	3.6E+07	nm	6.3E+00	n	2.6E+01	n							
5.6E-02	C			1.0E-02	I				1	0.1		Alachlor	15972-60-8	9.7E+00	c*	4.1E+01	c					1.1E+00	c	2.0E+00	8.7E-04	c	1.6E-03	
				1.0E-03	I				1	0.1		Aldicarb	116-06-3	6.3E+01	n	8.2E+02	n					2.0E+01	n	3.0E+00	4.9E-03	n	7.5E-04	
				1.0E-03	I				1	0.1		Aldicarb Sulfone	1646-88-4	6.3E+01	n	8.2E+02	n					2.0E+01	n	2.0E+00	4.4E-03	n	4.4E-04	
1.7E+01	I	4.9E-03	I	3.0E-05	I		V		1	0.1		Aldicarb sulfoxide	1646-87-3											4.0E+00				
									309-00-2			Aldrin	309-00-2	3.9E-02	c*	1.8E-01	c	5.7E-04	c	2.5E-03	c	9.2E-04	c		1.5E-04	c	8.8E-04	
				5.0E-03	I	1.0E-04	X	V	1		1.1E+05	Allyl Alcohol	107-18-6	3.5E+00	n	1.5E+01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		4.2E-05	n		
2.1E-02	C	6.0E-06	C			1.0E-03	I	V	1		1.4E+03	Allyl Chloride	107-05-1	7.2E-01	c**	3.2E+00	c**	4.7E-01	c**	2.0E+00	c**	7.3E-01	c**		2.3E-04	c**		
				1.0E+00	P	5.0E-03	P		1			Aluminum	7429-90-5	7.7E+04	n	1.1E+06	nm	5.2E+00	n	2.2E+01	n	2.0E+04	n		3.0E+04	n		
				4.0E-04	I				1			Aluminum Phosphide	20859-73-8	3.1E+01	n	4.7E+02	n					8.0E+00	n			n		
2.1E+01	C	6.0E-03	C			9.0E-03	I		1	0.1		Ametryn	834-12-8	5.7E+02	n	7.4E+03	n					1.5E+02	n		1.6E-01	n		
									1	0.1		Aminobiphenyl, 4-	92-67-1	2.6E-02	c	1.1E-01	c	4.7E-04	c	2.0E-03	c	3.0E-03	c		1.5E-05	c		
				8.0E-02	P				1	0.1		Aminophenol, m-	591-27-5	5.1E+03	n	6.6E+04	n					1.6E+03	n		6.1E-01	n		
				2.0E-02	P				1	0.1		Aminophenol, p-	123-30-8	1.3E+03	n	1.6E+04	n					4.0E+02	n		1.5E-01	n		
				2.5E-03	I				1	0.1		Amitraz	33089-61-1	1.6E+02	n	2.1E+03	n					8.2E+00	n		4.2E+00	n		
				1.0E-01	I	V			1			Ammonia	7664-41-7					1.0E+02	n	4.4E+02	n					n		
				2.0E-01	I				1			Ammonium Sulfamate	7773-06-0	1.6E+04	n	2.3E+05	nm					4.0E+03	n			n		
				3.0E-03	X	V			1		1.4E+04	Amyl Alcohol, tert-	75-85-4	8.2E+01	n	3.4E+02	n	3.1E+00	n	1.3E+01	n	6.3E+00	n		1.3E-03	n		
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I		1	0.1		Aniline	62-53-3	9.5E+01	c**	4.0E+02	c*	1.0E+00	n	4.4E+00	n	1.3E+01	c*		4.6E-03	c*		
4.0E-02	P			2.0E-03	X				1	0.1		Anthraquinone, 9,10-	84-65-1	1.4E+01	c**	5.7E+01	c*					1.4E+00	c*		1.4E-02	c*		
				4.0E-04	I				0.15			Antimony (metallic)	7440-36-0	3.1E+01	n	4.7E+02	n					7.8E+00	n	6.0E+00	3.5E-01	n	2.7E-01	
				5.0E-04	H				0.15			Antimony Pentoxide	1314-60-9	3.9E+01	n	5.8E+02	n					9.7E+00	n			n		
				4.0E-04	H				0.15			Antimony Tetroxide	1332-81-6	3.1E+01	n	4.7E+02	n					7.8E+00	n			n		
				2.0E-04	I				0.15			Antimony Trioxide	1309-64-4	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n					n		
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C		1	0.03		Arsenic, Inorganic	7440-38-2	6.8E-01	c*R	3.0E+00	cR	6.5E-04	c*	2.9E-03	c*	5.2E-02	c	1.0E+01	1.5E-03	c	2.9E-01	
				3.5E-06	C	5.0E-05	I		1			Arsine	7784-42-1	2.7E-01	n	4.1E+00	n	5.2E-02	n	2.2E-01	n	7.0E-02	n			n		
				5.0E-02	I				1	0.1		Asulam	3337-71-1	3.2E+03	n	4.1E+04	n					1.0E+03	n		2.6E-01	n		
2.3E-01	C			3.5E-02	I				1	0.1		Atrazine	1912-24-9	2.4E+00	c	1.0E+01	c					3.0E-01	c	3.0E+00	2.0E-04	c	1.9E-03	
8.8E-01	C	2.5E-04	C						1	0.1		Auramine	492-80-8	6.2E-01	c	2.6E+00	c	1.1E-02	c	4.9E-02	c	6.7E-02	c		6.1E-04	c		
				4.0E-04	I				1	0.1		Avermectin B1	65195-55-3	2.5E+01	n	3.3E+02	n					8.0E+00	n		1.4E+01	n		
				3.0E-03	A	1.0E-02	A		1	0.1		Azinphos-methyl	86-50-0	1.9E+02	n	2.5E+03	n	1.0E+01	n	4.4E+01	n	5.6E+01	n		1.7E-02	n		
1.1E-01	I	3.1E-05	I	1.0E+00	P	7.0E-06	P	V	1	0.1		Azobenzene	103-33-3	5.6E+00	c	2.6E+01	c	9.1E-02	c	4.0E-01	c	1.2E-01	c		9.3E-04	c		
									1			Azodicarbonamide	123-77-3	8.6E+03	n	4.0E+04	n	7.3E-03	n	3.1E-02	n	2.0E+04	n		6.8E+00	n		
5.0E-01	C	1.5E-01	C	2.0E-01	I	5.0E-04	H		0.07			Barium	7440-39-3	1.5E+04	n	2.2E+05	nm	5.2E-01	n	2.2E+00	n	3.8E+03	n	2.0E+03	1.6E+02	n	8.2E+01	
				2.0E-02	C	2.0E-04	C	M	0.025			Barium Chromate	10294-40-3	3.0E-01	c	6.2E+00	c	6										

Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) November 2015

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice);
c = cancer; n = noncancer; * = where n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information											Contaminant		Screening Levels											Protection of Ground Water SSLs			
SFO (mg/kg-day) ¹	k _e (y)	IUR (ug/m ³) ²	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RF _C (mg/m ³) ³	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (ug/L)	key	Resident Air (ug/m ³)	key	Industrial Air (mg/kg)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.0E-03	P					1	0.1	Bis(2-chloroethoxy)methane	111-91-1	1.9E+02	n	2.5E+03	n					5.9E+01	n		1.3E-02	n	
1.1E+00	I	3.3E-04	I				V			1	5.1E+03	Bis(2-chloroethyl)ether	111-44-4	2.3E-01	c	1.0E+00	c	8.5E-03	c	3.7E-02	c	1.4E-02	c		3.6E-06	c	
2.2E+02	I	6.2E-02	I				V			1	4.2E+03	Bis(chloromethyl)ether	542-88-1	8.3E-05	c	3.6E-04	c	4.5E-05	c	2.0E-04	c	7.2E-05	c		1.7E-08	c	
				5.0E-02	I					1	0.1	Bisphenol A	80-05-7	3.2E+03	n	4.1E+04	n					7.7E+02	n		5.8E+01	n	
				2.0E-01	I	2.0E-02	H			1		Boron And Borates Only	7440-42-8	1.6E+04	n	2.3E+05	nm	2.1E+01	n	8.8E+01	n	4.0E+03	n		1.3E+01	n	
				2.0E+00	P	2.0E-02	P	V		1		Boron Trichloride	10294-34-5	1.6E+05	nm	2.3E+06	nm	2.1E+01	n	8.8E+01	n	4.0E+03	n			n	
				4.0E-02	C	1.3E-02	C	V		1		Boron Trifluoride	7637-07-2	3.1E+03	n	4.7E+04	n	1.4E+01	n	5.7E+01	n	2.6E+01	n			n	
7.0E-01	I			4.0E-03	I					1		Bromate	15541-45-4	9.9E-01	c	4.7E+00	c					1.1E-01	c	1.0E+01	8.5E-04	c	7.7E-02
2.0E+00	X	6.0E-04	X				V			1	2.4E+03	Bromo-2-chloroethane, 1-	107-04-0	2.6E-02	c	1.1E-01	c	4.7E-03	c	2.0E-02	c	7.4E-03	c		2.1E-06	c	
				8.0E-03	I	6.0E-02	I	V		1	6.8E+02	Bromobenzene	108-86-1	2.9E+02	n	1.8E+03	ns	6.3E+01	n	2.6E+02	n	6.2E+01	n		4.2E-02	n	
						4.0E-02	X	V		1	4.0E+03	Bromochloromethane	74-97-5	1.5E+02	n	6.3E+02	n	4.2E+01	n	1.8E+02	n	8.3E+01	n		2.1E-02	n	
6.2E-02	I	3.7E-05	C	2.0E-02	I		V			1	9.3E+02	Bromodichloromethane	75-27-4	2.9E-01	c	1.3E+00	c	7.6E-02	c	3.3E-01	c	1.3E-01	c	8.0E+01(F)	3.6E-05	c	2.2E-02
7.9E-03	I	1.1E-06	I	2.0E-02	I		V			1	9.2E+02	Bromoform	75-25-2	1.9E+01	c*	8.6E+01	c	2.6E+00	c	1.1E+01	c	3.3E+00	c	8.0E+01(F)	8.7E-04	c	2.1E-02
				1.4E-03	I	5.0E-03	I	V		1	3.6E+03	Bromomethane	74-83-9	6.8E+00	n	3.0E+01	n	5.2E+00	n	2.2E+01	n	7.5E+00	n		1.9E-03	n	
				5.0E-03	H		V			1		Bromophos	2104-96-3	3.9E+02	n	5.8E+03	n					3.5E+01	n		1.5E-01	n	
				2.0E-02	I					1	0.1	Bromoxynil	1689-84-5	1.3E+03	n	1.6E+04	n					3.3E+02	n		2.8E-01	n	
				2.0E-02	I		V			1		Bromoxynil Octanoate	1689-99-2	1.6E+03	n	2.3E+04	n					1.4E+02	n		1.2E+00	n	
3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1	6.7E+02	Butadiene, 1,3-	106-99-0	5.8E-02	c*	2.6E-01	c*	9.4E-02	c*	4.1E-01	c*	1.8E-02	c		9.9E-06	c	
				1.0E-01	I		V			1	7.6E+03	Butanol, N-	71-36-3	7.8E+03	ns	1.2E+05	nms					2.0E+03	n		4.1E-01	n	
1.9E-03	P			2.0E-01	I					1	0.1	Butyl Benzyl Phthalate	85-68-7	2.9E+02	c*	1.2E+03	c					1.6E+01	c		2.4E-01	c	
				2.0E+00	P	3.0E+01	P	V		1	2.1E+04	Butyl alcohol, sec-	78-92-2	1.3E+05	nms	1.5E+06	nms	3.1E+04	n	1.3E+05	n	2.4E+04	n		5.0E+00	n	
				5.0E-02	I		V			1		Butylate	2008-41-5	3.9E+03	n	5.8E+04	n					4.6E+02	n		4.5E-01	n	
2.0E-04	C	5.7E-08	C							1	0.1	Butylated hydroxyanisole	25013-16-5	2.7E+03	c	1.1E+04	c	4.9E+01	c	2.2E+02	c	1.5E+02	c		2.9E-01	c	
3.6E-03	P			3.0E-01	P					1	0.1	Butylated hydroxytoluene	128-37-0	1.5E+02	c	6.4E+02	c					3.4E+00	c		1.0E-01	c	
				5.0E-02	P		V			1	1.1E+02	Butylbenzene, n-	104-51-8	3.9E+03	ns	5.8E+04	ns					1.0E+03	n		3.2E+00	n	
				1.0E-01	X		V			1	1.5E+02	Butylbenzene, sec-	135-98-8	7.8E+03	ns	1.2E+05	nms					2.0E+03	n		5.9E+00	n	
				1.0E-01	X		V			1	1.8E+02	Butylbenzene, tert-	98-06-6	7.8E+03	ns	1.2E+05	nms					6.9E+02	n		1.6E+00	n	
				2.0E-02	A					1	0.1	Cacodylic Acid	75-60-5	1.3E+03	n	1.6E+04	n					4.0E+02	n		1.1E-01	n	
1.8E-03	I	1.0E-03	I	1.0E-05	A					0.025	0.001	Cadmium (Diet)	7440-43-9	7.1E+01	n	9.8E+02	n					9.2E+00	n	5.0E+00	6.9E-01	n	3.8E-01
1.8E-03	I	5.0E-04	I	1.0E-05	A					0.05	0.001	Cadmium (Water)	7440-43-9					1.6E-03	c**	6.8E-03	c**	9.2E+00	n			n	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M		0.025		Calcium Chromate	13765-19-0	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				5.0E-01	I	2.2E-03	C			1	0.1	Caprolactam	105-60-2	3.1E+04	n	4.0E+05	nm	2.3E+00	n	9.6E+00	n	1.0E+03	n		2.5E+00	n	
1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1	Captafol	2425-06-1	3.6E+00	c*	1.5E+01	c	6.5E-02	c	2.9E-01	c	4.0E-01	c*		7.1E-04	c*	
2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1	Captan	133-06-2	2.4E+02	c*	1.0E+03	c	4.3E+00	c	1.9E+01	c	3.1E+01	c*		2.2E-02	c*	
				1.0E-01	I					1	0.1	Carbaryl	63-25-2	6.3E+03	n	8.2E+04	n					1.8E+03	n		1.7E+00	n	
				5.0E-03	I					1	0.1	Carbifuran	1563-66-2	3.2E+02	n	4.1E+03	n					9.4E+01	n	4.0E+01	3.7E-02	n	1.6E-02
				1.0E-01	I	7.0E-01	I	V		1	7.4E+02	Carbon Disulfide	75-15-0	7.7E+02	ns	3.5E+03	ns	7.3E+02	n	3.1E+03	n	8.1E+02	n		2.4E-01	n	
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		1	4.6E+02	Carbon Tetrachloride	56-23-5	6.5E-01	c	2.9E+00	c	4.7E-01	c	2.0E+00	c	4.6E-01	c	5.0E+00	1.8E-04	c	1.9E-03
						1.0E-01	P	V		1	5.9E+03	Carbonyl Sulfide	463-58-1	6.7E+01	n	2.8E+02	n	1.0E+02	n	4.4E+02	n	2.1E+02	n		5.1E-01	n	
				1.0E-02	I					1	0.1	Carbosulfan	55285-14-8	6.3E+02	n	8.2E+03	n					5.1E+01	n		1.2E+00	n	
				1.0E-01	I					1	0.1	Carboxin	5234-68-4	6.3E+03	n	8.2E+04	n					1.9E+03	n		1.0E+00	n	
						9.0E-04	I			1		Ceric oxide	1306-38-3	1.3E+06	nm	5.4E+06	nm	9.4E-01	n	3.9E+00	n				4.0E-01	n	
				1.0E-01	I		V			1		Chloral Hydrate	302-17-0	7.8E+03	n	1.2E+05	nm					2.0E+03	n			n	
				1.5E-02	I					1	0.1	Chloramben	133-90-4	9.5E+02	n	1.2E+04	n					2.9E+02	n		7.0E-02	n	
4.0E-01	H									1	0.1	Chloranil	118-75-2	1.3E+00	c	5.7E+00	c					1.8E-01	c		1.5E-04	c	
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	V		1	0.04	Chlordane	12789-03-6	1.7E+00	c*	7.5E+00	c*	2.8E-02	c*	1.2E-01	c*	4.5E-02	c*	2.0E+00	3.0E-03	c*	1.4E-01
1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1	Chlordecone (Kepone)	143-50-0	5.4E-02	c	2.3E-01	c	6.1E-04	c	2.7E-03	c	3.5E-03	c		1.2E-04	c	
				7.0E-04	A					1	0.1	Chlorfenvinphos	470-90-6	4.4E+01	n	5.7E+02	n					1.1E+01	n		3.1E-02	n	
				2.0E-02	I					1	0.1	Chlor															

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information											Contaminant		Screening Levels												Protection of Ground Water SSLs				
SFO (mg/kg-day)	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (mg/kg-day)	RfD _a (mg/kg-day)	k _e (mg/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e (mg/m ³) ⁻¹	mutagen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)	key	
					5.0E+01	I	V		1		1.7E+03	Chlorodifluoromethane	75-45-6	4.9E+04	ns	2.1E+05	nms	5.2E+04	n	2.2E+05	n	1.0E+05	n		4.3E+01	n			
				2.0E-02	P		V		1		1.1E+05	Chloroethanol, 2-	107-07-3	1.6E+03	n	2.3E+04	n					4.0E+02	n		8.1E-02	n			
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V	1		2.5E+03	Chloroform	67-66-3	3.2E-01	c	1.4E+00	c	1.2E-01	c	5.3E-01	c	2.2E-01	c	8.0E+01(F)	6.1E-05	c	2.2E-02		
						9.0E-02	I	V	1		1.3E+03	Chloromethane	74-87-3	1.1E+02	n	4.6E+02	n	9.4E+01	n	3.9E+02	n	1.9E+02	n		4.9E-02	n			
2.4E+00	C	6.9E-04	C				V		1		9.3E+03	Chloromethyl Methyl Ether	107-30-2	2.0E-02	c	8.9E-02	c	4.1E-03	c	1.8E-02	c	6.5E-03	c		1.4E-06	c			
3.0E-01	P			3.0E-03	P	1.0E-05	X		1	0.1		Chloronitrobenzene, o-	88-73-3	1.8E+00	c	7.7E+00	c	1.0E-02	n	4.4E-02	n	2.4E-01	c		2.2E-04	c			
6.3E-03	P			1.0E-03	P	6.0E-04	P		1	0.1		Chloronitrobenzene, p-	100-00-5	6.3E+01	n	3.6E+02	c**	6.3E-01	n	2.6E+00	n	1.1E+01	c**		1.0E-02	c**			
				5.0E-03	I		V		1		2.2E+04	Chlorophenol, 2-	95-57-8	3.9E+02	n	5.8E+03	n					9.1E+01	n		7.4E-02	n			
						4.0E-04	C	V	1		6.2E+02	Chloropicrin	76-06-2	2.0E+00	n	8.2E+00	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		2.5E-04	n			
3.1E-03	C	8.9E-07	C	1.5E-02	I				1	0.1		Chlorothalonil	1897-45-6	1.8E+02	c**	7.4E+02	c*	3.2E+00	c	1.4E+01	c	2.2E+01	c*		5.0E-02	c*			
				2.0E-02	I		V		1		9.1E+02	Chlorotoluene, o-	95-49-8	1.6E+03	ns	2.3E+04	ns					2.4E+02	n		2.3E-01	n			
									1		2.5E+02	Chlorotoluene, p-	106-43-4	1.6E+03	ns	2.3E+04	ns					2.5E+02	n		2.4E-01	n			
2.4E+02	C	6.9E-02	C						1	0.1		Chlorozotocin	54749-90-5	2.3E-03	c	9.6E-03	c	4.1E-05	c	1.8E-04	c	3.2E-04	c		7.1E-08	c			
				2.0E-01	I				1	0.1		Chlorpropham	101-21-3	1.3E+04	n	1.6E+05	nm					2.8E+03	n		2.6E+00	n			
						1.0E-03	A		1	0.1		Chlorpyrifos	2921-88-2	6.3E+01	n	8.2E+02	n					8.4E+00	n		1.2E-01	n			
				1.0E-02	H				1	0.1		Chlorpyrifos Methyl	5598-13-0	6.3E+02	n	8.2E+03	n					1.2E+02	n		5.4E-01	n			
				5.0E-02	I				1	0.1		Chlorsulfuron	64902-72-3	3.2E+03	n	4.1E+04	n					9.9E+02	n		8.3E-01	n			
						1.0E-02	I		1	0.1		Chlorthal-dimethyl	1861-32-1	6.3E+02	n	8.2E+03	n					1.2E+02	n		1.5E-01	n			
				8.0E-04	H				1	0.1		Chlorthiophos	60238-56-4	5.1E+01	n	6.6E+02	n					2.8E+00	n		7.3E-02	n			
				1.5E+00	I				0.013			Chromium(III), Insoluble Salts	16065-83-1	1.2E+05	nm	1.8E+06	nm					2.2E+04	n		4.0E+07	n			
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I	M	0.025			Chromium(VI)	18540-79-9	3.0E-01	c	6.3E+00	c	1.2E-05	c	1.5E-04	c	3.5E-02	c	1.0E+02	6.7E-04	c	1.8E+05		
									0.013			Chromium, Total	7440-47-3																
				1.3E-02	I				1	0.1		Clofentazine	74115-24-5	8.2E+02	n	1.1E+04	n					2.3E+02	n		1.4E+01	n			
									1			Cobalt	7440-48-4	2.3E+01	n	3.5E+02	n	3.1E-04	c*	1.4E-03	c*	6.0E+00	n		2.7E-01	n			
9.0E-03	P			3.0E-04	P	6.0E-06	P		1			Coke Oven Emissions	8007-45-2					1.6E-03	c	2.0E-02	c								
6.2E-04	I						V	M	1			Copper	7440-50-8	3.1E+03	n	4.7E+04	n					8.0E+02	n	1.3E+03	2.8E+01	n	4.6E+01		
				4.0E-02	H				1			Cresol, m-	108-39-4	3.2E+03	n	4.1E+04	n	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.4E-01	n			
						5.0E-02	I	6.0E-01	C	1	0.1	Cresol, o-	95-48-7	3.2E+03	n	4.1E+04	n	6.3E+02	n	2.6E+03	n	9.3E+02	n		7.5E-01	n			
				1.0E-01	A	6.0E-01	C		1	0.1		Cresol, p-	106-44-5	6.3E+03	n	8.2E+04	n	6.3E+02	n	2.6E+03	n	1.9E+03	n		1.5E+00	n			
						1.0E-01	A		1	0.1		Cresol, p-chloro-m-	59-50-7	6.3E+03	n	8.2E+04	n					1.4E+03	n		1.7E+00	n			
1.9E+00	H			1.0E-01	A	6.0E-01	C		1	0.1		Cresols	1319-77-3	6.3E+03	n	8.2E+04	n	6.3E+02	n	2.6E+03	n	1.5E+03	n		1.3E+00	n			
				1.0E-03	P		V		1		1.7E+04	Crotonaldehyde, trans-	123-73-9	3.7E-01	c	1.7E+00	c					4.0E-02	c		8.2E-06	c			
						1.0E-01	I	4.0E-01	I	V	1	2.7E+02	Cumene	98-82-8	1.9E+03	ns	9.9E+03	ns	4.2E+02	n	1.8E+03	n	4.5E+02	n		7.4E-01	n		
2.2E-01	C	6.3E-05	C						1	0.1		Cupferron	135-20-6	2.5E+00	c	1.0E+01	c	4.5E-02	c	1.9E-01	c	3.5E-01	c		6.1E-04	c			
8.4E-01	H			2.0E-03	H				1	0.1		Cyanazine	21725-46-2	6.5E-01	c	2.7E+00	c					8.8E-02	c		4.1E-05	c			
												Cyanides																	
				1.0E-03	I				1			*Calcium Cyanide	592-01-8	7.8E+01	n	1.2E+03	n					2.0E+01	n			n			
				5.0E-03	I				1			*Copper Cyanide	544-92-3	3.9E+02	n	5.8E+03	n					1.0E+02	n			n			
				6.0E-04	I	8.0E-04	S	V	1		9.7E+05	*Cyanide (CN-)	57-12-5	2.7E+00	n	1.2E+01	n	8.3E-01	n	3.5E+00	n	1.5E+00	n	2.0E+02	1.5E-02	n	2.0E+00		
				1.0E-03	I		V		1			*Cyanogen	460-19-5	7.8E+01	n	1.2E+03	n					2.0E+01	n			n			
				9.0E-02	I		V		1			*Cyanogen Bromide	506-68-3	7.0E+03	n	1.1E+05	nm					1.8E+03	n			n			
						5.0E-02	I		V	1		*Cyanogen Chloride	506-77-4	3.9E+03	n	5.8E+04	n					1.0E+03	n			n			
				6.0E-04	I	8.0E-04	I	V	1		1.0E+07	*Hydrogen Cyanide	74-90-8	2.3E+01	n	1.5E+02	n	8.3E-01	n	3.5E+00	n	1.5E+00	n		1.5E-02	n			
				2.0E-03	I				1			*Potassium Cyanide	151-50-8	1.6E+02	n	2.3E+03	n					4.0E+01	n			n			
						5.0E-03	I		0.04			*Potassium Silver Cyanide	506-61-6	3.9E+02	n	5.8E+03	n					8.2E+01	n			n			
				1.0E-01	I				0.04			*Silver Cyanide	506-64-9	7.8E+03	n	1.2E+05	nm					1.8E+03	n			n			
				1.0E-03	I				1			*Sodium Cyanide	143-33-9	7.8E+01	n	1.2E+03	n					2.0E+01	n	2.0E+02		n			
				2.0E-04	P				1			*Thiocyanates	NA	1.6E+01	n	2.3E+02	n					4.0E+00	n			n			
				2.0E-04	X		V		1			*Thiocyanic Acid	463-56-9	1.6E+01	n	2.3E+02	n					4.0E+00	n			n			
				5.0E-02	I				1			*Zinc Cyanide	557-21-1	3.9E+03	n	5.8E+04	n					1.0E+03	n			n			

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day) ¹	k _e (y)	IUR (ug/m ³) ²	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³) ³	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)		
				4.0E-05	I					1	0.1	Demeton	8065-48-3	2.5E+00	n	3.3E+01	n					4.2E-01	n		n				
1.2E-03	I			6.0E-01	I					1	0.1	Di(2-ethylhexyl)adipate	103-23-1	4.5E+02	c*	1.9E+03	c					6.5E+01	c	4.0E+02	4.7E+00	c	2.9E+01		
6.1E-02	H									1	0.1	Diallate	2303-16-4	8.9E+00	c	3.8E+01	c					5.4E-01	c		8.0E-04	c			
				7.0E-04	A					1	0.1	Diazinon	333-41-5	4.4E+01	n	5.7E+02	n					1.0E+01	n		6.5E-02	n			
				1.0E-02	X			V		1		Dibenzothiophene	132-65-0	7.8E+02	n	1.2E+04	n					6.5E+01	n		1.2E+00	n			
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1	9.8E+02	Dibromo-3-chloropropane, 1,2-	96-12-8	5.3E-03	c	6.4E-02	c	1.7E-04	c	2.0E-03	c	3.3E-04	c	2.0E-01	1.4E-07	c	8.6E-05		
				4.0E-04	X			V		1	1.6E+02	Dibromobenzene, 1,3-	108-36-1	3.1E+01	n	4.7E+02	ns					5.3E+00	n		5.1E-03	n			
				1.0E-02	I			V		1		Dibromobenzene, 1,4-	106-37-6	7.8E+02	n	1.2E+04	n					1.3E+02	n		1.2E-01	n			
8.4E-02	I			2.0E-02	I			V		1	8.0E+02	Dibromochloromethane	124-48-1	8.3E+00	c	3.9E+01	c					8.7E-01	c	8.0E+01(F)	2.3E-04	c	2.1E-02		
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1	1.3E+03	Dibromomethane, 1,2-	106-93-4	3.6E-02	c	1.6E-01	c	4.7E-03	c	2.0E-02	c	7.5E-03	c	5.0E-02	2.1E-06	c	1.4E-05		
				4.0E-03	X	V				1	2.8E+03	Dibromomethane (Methylene Bromide)	74-95-3	2.4E+01	n	9.9E+01	n	4.2E+00	n	1.8E+01	n	8.3E+00	n		2.1E-03	n			
				3.0E-04	P					1	0.1	Dibutyltin Compounds	NA	1.9E+01	n	2.5E+02	n					6.0E+00	n		n				
				3.0E-02	I					1	0.1	Dicamba	1918-00-9	1.9E+03	n	2.5E+04	n					5.7E+02	n		1.5E-01	n			
	4.2E-03	P						V		1	5.5E+02	Dichloro-2-butene, 1,4-	764-41-0	2.1E-03	c	9.4E-03	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.6E-07	c			
	4.2E-03	P						V		1	5.2E+02	Dichloro-2-butene, cis-1,4-	1476-11-5	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c			
	4.2E-03	P						V		1	7.6E+02	Dichloro-2-butene, trans-1,4-	110-57-6	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c			
5.0E-02	I			4.0E-03	I					1	0.1	Dichloroacetic Acid	79-43-6	1.1E+01	c*	4.6E+01	c*					1.5E+00	c*	6.0E+01	3.1E-04	c*	1.2E-02		
				9.0E-02	I	2.0E-01	H	V		1		Dichlorobenzene, 1,2-	95-50-1	1.8E+03	ns	9.3E+03	ns	2.1E+02	n	8.8E+02	n	3.0E+02	n	6.0E+02	3.0E-01	n	5.8E-01		
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1		Dichlorobenzene, 1,4-	106-46-7	2.6E+00	c	1.1E+01	c	2.6E-01	c	1.1E+00	c	4.8E-01	c	7.5E+01	4.6E-04	c	7.2E-02		
4.5E-01	I	3.4E-04	C							1	0.1	Dichlorobenzidine, 3,3'-	91-94-1	1.2E+00	c	5.1E+00	c	8.3E-03	c	3.6E-02	c	1.3E-01	c		8.2E-04	c			
				9.0E-03	X					1	0.1	Dichlorobenzophenone, 4,4'-	90-98-2	5.7E+02	n	7.4E+03	n					7.8E+01	n		4.7E-01	n			
				2.0E-01	I	1.0E-01	X	V		1	8.5E+02	Dichlorodifluoromethane	75-71-8	8.7E+01	n	3.7E+02	n	1.0E+02	n	4.4E+02	n	2.0E+02	n		3.0E-01	n			
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1	1.7E+03	Dichloroethane, 1,1-	75-34-3	3.6E+00	c	1.6E+01	c	1.8E+00	c	7.7E+00	c	2.8E+00	c		7.8E-04	c			
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		1	3.0E+03	Dichloroethane, 1,2-	107-06-2	4.6E-01	c*	2.0E+00	c*	1.1E-01	c*	4.7E-01	c*	1.7E-01	c*	5.0E+00	4.8E-05	c*	1.4E-03		
				5.0E-02	I	2.0E-01	I	V		1	1.2E+03	Dichloroethylene, 1,1-	75-35-4	2.3E+02	n	1.0E+03	n	2.1E+02	n	8.8E+02	n	2.8E+02	n	7.0E+00	1.0E-01	n	2.5E-03		
				2.0E-03	I			V		1	2.4E+03	Dichloroethylene, 1,2-cis-	156-59-2	1.6E+02	n	2.3E+03	n					3.6E+01	n	7.0E+01	1.1E-02	n	2.1E-02		
				2.0E-02	I			V		1	1.9E+03	Dichloroethylene, 1,2-trans-	156-60-5	1.6E+03	n	2.3E+04	ns					3.6E+02	n	1.0E+02	1.1E-01	n	3.1E-02		
				3.0E-03	I					1	0.1	Dichlorophenol, 2,4-	120-83-2	1.9E+02	n	2.5E+03	n					4.6E+01	n		5.4E-02	n			
				1.0E-02	I					1	0.05	Dichlorophenoxy Acetic Acid, 2,3-	94-75-7	7.0E+02	n	9.6E+03	n					1.7E+02	n	7.0E+01	4.5E-02	n	1.8E-02		
				8.0E-03	I					1	0.1	Dichlorophenoxybutyric Acid, 4-(2,4-	94-82-6	5.1E+02	n	6.6E+03	n					1.2E+02	n		1.1E-01	n			
3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1	1.4E+03	Dichloropropane, 1,2-	78-87-5	1.0E+00	c*	4.4E+00	c*	2.8E-01	c*	1.2E+00	c*	4.4E-01	c*	5.0E+00	1.5E-04	c*	1.7E-03		
				2.0E-02	P			V		1	1.5E+03	Dichloropropane, 1,3-	142-28-9	1.6E+03	ns	2.3E+04	ns					3.7E+02	n		1.3E-01	n			
				3.0E-03	I					1	0.1	Dichloropropanol, 2,3-	616-23-9	1.9E+02	n	2.5E+03	n					5.9E+01	n		1.3E-02	n			
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1	1.6E+03	Dichloropropane, 1,3-	542-75-6	1.8E+00	c*	8.2E+00	c*	7.0E-01	c*	3.1E+00	c*	4.7E-01	c*		1.7E-04	c*			
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1	Dichlorophos	62-73-7	1.9E+00	c*	7.9E+00	c*	3.4E-02	c*	1.5E-01	c*	2.6E-01	c*		8.1E-05	c*			
				1.0E-04	I					1	0.1	Dicrotophos	141-66-2	6.3E+00	n	8.2E+01	n					2.0E+00	n		4.7E-04	n			
1.6E+01	I	4.6E-03	I	8.0E-02	P	3.0E-04	X	V		1	2.6E+02	Dicyclopentadiene	77-73-6	1.3E+00	n	5.4E+00	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		2.2E-03	n			
				5.0E-05	I					1	0.1	Dieldrin	60-57-1	3.4E-02	c*	1.4E-01	c	6.1E-04	c	2.7E-03	c	1.8E-03	c		7.1E-05	c			
				3.0E-04	C	5.0E-03	I			1	0.1	Diesel Engine Exhaust	NA					9.4E-03	c	4.1E-02	c								
				2.0E-03	P	2.0E-04	P			1	0.1	Diethanolamine	111-42-2	1.3E+02	n	1.6E+03	n	2.1E-01	n	8.8E-01	n	4.0E+01	n		8.1E-03	n			
				3.0E-02	P	1.0E-04	P			1	0.1	Diethylene Glycol Monobutyl Ether	112-34-5	1.9E+03	n	2.4E+04	n	1.0E-01	n	4.4E-01	n	6.0E+02	n		1.3E-01	n			
				6.0E-02	P	3.0E-04	P			1	0.1	Diethylene Glycol Monoethyl Ether	111-90-0	3.8E+03	n	4.8E+04	n	3.1E-01	n	1.3E+00	n	1.2E+03	n		2.4E-01	n			
3.5E+02	C	1.0E-01	C	1.0E-03	P			V		1	1.1E+05	Diethylformamide	617-84-5	7.8E+01	n	1.2E+03	n					2.0E+01	n		4.1E-03	n			
										1	0.1	Diethylstilbestrol	56-53-1	1.6E-03	c	6.6E-03	c	2.8E-05	c	1.2E-04	c	5.1E-05	c		2.8E-05	c			
				8.0E-02	I					1	0.1	Difenzoquat	43222-48-6	5.1E+03	n	6.6E+04	n					1.6E+03	n		n				
				2.0E-02	I					1	0.1	Diflubenzuron	35367-38-5	1.3E+03	n	1.6E+04	n					2.9E+02	n		3.3E-01	n			
4.4E-02	C	1.3E-05	C			4.0E+01	I	V		1	1.4E+03	Diffuoroethane, 1,1-	75-37-6	4.8E+04	ns	2.0E+05	nms	4.2E+04	n	1.8E+05	n	8.3E+04	n		2.8E+01	n			
										1		Dihyd																	

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Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day) ¹	key	IUR (ug/m ³) ²	key	RTD _o (mg/kg-day)	key	RfC _i (mg/m ³) ³	key	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)	
4.5E-02	C	1.3E-05	C					V	1		1.3E+03	Dimethylvinylchloride	513-37-1	2.0E-01	c	8.9E-01	c	2.2E-01	c	9.4E-01	c	3.3E-01	c		2.4E-04	c		
				8.0E-05	X				1	0.1		Dinitro-o-cresol, 4,6-	534-52-1	5.1E+00	n	6.6E+01	n					1.5E+00	n		2.6E-03	n		
				2.0E-03	I				1	0.1		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	1.3E+02	n	1.6E+03	n					2.3E+01	n		7.7E-01	n		
				1.0E-04	P				1	0.1		Dinitrobenzene, 1,2-	528-29-0	6.3E+00	n	8.2E+01	n					1.9E+00	n		1.8E-03	n		
				1.0E-04	I				1	0.1		Dinitrobenzene, 1,3-	99-65-0	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.8E-03	n		
				1.0E-04	P				1	0.1		Dinitrobenzene, 1,4-	100-25-4	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.8E-03	n		
				2.0E-03	I				1	0.1		Dinitrophenol, 2,4-	51-28-5	1.3E+02	n	1.6E+03	n					3.9E+01	n		4.4E-02	n		
6.8E-01	I								1	0.1		Dinitrotoluene Mixture, 2,4/2,6-	NA	8.0E-01	c	3.4E+00	c					1.1E-01	c		1.5E-04	c		
3.1E-01	C	8.9E-05	C	2.0E-03	I				1	0.102		Dinitrotoluene, 2,4-	121-14-2	1.7E+00	c*	7.4E+00	c	3.2E-02	c	1.4E-01	c	2.4E-01	c		3.2E-04	c		
1.5E+00	P			3.0E-04	X				1	0.099		Dinitrotoluene, 2,6-	606-20-2	3.6E-01	c*	1.5E+00	c					4.9E-02	c		6.7E-05	c		
				2.0E-03	S				1	0.006		Dinitrotoluene, 2-Amino-4,6-	35572-78-2	1.5E+02	n	2.3E+03	n					3.9E+01	n		3.0E-02	n		
				2.0E-03	S				1	0.009		Dinitrotoluene, 4-Amino-2,6-	19406-51-0	1.5E+02	n	2.3E+03	n					3.9E+01	n		3.0E-02	n		
4.5E-01	X			9.0E-04	X				1	0.1		Dinitrotoluene, Technical grade	25321-14-6	1.2E+00	c*	5.1E+00	c					1.0E-01	c		1.4E-04	c		
				1.0E-03	I				1	0.1		Dinoseb	88-85-7	6.3E+01	n	8.2E+02	n					1.5E+01	n	7.0E+00	1.3E-01	n	6.2E-02	
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	V	1		1.2E+05	Dioxane, 1,4-Dioxins	123-91-1	5.3E+00	c	2.4E+01	c	5.6E-01	c*	2.5E+00	c*	4.6E-01	c		9.4E-05	c		
6.2E+03	I	1.3E+00	I						1	0.03		*Hexachlorodibenzo-p-dioxin, Mixture	NA	1.0E-04	c	4.7E-04	c	2.2E-06	c	9.4E-06	c	1.3E-05	c		1.7E-05	c		
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C	V	1	0.03		*TCDD, 2,3,7,8-Diphenamid	1746-01-6	4.8E-06	c*	2.2E-05	c*	7.4E-08	c	3.2E-07	c	1.2E-07	c	3.0E-05	5.9E-08	c	1.5E-05	
				3.0E-02	I				1	0.1			957-51-7	1.9E+03	n	2.5E+04	n					5.3E+02	n		5.2E+00	n		
				8.0E-04	X				1	0.1		Diphenyl Sulfone	127-63-9	5.1E+01	n	6.6E+02	n					1.5E+01	n		3.6E-02	n		
				2.5E-02	I				1	0.1		Diphenylamine	122-39-4	1.6E+03	n	2.1E+04	n					3.1E+02	n		5.8E-01	n		
8.0E-01	I	2.2E-04	I						1	0.1		Diphenylhydrazine, 1,2-	122-66-7	6.8E-01	c	2.9E+00	c	1.3E-02	c	5.6E-02	c	7.8E-02	c		2.5E-04	c		
				2.2E-03	I				1	0.1		Diquat	85-00-7	1.4E+02	n	1.8E+03	n					4.4E+01	n	2.0E+01	8.3E-01	n	3.7E-01	
7.1E+00	C	1.4E-01	C						1	0.1		Direct Black 38	1937-37-7	7.6E-02	c	3.2E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		5.3E+00	c		
7.4E+00	C	1.4E-01	C						1	0.1		Direct Blue 6	2602-46-2	7.3E-02	c	3.1E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		1.7E+01	c		
6.7E+00	C	1.4E-01	C						1	0.1		Direct Brown 95	16071-86-6	8.1E-02	c	3.4E-01	c	2.0E-05	c	8.8E-05	c	1.2E-02	c			c		
				4.0E-05	I				1	0.1		Disulfoton	298-04-4	2.5E+00	n	3.3E+01	n					5.0E-01	n		9.4E-04	n		
				1.0E-02	I			V	1			Dithiane, 1,4-	505-29-3	7.8E+02	n	1.2E+04	n					2.0E+02	n		9.7E-02	n		
				2.0E-03	I				1	0.1		Diuron	330-54-1	1.3E+02	n	1.6E+03	n					3.6E+01	n		1.5E-02	n		
				4.0E-03	I				1	0.1		Dodine	2439-10-3	2.5E+02	n	3.3E+03	n					8.0E+01	n		4.1E-01	n		
				2.5E-02	I			V	1			EPTC	759-94-4	2.0E+03	n	2.9E+04	n					3.8E+02	n		2.0E-01	n		
				6.0E-03	I			V	1			Endosulfan	115-29-7	4.7E+02	n	7.0E+03	n					1.0E+02	n		1.4E+00	n		
				2.0E-02	I				1	0.1		Endothall	145-73-3	1.3E+03	n	1.6E+04	n					3.8E+02	n	1.0E+02	9.1E-02	n	2.4E-02	
				3.0E-04	I				1	0.1		Endrin	72-20-8	1.9E+01	n	2.5E+02	n					2.3E+00	n	2.0E+00	9.2E-02	n	8.1E-02	
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V	1		1.1E+04	Epichlorohydrin	106-89-8	1.9E+01	n	8.2E+01	n	1.0E+00	n	4.4E+00	n	2.0E+00	n		4.5E-04	n		
				2.0E-02	I				1		1.5E+04	Epoxybutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	106-88-7	1.6E+02	n	6.7E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n		9.2E-03	n		
				4.0E-02	P				1	0.1			111-77-3	2.5E+03	n	3.3E+04	n					8.0E+02	n		1.6E-01	n		
				5.0E-03	I				1	0.1		Ethephon	16672-87-0	3.2E+02	n	4.1E+03	n					1.0E+02	n		2.1E-02	n		
				5.0E-04	I				1	0.1		Ethion	563-12-2	3.2E+01	n	4.1E+02	n					4.3E+00	n		8.5E-03	n		
				1.0E-01	P	6.0E-02	P	V	1		2.4E+04	Ethoxyethanol Acetate, 2-Ethoxyethanol, 2-Ethyl Acetate	111-15-9	2.6E+03	n	1.4E+04	n	6.3E+01	n	2.6E+02	n	1.2E+02	n		2.5E-02	n		
				9.0E-02	P	2.0E-01	I	V	1		1.1E+05	Ethoxyethanol, 2-Ethyl Chloride (Chloroethane)	110-80-5	5.2E+03	n	4.7E+04	n	2.1E+02	n	8.8E+02	n	3.4E+02	n		6.8E-02	n		
				9.0E-01	I	7.0E-02	P	V	1		1.1E+04	Ethyl Acetate	141-78-6	6.2E+02	n	2.6E+03	n	7.3E+01	n	3.1E+02	n	1.4E+02	n		3.1E-02	n		
				5.0E-03	P	8.0E-03	P	V	1		2.5E+03	Ethyl Acrylate	140-88-5	4.7E+01	n	2.1E+02	n	8.3E+00	n	3.5E+01	n	1.4E+01	n		3.2E-03	n		
				1.0E+01	I				1		2.1E+03	Ethyl Chloride (Chloroethane)	75-00-3	1.4E+04	ns	5.7E+04	ns	1.0E+04	n	4.4E+04	n	2.1E+04	n		5.9E+00	n		
				2.0E-01	I			V	1		1.0E+04	Ethyl Ether	60-29-7	1.6E+04	ns	2.3E+05	nms					3.9E+03	n		8.8E-01	n		
				3.0E-01	P	V			1		1.1E+03	Ethyl Methacrylate	97-63-2	1.8E+03	ns	7.6E+03	ns	3.1E+02	n	1.3E+03	n	6.3E+02	n		1.5E-01	n		
				1.0E-05	I				1	0.1		Ethyl-p-nitrophenyl Phosphonate	2104-64-5	6.3E-01	n	8.2E+00	n					8.9E-02	n		2.8E-03	n		
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V	1		4.8E+02	Ethylbenzene	100-41-4	5.8E+00	c	2.5E+01	c	1.1E+00	c	4.9E+00	c	1.5E+00	c	7.0E+02	1.7E-03	c	7.8E-01	
				7.0E-02	P				1	0.1		Ethylene Cyanohydrin	109-78-4	4.4E+03	n	5.7E+04	n					1.4E+03	n		2.8E-01	n		
				9.0E-02	P			V	1		1.9E+05	Ethylene Diamine	107-15-3	7.0E+03	n	1.1E+05	nm					1.8E+03	n		4.1E-01	n		
				2.0E+00	I	4.0E-01	C																					

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day)	k _e (y)	IUR (ug/m ³) ⁻¹	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³)	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)		
				6.0E-02 1.0E-02	I				1	0.1		Flutolanil Fluvalinate	66332-96-5 69409-94-5	3.8E+03 6.3E+02	n	4.9E+04 8.2E+03	n					9.5E+02 2.0E+02	n		5.0E+00 2.9E+02	n			
3.5E-03 1.9E-01	I			1.0E-01 2.0E-03	I				1	0.1		Folpet Fomesafen Fonofos	133-07-3 72178-02-0 944-22-9	1.6E+02 2.9E+00 1.3E+02	c*	6.6E+02 1.2E+01 1.6E+03	c					2.0E+01 3.9E-01 2.4E+01	c*		4.7E-03 1.3E-03 4.7E-02	c*			
1.3E-05	I			2.0E-01 9.0E-01 3.0E+00	I P I	9.8E-03 3.0E-04	A X V	V	1		4.2E+04 1.1E+05 0.1	Formaldehyde Formic Acid Fosetyl-AL	50-00-0 64-18-6 39148-24-8	1.7E+01 2.9E+01 1.9E+05	c*	7.3E+01 1.2E+02 2.5E+06	c*	2.2E-01 3.1E-01 n	c*	9.4E-01 1.3E+00 n	c*	4.3E-01 6.3E-01 6.0E+04	c*		8.7E-05 1.3E-04 7.9E+02	c*			
				1.0E-03 1.0E-03	X I			V V	1	0.03		Furans *Dibenzofuran *Furan	132-64-9 110-00-9	7.3E+01 7.3E+01	n	1.0E+03 1.0E+03	n					7.9E+00 1.9E+01	n		1.5E-01 7.3E-03	n			
3.8E+00	H			9.0E-01 3.0E-03	I I	2.0E+00 5.0E-02	I H V	V	1	0.03	1.7E+05 0.1	*Tetrahydrofuran Furazolidone Furfural	109-99-9 67-45-8 98-01-1	1.8E+04 1.4E-01 2.1E+02	n	9.6E+04 6.0E-01 2.6E+03	n	2.1E+03 6.0E-01 5.2E+01	n	8.8E+03 n 2.2E+02	n	3.4E+03 2.0E-02 3.8E+01	n		7.5E-01 3.9E-05 8.1E-03	n			
1.5E+00 3.0E-02	C I	4.3E-04 8.6E-06	C C						1	0.1		Furium Furmecyclo Glufosinate, Ammonium	531-82-8 60568-05-0 77182-82-2	3.6E-01 1.8E+01 2.5E+01	c c n	1.5E+00 7.7E+01 3.3E+02	c	6.5E-03 3.3E-01 n	c	2.9E-02 1.4E+00 n	c	5.1E-02 1.1E+00 8.0E+00	c		6.8E-05 1.2E-03 1.8E-03	c			
				8.0E-05 4.0E-04 1.0E-01	C I I				1	0.1		Glutaraldehyde Glycidyl Glyphosate	111-30-8 765-34-4 1071-83-6	1.1E+05 2.3E+01 6.3E+03	nm n n	4.8E+05 2.1E+02 8.2E+04	nm n n	8.3E-02 1.0E+00 n	n	3.5E-01 4.4E+00 n	n		1.7E+00 2.0E+03	n	7.0E+02	3.3E-04 8.8E+00	n	3.1E+00	
				1.0E-02 2.0E-02 5.0E-05	X P I			V P I	1	0.1		Guanidine Guanidine Chloride Haloxypol, Methyl	113-00-8 50-01-1 69806-40-2	7.8E+02 1.3E+03 3.2E+00	n	1.2E+04 1.6E+04 4.1E+01	n					2.0E+02 4.0E+02 7.6E-01	n		4.5E-02 n 8.4E-03	n			
4.5E+00 9.1E+00	I I	1.3E-03 2.6E-03	I I	5.0E-04 1.3E-05 2.0E-03	I I I			V V V	1			Heptachlor Heptachlor Epoxide Hexabromobenzene	76-44-8 1024-57-3 87-82-1	1.3E-01 7.0E-02 1.6E+02	c c* n	6.3E-01 3.3E-01 2.3E+03	c	2.2E-03 1.1E-03 n	c	9.4E-03 4.7E-03 n	c	1.4E-03 1.4E-03 4.0E+01	c	4.0E-01 2.0E-01	1.2E-04 2.8E-05 2.3E-01	c c* n	3.3E-02 4.1E-03		
				2.0E-04 1.6E+00 7.8E-02	I I I	8.0E-04 1.0E-03	I P	V V	1	0.1		Hexabromodiphenyl ether, 2,2',4,4',5,5'-(BDE-153) Hexachlorobenzene Hexachlorobutadiene	68631-49-2 118-74-1 87-68-3	1.3E+01 2.1E-01 1.2E+00	n	1.6E+02 9.6E-01 5.3E+00	n			6.1E-03 2.7E-02 5.6E-01	c	4.0E+00 9.8E-03 1.4E-01	n	1.0E+00	1.2E-04 2.7E-04	n	1.3E-02		
6.3E+00 1.8E+00 1.1E+00	I I C	1.8E-03 5.3E-04 3.1E-04	I I C	8.0E-03 3.0E-04	A I I				1	0.1		Hexachlorocyclohexane, Alpha- Hexachlorocyclohexane, Beta- Hexachlorocyclohexane, Gamma- (Lindane)	319-84-6 319-85-7 58-89-9	8.6E-02 3.0E-01 5.7E-01	c c c*	3.6E-01 1.3E+00 2.5E+00	c	1.6E-03 5.3E-03 9.1E-03	c	6.8E-03 2.3E-02 4.0E-02	c	7.2E-03 2.5E-02 4.2E-02	c	2.0E-01	4.2E-05 1.5E-04 2.4E-04	c n c*	1.2E-03		
1.8E+00	I	5.1E-04	I						1	0.1		Hexachlorocyclohexane, Technical	608-73-1	3.0E-01	c	1.3E+00	c	5.5E-03	c	2.4E-02	c	2.5E-02	c	5.0E+01	1.5E-04	c			
4.0E-02	I	1.1E-05	C	6.0E-03 7.0E-04	I I	2.0E-04 3.0E-02	I I	V V	1		1.6E+01 0.1	Hexachlorocyclopentadiene Hexachloroethane	77-47-4 67-72-1	1.8E+00 1.8E+00	n c*	7.5E+00 8.0E+00	n c*	2.1E-01 2.6E-01	n c	8.8E-01 1.1E+00	n	4.1E-01 3.3E-01	n c*		1.3E-03 2.0E-04	n c*	1.6E-01		
1.1E-01	I			3.0E-04 3.0E-03	I I				1	0.1	3.4E+03	Hexachlorophene Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) Hexamethylene Diisocyanate, 1,6-	70-30-4 121-82-4 822-06-0	1.9E+01 6.1E+00 3.1E+00	n c* n	2.5E+02 2.8E+01 1.3E+01	n			1.0E-02	n	4.4E-02	n	6.0E+00 7.0E-01 2.1E-02	n		8.0E+00 2.7E-04 2.1E-04	n	
				4.0E-04 2.0E+00	P P				1	0.1	1.4E+02	Hexamethylphosphoramide Hexane, N- Hexanedioic Acid	680-31-9 110-54-3 124-04-9	2.5E+01 6.1E+02 1.3E+05	n ns nm	3.3E+02 2.5E+03 1.6E+06	n ns nm			7.3E+02	n	3.1E+03	n	8.0E+00 1.5E+03 4.0E+04	n		1.8E-03 1.0E+01 9.9E+00	n	
				5.0E-03 3.3E-02 2.5E-02	I I I	3.0E-02 I	I I	V I	1		3.3E+03 0.1 0.1	Hexanone, 2- Hexazinone Hexythiazox	591-78-6 51235-04-2 78587-05-0	2.0E+02 2.1E+03 1.6E+03	n n n	1.3E+03 2.7E+04 2.1E+04	n	3.1E+01	n	1.3E+02	n	3.8E+01 6.4E+02 1.1E+02	n		8.8E-03 3.0E-01 5.0E-01	n			
3.0E+00 3.0E+00	I I	4.9E-03 4.9E-03	I I			3.0E-05	P V	V	1			Hydramethylnon Hydrazine Hydrazine Sulfate	67485-29-4 302-01-2 10034-93-2	1.9E+01 2.3E-01 2.3E-01	n c c	2.5E+02 1.1E+00 1.1E+00	n			5.7E-04 5.7E-04	c* c	2.5E-03 2.5E-03	c* c	1.1E-03 2.6E-02	c* c		2.1E+03 c* c		
				2.0E-02 4.0E-02	I C	2.0E-02 1.4E-02 2.0E-03	I C I	V V V	1			Hydrogen Chloride Hydrogen Fluoride Hydrogen Sulfide	7647-01-0 7664-39-3 7783-06-4	2.8E+07 3.1E+03 2.8E+06	nm n nm	1.2E+08 4.7E+04 1.2E+07	nm n nm	2.1E+01 1.5E+01 2.1E+00	n n n	8.8E+01 6.1E+01 8.8E+00	n n n	4.2E+01 4.1E+02 4.2E+00	n n n						
6.0E-02	P			4.0E-02 1.3E-02 2.5E-01	P I I				1	0.1		Hydroquinone Imazali Imazaquin	123-31-9 35554-44-0 81335-37-7	9.0E+00 8.2E+02 1.6E+04	c n n	3.8E+01 1.1E+04 2.1E+05	c n nm					1.3E+00 1.9E+02 4.9E+03	c n n		8.7E-04 3.2E+00 2.4E+01	c n n			
				2.5E-01 1.0E-02 4.0E-02	I A I				1	0.1		Imazethapyr Iodine Iprodione	81335-77-5 7553-56-2 36734-19-7	1.6E+04 7.8E+02 2.5E+03	n n n	2.1E+05 1.2E+04 3.3E+04	nm n n					4.7E+03 2.0E+02 7.4E+02	n n n		4.1E+00 1.2E+01 2.2E-01	n n n			
				7.0E-01 3.0E-01 2.0E-01	P I I				1		1.0E+04	Iron Isobutyl Alcohol Isophorone	7439-89-6 78-83-1 78-59-1	5.5E+04 2.3E+04 5.7E+02	n ns c*	8.2E+05 3.5E+05 2.4E+03	nm nms c*					1.4E+04 5.9E+03 7.8E+01	n n c*		3.5E+02 1.2E+00 2.6E-02	n n c*			
9.5E-04	I			1.5E-02 2.0E+00 1.0E-01	I P I			V P V	1		1.1E+05	Isopropalin Isopropanol Isopropyl Methyl Phosphonic Acid	33820-53-0 67-63-0 1832-54-8	1.2E+03 5.6E+03 6.3E+03	n n n	1.8E+04 2.4E+04 8.2E+04	n	2.1E+02	n	8.8E+02	n	4.0E+01 4.1E+02 2.0E+03	n		9.2E-01 8.4E-02 4.3E-01	n			
				5.0E-02 2.0E-03	I I				1	0.1		Isoxaben JP-7 Lactofen	82558-50-7 NA 77501-63-4	3.2E+03 4.3E+08 1.3E+02	n nm n	4.1E+04 1.8E+09 1.6E+03	n nm n			3.1E+02	n	1.3E+03	n	7.3E+02 6.3E+02 2.5E+01	n		2.0E+00 n 1.2E+00	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information											Contaminant		Screening Levels											Protection of Ground Water SSLs					
SFO (mg/kg-day) ¹	k _e (ug/m ³) ²	IUR (ug/m ³) ³	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³) ⁴	RfC _i (mg/m ³) ⁵	k _e (ug/m ³) ⁶	Vo (l)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M		0.025			Lead Compounds	7758-97-6	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c				c	
8.5E-03	C	1.2E-05	C							1			*Lead Phosphate	7446-27-7	8.2E+01	c	3.8E+02	c	2.3E-01	c	1.0E+00	c	9.1E+00	c				c	
2.8E-01	C	8.0E-05	C							1	0.1		*Lead acetate	301-04-2	1.9E+00	c	8.2E+00	c	3.5E-02	c	1.5E-01	c	2.8E-01	c	1.5E+01			c	
8.5E-03	C	1.2E-05	C							1	0.1		*Lead and Compounds *Lead subacetate	7439-92-1 1335-32-6	4.0E+02 6.4E+01	L c	8.0E+02 2.7E+02	L c	1.5E-01 2.3E-01	L c	1.0E+00	c	1.5E+01 9.2E+00	L c	1.5E+01			L c	1.4E+01
				1.0E-07	I			V		1		2.4E+00	*Tetraethyl Lead	78-00-2	7.8E-03	n	1.2E-01	n					1.3E-03					n	4.7E-06
				5.0E-06	P			V		1		3.8E+02	Lewisite	541-25-3	3.9E-01	n	5.8E+00	n					9.0E-02					n	3.8E-05
				2.0E-03	I					1	0.1		Linuron	330-55-2	1.3E+02	n	1.6E+03	n					3.3E+01	n				n	2.9E-02
				2.0E-03	P					1			Lithium	7439-93-2	1.6E+02	n	2.3E+03	n					4.0E+01	n				n	1.2E+01
				5.0E-04	I					1	0.1		MCPA	94-74-6	3.2E+01	n	4.1E+02	n					7.5E+00	n				n	2.0E-03
				1.0E-02	I					1	0.1		MCPB	94-81-5	6.3E+02	n	8.2E+03	n					1.5E+02	n				n	5.8E-02
				1.0E-03	I					1	0.1		MCPP	93-65-2	6.3E+01	n	8.2E+02	n					1.6E+01	n				n	4.7E-03
				2.0E-02	I					1	0.1		Malathion	121-75-5	1.3E+03	n	1.6E+04	n					3.9E+02	n				n	1.0E-01
				1.0E-01	I	7.0E-04	C			1	0.1		Maleic Anhydride	108-31-6	6.3E+03	n	8.0E+04	n	7.3E-01	n	3.1E+00	n	1.9E+03	n				n	3.8E-01
				5.0E-01	I					1	0.1		Maleic Hydrazide	123-33-1	3.2E+04	n	4.1E+05	nm					1.0E+04	n				n	2.1E+00
				1.0E-04	P					1	0.1		Malononitrile	109-77-3	6.3E+00	n	8.2E+01	n					2.0E+00	n				n	4.1E-04
				3.0E-02	H					1	0.1		Mancozeb	8018-01-7	1.9E+03	n	2.5E+04	n					5.4E+02	n				n	7.6E-01
				5.0E-03	I					1	0.1		Maneb	12427-38-2	3.2E+02	n	4.1E+03	n					9.8E+01	n				n	1.4E-01
				1.4E-01	I	5.0E-05	I			1			Manganese (Diet)	7439-96-5										n				n	
				2.4E-02	S	5.0E-05	I			0.04			Manganese (Non-diet)	7439-96-5	1.8E+03	n	2.6E+04	n	5.2E-02	n	2.2E-01	n	4.3E+02	n				n	2.8E+01
				9.0E-05	H					1	0.1		Mephosfolan	950-10-7	5.7E+00	n	7.4E+01	n					1.8E+00	n				n	2.6E-03
				3.0E-02	I					1	0.1		Mepiquat Chloride	24307-26-4	1.9E+03	n	2.5E+04	n					6.0E+02	n				n	2.0E-01
													Mercury Compounds																
				3.0E-04	I	3.0E-04	S			0.07			*Mercuric Chloride (and other Mercury salts)	7487-94-7	2.3E+01	n	3.5E+02	n	3.1E-01	n	1.3E+00	n	5.7E+00	n	2.0E+00			n	
						3.0E-04	I	V		1		3.1E+00	*Mercury (elemental)	7439-97-6	1.1E+01	ns	4.6E+01	ns	3.1E-01	n	1.3E+00	n	6.3E-01	n	2.0E+00			n	
				1.0E-04	I					1			*Methyl Mercury	22967-92-6	7.8E+00	n	1.2E+02	n					2.0E+00	n				n	1.0E-01
				8.0E-05	I					1	0.1		*Phenylmercuric Acetate	62-38-4	5.1E+00	n	6.6E+01	n					1.6E+00	n				n	5.0E-04
				3.0E-05	I			V		1			Merphos	150-50-5	2.3E+00	n	3.5E+01	n					6.0E-01	n				n	5.9E-02
				3.0E-05	I					1	0.1		Merphos Oxide	78-48-8	1.9E+00	n	2.5E+01	n					8.5E-02	n				n	4.2E-04
				6.0E-02	I					1	0.1		Metalaxyl	57837-19-1	3.8E+03	n	4.9E+04	n					1.2E+03	n				n	3.3E-01
				1.0E-04	I	3.0E-02	P	V		1		4.6E+03	Methacrylonitrile	126-98-7	7.5E+00	n	1.0E+02	n	3.1E+01	n	1.3E+02	n	1.9E+00	n				n	4.3E-04
				5.0E-05	I					1	0.1		Methamidophos	10265-92-6	3.2E+00	n	4.1E+01	n					1.0E+00	n				n	2.1E-04
				2.0E+00	I	2.0E+01	I	V		1		1.1E+05	Methanol	67-56-1	1.2E+05	nms	1.2E+06	nms	2.1E+04	n	8.8E+04	n	2.0E+04	n				n	4.1E+00
				1.0E-03	I					1	0.1		Methidathion	950-37-8	6.3E+01	n	8.2E+02	n					1.9E+01	n				n	4.7E-03
				2.5E-02	I					1	0.1		Methomyl	16752-77-5	1.6E+03	n	2.1E+04	n					5.0E+02	n				n	1.1E-01
4.9E-02	C	1.4E-05	C							1	0.1		Methoxy-5-nitroaniline, 2-	99-59-2	1.1E+01	c	4.7E+01	c	2.0E-01	c	8.8E-01	c	1.5E+00	c	4.0E+01			c	5.3E-04
				5.0E-03	I					1	0.1		Methoxychlor	72-43-5	3.2E+02	n	4.1E+03	n					3.7E+01	n				n	2.0E+00
				8.0E-03	P	1.0E-03	P	V		1		1.2E+05	Methoxyethanol Acetate, 2-	110-49-6	1.1E+02	n	5.1E+02	n	1.0E+00	n	4.4E+00	n	2.1E+00	n				n	4.2E-04
				5.0E-03	P	2.0E-02	I	V		1		1.1E+05	Methoxyethanol, 2-	109-86-4	3.3E+02	n	3.5E+03	n	2.1E+01	n	8.8E+01	n	2.9E+01	n				n	5.9E-03
				2.9E+04	X			V		1		2.9E+04	Methyl Acetate	79-20-9	7.8E+04	ns	1.2E+06	nms					2.0E+04	n				n	4.1E+00
				1.0E+00	X	2.0E-02	P	V		1		6.8E+03	Methyl Acrylate	96-33-3	1.5E+02	n	6.1E+02	n	2.1E+01	n	8.8E+01	n	4.2E+01	n				n	8.9E-03
				6.0E-01	I	5.0E+00	I	V		1		2.8E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3	2.7E+04	n	1.9E+05	nms	5.2E+03	n	2.2E+04	n	5.6E+03	n				n	1.2E+00
				1.0E-03	X	2.0E-05	X	V		1		1.8E+05	Methyl Hydrazine	60-34-4	1.4E-01	c**	6.2E-01	c**	2.8E-03	c**	1.2E-02	c**	5.6E-03	c**				c**	1.3E-06
						3.0E+00	I	V		1		3.4F+03	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	3.3E+04	ns	1.4E+05	nms	3.1E+03	n	1.3E+04	n	6.3E+03	n				n	1.4E+00
						1.0E-03	C	V		1		1.0E+04	Methyl Isocyanate	624-83-9	4.6E+00	n	1.9E+01	n	1.0E+00	n	4.4E+00	n	2.1E+00	n				n	5.9E-04
				1.4E+00	I	7.0E-01	I	V		1		2.4E+03	Methyl Methacrylate	80-62-6	4.4E+03	ns	1.9E+04	ns	7.3E+02	n	3.1E+03	n	1.4E+03	n				n	3.0E-01
				2.5E-04	I					1	0.1		Methyl Parathion	298-00-0	1.6E+01	n	2.1E+02	n					4.5E+00	n				n	7.4E-03
				6.0E-02	X					1	0.1		Methyl Phosphonic Acid	993-13-5	3.8E+03	n	4.9E+04	n					1.2E+03	n				n	2.4E-01
				6.0E-03	H	4.0E-02	H	V		1		3.9E+02	Methyl Styrene (Mixed Isomers)	25013-15-4	3.2E+02	n	2.6E+03	ns	4.2E+01	n	1.8E+02	n	2.3E+01	n				n	3.8E-02
9.9E-02	C	2.8E-05	C							1	0.1		Methyl methanesulfonate	66-27-3	5.5E+00	c	2.3E+01	c	1.0E-01	c	4.4E-01	c	7.9E-01	c				c	1.6E-04
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	4.7E+01	c	2.1E+02	c	1.1E+01	c	4.7E+01	c	1.4E+01	c				c	3.2E-03
				3.0E-04	X					1	0.1		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	1.9E+01	n	2.5E+02	n					6.0E+00	n				n	3.6E-03
9.0E-03	P			2.0E-02	X					1	0.1		Methyl-5-Nitroaniline, 2-	99-55-8	6.0E+01	c*	2.6E+02	c*					8.2E+00	c*				c*	4.6E-03
8.3E+00	C	2.4E-03	C							1	0.1		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	6.5E-02	c	2.8E-01	c	1.2E-03	c	5.1E-03	c	9.4E-03	c				c	3.2E-06
1.3E-01	C	3.7E-05	C							1	0.1		Methylaniline Hydrochloride, 2-	636-21-5	4.2E+00	c	1.8E+01	c	7.6E-02	c	3.3E-01	c	6.0E-01	c				c	2.6E-04
				1.0E-02	A					1	0.1		Methylarsonic acid	124-58-3	6.3E+02	n	8.2E+03	n					2.0E+02	n				n	
				2.0E-04	X					1	0.1		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	1.3E+01	n	1.6E+02	n					4.0E+00	n				n	
				3.0E-04	X					1	0.1		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	5.4E+00	c**	2.3E+01	c*					7.8E-01	c**				c**	
2.2E+01	C	6.3E-03	C						M	1	0.1		Methylcholanthrene, 3-	56-49-5	5.5E-03	c	1.0E-01	c	1.6E-04	c	1.9E-03	c	1.1E-03	c				c	2.2E-03
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	1		3.																	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where $n \leq 100X \leq cL$; ** = where $n \leq 10X \leq cL$; SSL values are based on DAF-1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-Specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day) ²	k _e (y)	IUR (ug/m ³) ³	k _e (y)	RfD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³)	k _e (y)	o _{muta}	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (ug/L)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)			
				7.0E-02	H			V			5.0E+02	Methylstyrene, Alpha-	98-83-9	5.5E+03	ns	8.2E+04	ns					7.8E+02	n			1.2E+00	n			
		1.5E-01	I						1	0.1		Metolachlor	51218-45-2	9.5E+03	n	1.2E+05	nm					2.7E+03	n			3.2E+00	n			
		2.5E-02	I						1	0.1		Metribufuron	21087-64-9	1.6E+03	n	2.1E+04	n					4.9E+02	n			1.5E-01	n			
		2.5E-01	I						1	0.1		Metribufuron-methyl	74223-64-6	1.6E+04	n	2.1E+05	nm					4.9E+03	n			1.9E+00	n			
1.8E+01	C	5.1E-03	C	3.0E+00	P			V	1		3.4E-01	Mineral oils	18012-95-1	2.3E+05	nms	3.5E+06	nms					6.0E+04	n			2.4E+03	n			
		2.0E-04	I					V	1			Mirex	2385-85-5	3.6E-02	c	1.7E-01	c	5.5E-04	c	2.4E-03	c				6.3E-04	c				
		2.0E-03	I						1	0.1		Molinate	2212-67-1	1.3E-02	n	1.6E+03	n					3.0E+01	n			1.7E-02	n			
		5.0E-03	I					1				Molybdenum	7439-98-7	3.9E+02	n	5.8E+03	n					1.0E+02	n			2.0E+00	n			
		1.0E-01	I						1			Monochloramine	10599-90-3	7.8E+03	n	1.2E+05	nm					2.0E+03	n	4.0E+03			n			
		2.0E-03	P						1	0.1		Monomethylaniline	100-61-8	1.3E+02	n	1.6E+03	n					3.8E+01	n			1.4E-02	n			
		2.5E-02	I						1	0.1		Myclobutanil	88671-89-0	1.6E+03	n	2.1E+04	n					4.5E+02	n			5.6E+00	n			
		3.0E-04	X						1	0.1		N,N'-Diphenyl-1,4-benzenediamine	74-31-7	1.9E+01	n	2.5E+02	n					3.6E+00	n			3.7E-01	n			
		2.0E-03	I					V	1			Naled	300-76-5	1.6E+02	n	2.3E+03	n					4.0E+01	n			1.8E-02	n			
1.8E+00	C	0.0E+00	C	3.0E-02	X	1.0E-01	P	V	1			Naphtha, High Flash Aromatic (HFAN)	64742-95-6	2.3E+03	n	3.5E+04	n	1.0E+02	n	4.4E+02	n	1.5E+02	n				n			
										0.1		Naphthylamine, 2-	91-59-8	3.0E-01	c	1.3E+00	c					3.9E-02	c			2.0E-04	c			
				1.0E-01	I				1	0.1		Napropamide	15299-99-7	6.3E+03	n	8.2E+04	n					1.6E+03	n			1.1E+01	n			
		2.6E-04	C	1.1E-02	C	1.4E-05	C		1	0.1		Nickel Acetate	373-02-4	6.7E-02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n				n			
		2.6E-04	C	1.1E-02	C	1.4E-05	C		1	0.1		Nickel Carbonate	3333-67-3	6.7E-02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n				n			
		2.6E-04	C	1.1E-02	C	1.4E-05	C	V	1			Nickel Carbonyl	13463-39-3	8.2E-02	n	1.1E+04	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	c**				c**			
		2.6E-04	C	1.1E-02	C	1.4E-05	C		0.04			Nickel Hydroxide	12054-48-7	8.2E+02	n	1.1E+04	n	1.1E-02	c**	4.7E-02	c**	2.0E+02	n				n			
		2.6E-04	C	1.1E-02	C	2.0E-05	C		0.04			Nickel Oxide	1313-99-1	8.4E+02	n	1.2E+04	n	1.1E-02	c**	4.7E-02	c**	2.0E+02	n				n			
		2.4E-04	I	1.1E-02	C	1.4E-05	C		0.04			Nickel Refinery Dust	NA	8.2E+02	n	1.1E+04	n	1.2E-02	c**	5.1E-02	c**	2.2E+02	n			3.2E+01	n			
1.7E+00	C	4.8E-04	I	1.1E-02	I	9.0E-05	A		0.04			Nickel Soluble Salts	7440-02-0	1.5E+03	n	2.2E+04	n	1.1E-02	c**	4.7E-02	c**	3.9E+02	n			2.6E+01	n			
		2.6E-04	C	1.1E-02	C	1.4E-05	C		0.04			Nickel Subsilfide	12035-72-2	4.1E-01	c	1.9E+00	c	5.8E-03	c**	2.6E-02	c**	4.5E-02	c				c			
		2.6E-04	C	1.1E-02	C	1.4E-05	C		1	0.1		Nickeloene	1271-28-9	6.7E-02	n	8.1E+03	n	1.1E-02	c**	4.7E-02	c**	2.2E+02	n				n			
		1.6E+00	I						1			Nitrate	14797-55-8	1.3E+05	nm	1.9E+06	nm					3.2E+04	n	1.0E+04			n			
									1			Nitrate + Nitrite (as N)	NA											1.0E+04						
		1.0E-01	I						1			Nitrite	14797-65-0	7.8E+03	n	1.2E+05	nm					2.0E+03	n	1.0E+03			n			
2.0E-02	P			1.0E-02	X	5.0E-05	X		1	0.1		Nitroaniline, 2	88-74-4	2.3E+02	n	8.0E+03	n	5.2E-02	n	2.2E-01	n	1.9E+00	n			8.0E-02	n			
		4.0E-03	P	6.0E-03	P				1	0.1		Nitroaniline, 4	100-01-6	6.7E+01	c**	1.1E+02	c*	6.3E+00	n	2.6E+01	n	3.8E+00	c*			1.6E-03	c*			
	4.0E-05	I		2.0E-03	I	9.0E-03	I	V	1		3.1E+03	Nitrobenzene	98-95-3	5.1E+00	c*	2.2E+01	c*	7.0E-02	c	3.1E-01	c	1.4E-01	c*			9.2E-05	c*			
1.3E+00	C	3.7E-04	C	3.0E+03	P				1	0.1		Nitrocellulose	9004-70-0	1.9E+08	nm	2.5E+09	nm					6.0E+07	n			1.3E+04	n			
				7.0E-02	H				1	0.1		Nitrofurantoin	67-20-9	4.4E+03	n	5.7E+04	n					1.4E+03	n			6.1E-01	n			
									1	0.1		Nitrofurazone	59-87-0	4.2E-01	c	1.8E+00	c	7.6E-03	c	3.3E-02	c	6.0E-02	c			5.4E-05	c			
1.7E-02	P			1.0E-04	P				1	0.1		Nitroglycerin	55-63-0	6.3E+00	n	8.2E+01	n					2.0E+00	n			8.5E-04	n			
		8.8E-06	P						1	0.1		Nitroguanidine	556-88-7	6.3E+03	n	8.2E+04	n					2.0E+03	n			4.8E-01	n			
				5.0E-03	P	V			1		1.8E+04	Nitromethane	75-52-5	5.4E+00	c*	2.4E+01	c*	3.2E-01	c*	1.4E+00	c*	6.4E-01	c*			1.4E-04	c*			
2.7E+01	C	7.7E-03	C	2.7E-03	H			2.0E-02	I	V	1	Nitropropane, 2	79-46-9	1.4E-02	c	6.0E-02	c	1.0E-03	c	4.5E-03	c	2.1E-03	c			5.4E-07	c			
1.2E+02	C	3.4E-02	C						M	1	0.1	Nitroso-N-ethylurea, N-	759-73-9	4.5E-03	c	8.5E-02	c	1.3E-04	c	1.6E-03	c	9.2E-04	c			2.2E-07	c			
									M	1	0.1	Nitroso-N-methylurea, N-	684-93-5	1.0E-03	c	1.9E-02	c	3.0E-05	c	3.6E-04	c	2.1E-04	c			4.6E-08	c			
5.4E+00	I	1.6E-03	I					V	1			Nitroso-di-N-butylamine, N-	924-16-3	9.9E-02	c	4.6E-01	c	1.8E-03	c	7.7E-03	c	2.7E-03	c			5.5E-06	c			
7.0E+00	I	2.0E-03	C						1	0.1		Nitroso-di-N-propylamine, N-	621-64-7	7.8E-02	c	3.3E-01	c	1.4E-03	c	6.1E-03	c	1.1E-02	c			8.1E-06	c			
2.8E+00	I	8.0E-04	C						1	0.1		Nitrosodiethanolamine, N-	1116-54-7	1.9E-01	c	8.2E-01	c	3.5E-03	c	1.5E-02	c	2.8E-02	c			5.6E-06	c			
1.5E+02	I	4.3E-02	I						M	1	0.1	Nitrosodimethylamine, N-	55-18-5	8.1E-04	c	1.5E-02	c	2.4E-05	c	2.9E-04	c	1.7E-04	c			6.1E-08	c			
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	V	M	1		Nitrosodimethylamine, N-	62-75-9	2.0E-03	c	3.4E-02	c	7.2E-05	c	8.8E-04	c	1.1E-04	c			2.7E-08	c			
4.9E-03	I	2.6E-06	C						1	0.1		Nitrosodiphenylamine, N-	86-30-6	1.1E+02	c	4.7E+02	c	1.1E+00	c	4.7E+00	c	1.2E+01	c			6.7E-02	c			
2.2E+01	I	6.3E-03	C					V	1		1.1E+05	Nitrosomethylethylamine, N-	10595-95-6	2.0E-02	c	9.1E-02	c	4.5E-04	c	1.9E-03	c	7.1E-04	c			2.0E-07	c			
6.7E+00	C	1.9E-03	C						1	0.1		Nitrosomorpholine [N-]	59-89-2	8.1E-02	c	3.4E-01	c	1.5E-03	c	6.5E-03	c	1.2E-02	c			2.8E-06	c			
9.4E+00	C	2.7E-03	C						1	0.1		Nitrosopiperidine [N-]	100-75-4	5.8E-02	c	2.4E-01	c	1.0E-03	c	4.5E-03	c	8.2E-03	c			4.4E-06	c			
2.1E+00	I	6.1E-04	I						1	0.1		Nitrosopyrrolidine, N-	930-55-2	2.6E-01	c	1.1E+00	c	4.6E-03	c	2.0E-02	c	3.7E-02	c			1.4E-05	c			
2.2E-01	P			1.0E-04	X				1	0.1		Nitrotoluene, m-	99-08-1	6.3E+00	n	8.2E+01	n					1.7E+00	n			1.6E-03	n			
				9.0E-04	P			V	1		1.5E+03	Nitrotoluene, o-	88-72-2	3.2E+00	c**	1.5E+01	c*					3.1E-01	c*			3.0E-04	c*			
1.6E-02	P			4.0E-03	P				1	0.1		Nitrotoluene, p-	99-99-0	3.4E+01	c**	1.4E+02	c*					4.3E+00	c*			4.0E-03	c*			
				3.0E-04	X	2.0E-02	P	V	1		6.9E+00	Nonane, n-	111-84-2	1.1E+01	ns	7.2E+01	ns	2.1E+01	n	8.8E+01	n	5.3E+00	n			7.5E-02	n			
				4.0E-02	I				1	0.1		Nitrofurazon	27314-13-2	2.5E+03	n	3.3E+04	n					7.7E+02	n			5.0E+00	n			
		3.0E-03	I						1	0.1		Octabromodiphenyl Ether	32536-52-0	1.9E+02	n	2.5E+03	n					6.0E+01	n			1.2E+01	n			
		5.0E-02	I						1	0.006		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	3.9E+03	n	5.7E+04	n					1.0E+03	n			1.3E+00	n			
		2.0E-03	H						1	0.1		Octamethylpyrophosphoramide	152-16-9	1.3E+02	n	1.6E+03	n					4.0E+01	n			9.6E-03	n			
		5.0E-02	I						1	0.1		Oryzalin	19044-88-3	3.2E+03	n	4.1E+04	n					8.1E+02	n			1.5E+00	n			
		5.0E-																												

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Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs	
SFO (mg/kg-day)	k _e (y)	IUR (ug/m ³) ⁻¹	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³)	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (ug/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				5.0E-02	H		V					Pebulate	1114-71-2	3.9E+03	n	5.8E+04	n					5.6E+02	n		4.5E-01	n	
				4.0E-02	I				1	0.1		Pendimethalin	40487-42-1	2.5E+03	n	3.3E+04	n					1.8E+02	n		2.1E+00	n	
				2.0E-03	I		V		1		3.1E-01	Pentabromodiphenyl Ether	32534-81-9	1.6E+02	ns	2.3E+03	ns					4.0E+01	n		1.7E+00	n	
				1.0E-04	I				1	0.1		Pentabromodiphenyl ether, 2,2',4,4',5'- (BDE-99)	60348-60-9	6.3E+00	n	8.2E+01	n					2.0E+00	n		8.7E-02	n	
				8.0E-04	I		V		1			Pentachlorobenzene	608-93-5	6.3E+01	n	9.3E+02	n					3.2E+00	n		2.4E-02	n	
9.0E-02	P						V		1		4.6E+02	Pentachloroethane	76-01-7	7.7E+00	c	3.6E+01	c					6.5E-01	c		3.1E-04	c	
2.6E-01	H			3.0E-03	I		V		1			Pentachloronitrobenzene	82-68-8	2.7E+00	c*	1.3E+01	c					1.2E-01	c		1.5E-03	c	
4.0E-01	I	5.1E-06	C	5.0E-03	I				1	0.25		Pentachlorophenol	87-86-5	1.0E+00	c	4.0E+00	c	5.5E-01	c	2.4E+00	c	4.1E-02	c	1.0E+00	4.2E-04	c	1.0E-02
4.0E-03	X			2.0E-03	P				1	0.1		Pentaerythritol tetranitrate (PETN)	78-11-5	1.3E+02	n	5.7E+02	c**					1.9E+01	c**		2.8E-02	c**	
						1.0E+00	P	V		1	3.9E+02	Pentane, n- Perchlorates	109-66-0	8.1E+02	ns	3.4E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		1.0E+01	n	
				7.0E-04	I				1			*Ammonium Perchlorate	7790-98-9	5.5E+01	n	8.2E+02	n					1.4E+01	n			n	
				7.0E-04	I				1			*Lithium Perchlorate	7791-03-9	5.5E+01	n	8.2E+02	n					1.4E+01	n			n	
				7.0E-04	I				1			*Perchlorate and Perchlorate Salts	14797-73-0	5.5E+01	n	8.2E+02	n					1.4E+01	n	1.5E+01(F)		n	
				7.0E-04	I				1			*Potassium Perchlorate	7778-74-7	5.5E+01	n	8.2E+02	n					1.4E+01	n			n	
				7.0E-04	I				1			*Sodium Perchlorate	7601-89-0	5.5E+01	n	8.2E+02	n					1.4E+01	n			n	
				2.0E-02	P		V		1			Perfluorobutane Sulfonate	375-73-5	1.6E+03	n	2.3E+04	n					3.8E+02	n		2.1E-01	n	
2.2E-03	C	6.3E-07	C	5.0E-02	I				1	0.1		Permethrin	52645-53-1	3.2E+03	n	4.1E+04	n					1.0E+03	n		2.4E+02	n	
				2.5E-01	I				1	0.1		Phenacetin	62-44-2	2.5E+02	c	1.0E+03	c	4.5E+00	c	1.9E+01	c	3.4E+01	c		9.7E-03	c	
									1	0.1		Phenmedipham	13684-63-4	1.6E+04	n	2.1E+05	nm					4.0E+03	n		2.1E+01	n	
				3.0E-01	I	2.0E-01	C		1	0.1		Phenol	108-95-2	1.9E+04	n	2.5E+05	nm	2.1E+02	n	8.8E+02	n	5.8E+03	n		3.3E+00	n	
				5.0E-04	X				1	0.1		Phenothiazine	92-84-2	3.2E+01	n	4.1E+02	n					4.3E+00	n		1.4E-02	n	
				6.0E-03	I				1	0.1		Phenylenediamine, m-	108-45-2	3.8E+02	n	4.9E+03	n					1.2E+02	n		3.2E-02	n	
4.7E-02	H								1	0.1		Phenylenediamine, o-	95-54-5	1.2E+01	c	4.9E+01	c					1.6E+00	c		4.4E-04	c	
				1.9E-01	H				1	0.1		Phenylenediamine, p-	106-50-3	1.2E+04	n	1.6E+05	nm					3.8E+03	n		1.0E+00	n	
1.9E-03	H								1	0.1		Phenylphenol, 2-	90-43-7	2.8E+02	c	1.2E+03	c					3.0E+01	c		4.1E-01	c	
				2.0E-04	H				1	0.1		Phorate	298-02-2	1.3E+01	n	1.6E+02	n					3.0E+00	n		3.4E-03	n	
						3.0E-04	I	V	1		1.6E+03	Phosgene	75-44-5	3.1E-01	n	1.3E+00	n	3.1E-01	n	1.3E+00	n				8.2E-02	n	
				2.0E-02	I				1	0.1		Phosmet	732-11-6	1.3E+03	n	1.6E+04	n					3.7E+02	n				
												Phosphates, Inorganic															
4.9E+01	P								1			*Aluminum metaphosphate	13776-88-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Ammonium polyphosphate	68333-79-9	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Calcium pyrophosphate	7790-76-3	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Diammonium phosphate	7783-28-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Dicalcium phosphate	7757-93-9	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Dimagnesium phosphate	7782-75-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Dipotassium phosphate	7758-11-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Disodium phosphate	7558-79-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Monocalcium phosphate	13530-50-2	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Monoammonium phosphate	7722-76-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Monocalcium phosphate	7758-23-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Monomagnesium phosphate	7757-86-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Monopotassium phosphate	7778-77-0	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Monosodium phosphate	7558-80-7	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Polyphosphoric acid	8017-16-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Potassium triphosphate	13845-36-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium acid pyrophosphate	7758-16-9	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium aluminum phosphate (acidic)	7785-88-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium aluminum phosphate (anhydrous)	10279-59-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium aluminum phosphate (tetrahydrate)	10305-76-7	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium hexametaphosphate	10124-56-8	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium polyphosphate	68915-31-1	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium trimetaphosphate	7785-84-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Sodium triphosphate	7758-29-4	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1			*Tetrapotassium phosphate	7320-34-5	3.8E+06	nm	5.7E+07	nm					9.7E+05	n			n	
4.9E+01	P								1																		

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Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day) ¹	k _e (y)	IUR (ug/m ³) ²	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RF _{C1} (mg/m ³) ³	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)		
1.4E-02	I	2.4E-06	C	2.0E-02	I				1	0.1		*Bis(2-ethylhexyl)phthalate	117-81-7	3.9E+01	c*	1.6E+02	c	1.2E+00	c	5.1E+00	c	5.6E+00	c*	6.0E+00	1.3E+00	c*	1.4E+00		
				1.0E+00	I				1	0.1		*Butylphthalyl Butylglycolate	85-70-1	6.3E+04	n	8.2E+05	nm					1.3E+04	n		3.1E+02	n			
				1.0E-01	I				1	0.1		*Dibutyl Phthalate	84-74-2	6.3E+03	n	8.2E+04	n					9.0E+02	n		2.3E+00	n			
				8.0E-01	I				1	0.1		*Diethyl Phthalate	84-66-2	5.1E+04	n	6.6E+05	nm					1.5E+04	n		6.1E+00	n			
				1.0E-01	I			V	1			*Dimethylterephthalate	120-61-6	7.8E+03	n	1.2E+05	nm					1.9E+03	n		4.9E-01	n			
				1.0E-02	P				1	0.1		*Octyl Phthalate, di-N-	117-84-0	6.3E+02	n	8.2E+03	n					2.0E+02	n		5.7E+01	n			
				1.0E+00	H				1	0.1		*Phthalic Acid, P-	100-21-0	6.3E+04	n	8.2E+05	nm					1.9E+04	n		6.8E+00	n			
				2.0E+00	I	2.0E-02	C		1	0.1		*Phthalic Anhydride	85-44-9	1.3E+05	nm	1.6E+06	nm	2.1E+01	n	8.8E+01	n	3.9E+04	n		8.5E+00	n			
				7.0E-02	I				1	0.1		Picloram	1918-02-1	4.4E+03	n	5.7E+04	n					1.4E+03	n	5.0E+02	3.8E-01	n	1.4E-01		
				1.0E-04	X				1	0.1		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	6.3E+00	n	8.2E+01	n					2.0E+00	n		1.3E-03	n			
				9.0E-04	X				1	0.1		Picric Acid (2,4,6-Trinitrophenol)	88-89-1	5.7E+01	n	7.4E+02	n					1.8E+01	n		8.4E-02	n			
				1.0E-02	I				1	0.1		Pirimiphos, Methyl	29232-93-7	6.3E+02	n	8.2E+03	n					1.2E+02	n		1.2E-01	n			
3.0E+01	C	8.6E-03	C	7.0E-06	H				1	0.1		Polybrominated Biphenyls	59536-65-1	1.8E-02	c*	7.7E-02	c*	3.3E-04	c	1.4E-03	c	2.6E-03	c*			c*			
7.0E-02	S	2.0E-05	S	7.0E-05	I			V	1	0.14		Polychlorinated Biphenyls (PCBs)																	
												*Aroclor 1016	12674-11-2	4.1E+00	n	2.7E+01	c**	1.4E-01	c	6.1E-01	c	2.2E-01	c**		2.1E-02	c**			
2.0E+00	S	5.7E-04	S					V	1	0.14		*Aroclor 1221	11104-28-2	2.0E-01	c	8.3E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c			
2.0E+00	S	5.7E-04	S					V	1	0.14		*Aroclor 1232	11141-16-5	1.7E-01	c	7.2E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c			
2.0E+00	S	5.7E-04	S					V	1	0.14		*Aroclor 1242	53469-21-9	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c			
2.0E+00	S	5.7E-04	S					V	1	0.14		*Aroclor 1248	12672-29-6	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c			
2.0E+00	S	5.7E-04	S	2.0E-05	I			V	1	0.14		*Aroclor 1254	11097-69-1	2.4E-01	c**	9.7E-01	c*	4.9E-03	c	2.1E-02	c	7.8E-03	c*		2.0E-03	c*			
2.0E+00	S	5.7E-04	S					V	1	0.14		*Aroclor 1260	11096-82-5	2.4E-01	c	9.9E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		5.5E-03	c			
				6.0E-04	X			V	1	0.14		*Aroclor 5460	11126-42-4	3.5E+01	n	4.4E+02	n					1.2E+01	n		2.0E+00	n			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Heptachlorobiphenyl, 2,3,3',4,4',5,5' (PCB 189)	39695-31-9	1.3E-01	c*	5.2E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		2.8E-03	c			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Hexachlorobiphenyl, 2,3',4,4',5,5' (PCB 167)	52663-72-6	1.2E-01	c*	5.2E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Hexachlorobiphenyl, 2,3,3',4,4',5' (PCB 157)	69782-90-7	1.2E-01	c*	5.1E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Hexachlorobiphenyl, 2,3,3',4,4',5' (PCB 156)	38380-08-4	1.2E-01	c*	5.1E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.7E-03	c			
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V	1	0.14		*Hexachlorobiphenyl, 3,3',4,4',5,5' (PCB 169)	32774-16-6	1.2E-04	c*	5.2E-04	c*	2.5E-06	c	1.1E-05	c	4.0E-06	c		1.7E-06	c			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Pentachlorobiphenyl, 2',3,4,4',5' (PCB 128)	65510-44-3	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Pentachlorobiphenyl, 2,3',4,4',5' (PCB 118)	31508-00-6	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Pentachlorobiphenyl, 2,3,3',4,4',5' (PCB 105)	32598-14-4	1.2E-01	c*	5.0E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		*Pentachlorobiphenyl, 2,3,4,4',5' (PCB 114)	74472-37-0	1.2E-01	c*	5.1E-01	c*	2.5E-03	c	1.1E-02	c	4.0E-03	c		1.0E-03	c			
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V	1	0.14		*Pentachlorobiphenyl, 3,3',4,4',5' (PCB 126)	57465-28-8	3.7E-05	c*	1.5E-04	c*	7.4E-07	c	3.2E-06	c	1.2E-06	c		3.0E-07	c			
2.0E+00	I	5.7E-04	I					V	1	0.14		*Polychlorinated Biphenyls (high risk)	1336-36-3	2.3E-01	c	9.4E-01	c	4.9E-03	c	2.1E-02	c								
4.0E-01	I	1.0E-04	I					V	1	0.14		*Polychlorinated Biphenyls (low risk)	1336-36-3					2.8E-02	c	1.2E-01	c	4.4E-02	c	5.0E-01	6.8E-03	c	7.8E-02		
7.0E-02	I	2.0E-05	I					V	1	0.14		*Polychlorinated Biphenyls (lowest risk)	1336-36-3					1.4E-01	c	6.1E-01	c								
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E	V	1	0.14		*Tetrachlorobiphenyl, 3,3',4,4' (PCB 77)	32598-13-3	3.8E-02	c*	1.6E-01	c*	7.4E-04	c	3.2E-03	c	6.0E-03	c*		9.4E-04	c*			
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V	1	0.14		*Tetrachlorobiphenyl, 3,4,4',5' (PCB 81)	70362-50-4	1.2E-02	c*	4.9E-02	c*	2.5E-04	c	1.1E-03	c	4.0E-04	c		6.2E-05	c			
				6.0E-04	I				1	0.1		Polymethic Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n								
												Polynuclear Aromatic Hydrocarbons (PAHs)																	
				6.0E-02	I			V	1	0.13		*Acenaphthene	83-32-9	3.6E+03	n	4.5E+04	n					5.3E+02	n		5.5E+00	n			
7.3E-01	E	1.1E-04	C	3.0E-01	I			V	1	0.13		*Anthracene	120-12-7	1.8E+04	n	2.3E+05	nm					1.8E+03	n		5.8E+01	n			
								V	M	1	0.13	*Benz[a]anthracene	56-55-3	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	1.2E-02	c		4.2E-03	c			
1.2E+00	C	1.1E-04	C							1	0.13	*Benzo[j]fluoranthene	205-82-3	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	6.5E-02	c		7.8E-02	c			
7.3E+00	I	1.1E-03	C						M	1	0.13	*Benzo[a]pyrene	50-32-8	1.6E-02	c	2.9E-01	c	9.2E-04	c	1.1E-02	c	3.4E-03	c		4.0E-03	c	2.4E-01		
7.3E-01	E	1.1E-04	C						M	1	0.13	*Benzo[b]fluoranthene	205-99-2	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	3.4E-02	c		4.1E-02	c			
7.3E-02	E	1.1E-04	C						M	1	0.13	*Benzo[k]fluoranthene	707-08-9	1.6E+00	c	2.9E+01	c	9.2E-03	c	1.1E-01	c	3.4E-0							

Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1) November 2015

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																													
Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day) ⁻¹	k _e (y)	IUR (ug/m ³) ⁻¹	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RF _C (mg/m ³) ⁻¹	k _e (y)	muta- gen	GI/ABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)		
4.0E-03	I								1	0.1		Propanediol, 1,2-	114-26-1	2.5E+02	n	3.3E+03	n					7.8E+01	n		2.5E-02	n			
5.0E-03	I								1	0.1		Propanil	709-98-8	3.2E+02	n	4.1E+03	n					8.2E+01	n		4.5E-02	n			
2.0E-02	I								1	0.1		Propargite	2312-35-8	1.3E+03	n	1.6E+04	n					1.6E+02	n		1.2E+01	n			
2.0E-03	I							V	1		1.1E+05	Propargyl Alcohol	107-19-7	1.6E+02	n	2.3E+03	n					4.0E+01	n		8.1E-03	n			
2.0E-02	I								1	0.1		Propazine	139-40-2	1.3E+03	n	1.6E+04	n					3.4E+02	n		3.0E-01	n			
2.0E-02	I								1	0.1		Propham	122-42-9	1.3E+03	n	1.6E+04	n					3.5E+02	n		2.2E-01	n			
1.3E-02	I								1	0.1		Propiconazole	60207-90-1	8.2E+02	n	1.1E+04	n					2.1E+02	n		6.9E-01	n			
				8.0E-03	I	V			1		3.3E+04	Propionaldehyde	123-38-6	7.5E+01	n	3.1E+02	n	8.3E+00	n	3.5E+01	n	1.7E+01	n		3.4E-03	n			
1.0E-01	X	1.0E+00	X	V					1		2.6E+02	Propyl benzene	103-65-1	3.8E+03	ns	2.4E+04	ns	1.0E+03	n	4.4E+03	n	6.6E+02	n		1.2E+00	n			
				3.0E+00	C	V			1		3.5E+02	Propylene	115-07-1	2.2E+03	ns	9.3E+03	ns	3.1E+03	n	1.3E+04	n	6.3E+03	n		6.0E+00	n			
2.0E+01	P								1	0.1		Propylene Glycol	57-55-6	1.3E+06	nm	1.6E+07	nm					4.0E+05	n		8.1E+01	n			
		2.7E-04	A						1	0.1		Propylene Glycol Dinitrate	6423-43-4	3.9E+05	nm	1.6E+06	nm	2.8E-01	n	1.2E+00	n								
7.0E-01	H	2.0E+00	I	V					1		1.1E+05	Propylene Glycol Monomethyl Ether	107-98-2	4.1E+04	n	3.7E+05	nms	2.1E+03	n	8.8E+03	n	3.2E+03	n		6.5E-01	n			
2.4E-01	I	3.7E-06	I			3.0E-02	I	V	1		7.8E+04	Propylene Oxide	75-56-9	2.1E+00	c	9.7E+00	c	7.6E-01	c*	3.3E+00	c*	2.7E-01	c		5.6E-05	c			
		7.5E-02	I						1	0.1		Propyzamide	23950-58-5	4.7E+03	n	6.2E+04	n					1.2E+03	n		1.2E+00	n			
		1.0E-03	I					V	1		5.3E+05	Pyridine	110-86-1	7.8E+01	n	1.2E+03	n					2.0E+01	n		6.8E-03	n			
3.0E+00	I								1	0.1		Quinalphos	13593-03-8	3.2E+01	n	4.1E+02	n					5.1E+00	n		4.3E-02	n			
									1	0.1		Quinoline	91-22-5	1.8E-01	c	7.7E-01	c					2.4E-02	c		7.8E-05	c			
		9.0E-03	I						1	0.1		Quizalofop-ethyl	76578-14-8	5.7E+02	n	7.4E+03	n					1.2E+02	n		1.9E+00	n			
				3.0E-02	A				1			Refractory Ceramic Fibers	NA	4.3E+07	nm	1.8E+08	nm	3.1E+01	n	1.3E+02	n								
		3.0E-02	I						1	0.1		Resmethrin	10453-86-8	1.9E+03	n	2.5E+04	n					6.7E+01	n		4.2E+01	n			
		5.0E-02	H					V	1			Resmethrin	299-84-2	3.9E+03	n	5.8E+04	n					4.1E+02	n		3.7E+00	n			
2.2E-01	C	6.3E-05	C						1	0.1		Rotenone	83-79-4	2.5E+02	n	3.3E+03	n					6.1E+01	n		3.2E+01	n			
								M	1	0.1		Saflure	94-59-7	5.5E-01	c	1.0E+01	c	1.6E-02	c	1.9E-01	c	9.6E-02	c		5.9E-05	c			
		5.0E-03	I						1			Selenious Acid	7783-00-8	3.9E+02	n	5.8E+03	n					1.0E+02	n						
		5.0E-03	I	2.0E-02	C				1			Selenium	7782-49-2	3.9E+02	n	5.8E+03	n	2.1E+01	n	8.8E+01	n	1.0E+02	n	5.0E+01	5.2E-01	n	2.6E-01		
		5.0E-03	C	2.0E-02	C				1			Selenium Sulfide	7446-34-6	3.9E+02	n	5.8E+03	n	2.1E+01	n	8.8E+01	n	1.0E+02	n						
		9.0E-02	I						1	0.1		Sethoxydim	74051-80-2	5.7E+03	n	7.4E+04	n					1.0E+03	n		9.3E+00	n			
				3.0E-03	C				1			Silica (crystalline, respirable)	7631-86-9	4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n								
1.2E-01	H			5.0E-03	I				0.04			Silver	7440-22-4	3.9E+02	n	5.8E+03	n					9.4E+01	n		8.0E-01	n			
		5.0E-03	I						1	0.1		Simazine	122-34-9	4.5E+00	c*	1.9E+01	c					6.1E-01	c	4.0E+00	3.0E-04	c	2.0E-03		
		1.3E-02	I						1	0.1		Sodium Adfluorfen	62476-59-9	8.2E+02	n	1.1E+04	n					2.6E+02	n		2.1E+00	n			
		4.0E-03	I						1			Sodium Azide	26628-22-8	3.1E+02	n	4.7E+03	n					8.0E+01	n						
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M	0.025			Sodium Dichromate	10588-01-9	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c						
2.7E-01	H			3.0E-02	I				1	0.1		Sodium Diethyldithiocarbamate	148-18-5	2.0E+00	c	8.5E+00	c					2.9E-01	c						
		5.0E-02	A	1.3E-02	C				1			Sodium Fluoride	7681-49-4	3.9E+03	n	5.8E+04	n	1.4E+01	n	5.7E+01	n	1.0E+03	n						
		2.0E-05	I						1	0.1		Sodium Fluoroacetate	62-74-8	1.3E+00	n	1.6E+01	n					4.0E-01	n		8.1E-05	n			
		1.0E-03	H						1			Sodium Metavanadate	13718-26-8	7.8E+01	n	1.2E+03	n					2.0E+01	n						
		8.0E-04	P						1			Sodium Tungstate	13472-45-2	6.3E+01	n	9.3E+02	n					1.6E+01	n						
		8.0E-04	P						1			Sodium Tungstate Dihydrate	10213-10-2	6.3E+01	n	9.3E+02	n					1.6E+01	n						
2.4E-02	H			3.0E-02	I				1	0.1		Stirofos (Tetrachlorovinphos)	961-11-5	2.3E+01	c*	9.6E+01	c					2.8E+00	c		8.2E-03	c			
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M	0.025			Strontium Chromate	7789-06-2	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c						
		6.0E-01	I						1			Strontium, Stable	7440-24-6	4.7E+04	n	7.0E+05	nm					1.2E+04	n		4.2E+02	n			
		3.0E-04	I						1	0.1		Strychnine	57-24-9	1.9E+01	n	2.5E+02	n					5.9E+00	n		6.5E-02	n			
		2.0E-01	I	1.0E+00	I	V			1		8.7E+02	Styrene	100-42-5	6.0E+03	ns	3.5E+04	ns	1.0E+03	n	4.4E+03	n	1.2E+03	n	1.0E+02	1.3E+00	n	1.1E-01		
		3.0E-03	P						1	0.1		Styrene-Acrylonitrile (SAN) Trimer	NA	1.9E+02	n	2.5E+03	n					4.8E+01	n						
		1.0E-03	P	2.0E-03	X				1	0.1		Sulfolane	126-33-0	6.3E+01	n	8.2E+02	n	2.1E+00	n	8.8E+00	n	2.0E+01	n		4.4E-03	n			
		8.0E-04	P						1	0.1		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	5.1E+01	n	6.6E+02	n					1.1E+01	n		6.5E-02	n			
				1.0E-03	C	V			1			Sulfur Trioxide	7446-11-9	1.4E+06	nm	6.0E+06	nm	1.0E+00	n	4.4E+00	n	2.1E+00	n						
2.5E-02	I	7.1E-06	I	5.0E-02	H				1	0.1		Sulf																	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day)	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RfD _a (mg/kg-day)	k _e y	RfC ₁ (mg/m ³) ⁻¹	k _e y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)		
				8.0E+01	I	V			1		2.1E+03	Tetrafluoroethane, 1,1,1,2-Tetryl (Trinitrophenylmethylnitramine)	811-97-2 479-45-8	1.0E+05 1.6E+02	nms	4.3E+05 2.3E+03	nms	8.3E+04	n	3.5E+05	n	1.7E+05 3.9E+01	n		9.3E+01 3.7E-01	n			
		2.0E-03	P						1	0.0007																			
		7.0E-06	X						1			Thallium (I) Nitrate	10102-45-1	5.5E-01	n	8.2E+00	n					1.4E-01	n			n			
		1.0E-05	X						1			Thallium (Soluble Salts)	7440-28-0	7.8E-01	n	1.2E+01	n					2.0E-01	n	2.0E+00	1.4E-02	n	1.4E-01		
		6.0E-06	X				V		1			Thallium Acetate	563-68-8	4.7E-01	n	7.0E+00	n					1.2E-01	n			n			
		2.0E-05	X				V		1			Thallium Carbonate	6533-73-9	1.6E+00	n	2.3E+01	n					4.0E-01	n			n			
		6.0E-06	X						1			Thallium Chloride	7791-12-0	4.7E-01	n	7.0E+00	n					1.2E-01	n			n			
		2.0E-05	X						1			Thallium Sulfate	7446-18-6	1.6E+00	n	2.3E+01	n					4.0E-01	n			n			
		1.3E-02	I						1	0.1		Thiophenol	79277-27-3	8.2E+02	n	1.1E+04	n					2.6E+02	n			7.8E-02	n		
		1.0E-02	I						1	0.1		Thiobencarb	28249-77-6	6.3E+02	n	8.2E+03	n					1.6E+02	n			5.5E-01	n		
		7.0E-02	X						1	0.0075		Thiodiglycol	111-48-8	5.4E+03	n	7.9E+04	n					1.4E+03	n			2.8E-01	n		
		3.0E-04	H						1	0.1		Thiofanox	39196-18-4	1.9E+01	n	2.5E+02	n					5.3E+00	n			1.8E-03	n		
		8.0E-02	I						1	0.1		Thiophanate, Methyl	23564-05-8	5.1E+03	n	6.6E+04	n					1.6E+03	n			1.4E+00	n		
		5.0E-03	I						1	0.1		Thiram	137-26-8	3.2E+02	n	4.1E+03	n					9.8E+01	n			1.4E-01	n		
		6.0E-01	H						1			Tin	7440-31-5	4.7E+04	n	7.0E+05	nm					1.2E+04	n			3.0E+03	n		
		8.0E-02	I	1.0E-04	A	V			1		8.2E+02	Titanium Tetrachloride	7550-45-0	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n	2.1E-01	n				n		
				5.0E+00	I	V			1			Toluene	108-88-3	4.9E+03	ns	4.7E+04	ns	5.2E+03	n	2.2E+04	n	1.1E+03	n	1.0E+03	7.6E-01	n	6.9E-01		
1.8E-01	X			2.0E-04	X				1	0.1		Toluene-2,5-diamine	95-70-5	3.0E+00	c**	1.3E+01	c*					4.3E-01	c**		1.3E-04	c**			
3.0E-02	P			4.0E-03	X				1	0.1		Toluidine, p-	106-49-0	1.8E+01	c*	7.7E+01	c*					2.5E+00	c*		1.1E-03	c*			
		3.0E+00	P				V		1		3.4E-01	Total Petroleum Hydrocarbons (Aliphatic High)	NA	2.3E+05	nms	3.5E+06	nms					6.0E+04	n		2.4E+03	n			
				6.0E-01	P	V			1		1.4E+02	Total Petroleum Hydrocarbons (Aliphatic Low)	NA	5.2E+02	ns	2.2E+03	ns	6.3E+02	n	2.6E+03	n	1.3E+03	n		8.8E+00	n			
		1.0E-02	X	1.0E-01	P	V			1		6.9E+00	Total Petroleum Hydrocarbons (Aliphatic Medium)	NA	9.6E+01	ns	4.4E+02	ns	1.0E+02	n	4.4E+02	n	1.0E+02	n		1.5E+00	n			
		4.0E-02	P						1	0.1		Total Petroleum Hydrocarbons (Aromatic High)	NA	2.5E+03	n	3.3E+04	n					8.0E+02	n		8.9E+01	n			
		4.0E-03	P	3.0E-02	P	V			1		1.8E+03	Total Petroleum Hydrocarbons (Aromatic Low)	NA	8.2E+01	n	4.2E+02	n	3.1E+01	n	1.3E+02	n	3.3E+01	n		1.7E-02	n			
		4.0E-03	P	3.0E-03	P	V			1			Total Petroleum Hydrocarbons (Aromatic Medium)	NA	1.1E+02	n	6.0E+02	n	3.1E+00	n	1.3E+01	n	5.5E+00	n		2.3E-02	n			
1.1E+00	I	3.2E-04	I						1	0.1		Toxaphene	8001-35-2	4.9E-01	c	2.1E+00	c	8.8E-03	c	3.8E-02	c	7.1E-02	c	3.0E+00	1.1E-02	c	4.6E-01		
		7.5E-03	I						1	0.1		Triacetone	66841-25-6	4.7E+02	n	6.2E+03	n					1.5E+02	n		5.8E+01	n			
		3.0E-04	A				V		1			Tri-n-butyltin	688-73-3	2.3E+01	n	3.5E+02	n					3.7E+00	n		8.2E-02	n			
		8.0E+01	X						1	0.1		Triacetin	102-76-1	5.1E+06	nm	6.6E+07	nm					1.6E+06	n		4.5E+02	n			
		3.0E-02	I						1	0.1		Triadimefon	43121-43-3	1.9E+03	n	2.5E+04	n					5.5E+02	n		4.4E-01	n			
		1.3E-02	I				V		1			Triallate	2303-17-5	1.0E+03	n	1.5E+04	n					1.2E+02	n		2.6E-01	n			
		1.0E-02	I						1	0.1		Triasulfuron	82097-50-5	6.3E+02	n	8.2E+03	n					2.0E+02	n		2.1E-01	n			
		8.0E-03	I						1	0.1		Tribenuron-methyl	101200-48-0	5.1E+02	n	6.6E+03	n					1.6E+02	n		6.1E-02	n			
		5.0E-03	I					V	1			Tribromobenzene, 1,2,4-	615-54-3	3.9E+02	n	5.8E+03	n					4.5E+01	n		6.4E-02	n			
9.0E-03	P			1.0E-02	P				1	0.1		Tributyl Phosphate	126-73-8	6.0E+01	c*	2.6E+02	c*					5.2E+00	c*		2.5E-02	c*			
		3.0E-04	P						1	0.1		Tributyltin Compounds	NA	1.9E+01	n	2.5E+02	n					6.0E+00	n			n			
		3.0E-04	I						1	0.1		Tributyltin Oxide	56-35-9	1.9E+01	n	2.5E+02	n					5.7E+00	n		2.9E+02	n			
		3.0E+01	I	3.0E+01	H	V			1		9.1E+02	Trichloro-1,2,2-trifluoroethane, 1,1,2	76-13-1	4.0E+04	ns	1.7E+05	nms	3.1E+04	n	1.3E+05	n	5.5E+04	n		1.4E+02	n			
7.0E-02	I			2.0E-02	I				1	0.1		Trichloroacetic Acid	76-03-9	7.8E+00	c	3.3E+01	c					1.1E+00	c	6.0E+01	2.2E-04	c	1.2E-02		
2.9E-02	H								1	0.1		Trichloroaniline HCl, 2,4,6-	33663-50-2	1.9E+01	c	7.9E+01	c					2.7E+00	n		7.4E-03	c			
7.0E-03	X			3.0E-05	X				1	0.1		Trichloroaniline, 2,4,6-	634-93-5	1.9E+00	n	2.5E+01	n					4.0E-01	n		3.6E-03	n			
		8.0E-04	X				V		1			Trichlorobenzene, 1,2,3-	87-61-6	6.3E+01	n	9.3E+02	n					7.0E+00	n		2.1E-02	n			
2.9E-02	P			1.0E-02	I	2.0E-03	P	V	1		4.0E+02	Trichlorobenzene, 1,2,4-	120-82-1	2.4E+01	c**	1.1E+02	c**	2.1E+00	n	8.8E+00	n	1.2E+00	c**	7.0E+01	3.4E-03	c**	2.0E-01		
		2.0E+00	I	5.0E+00	I	V			1		6.4E+02	Trichloroethane, 1,1,1-	71-55-6	8.1E+03	ns	3.6E+04	ns	5.2E+03	n	2.2E+04	n	8.0E+03	n		2.8E+00	n	7.0E-02		
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V	1		2.2E+03	Trichloroethane, 1,1,2-	79-00-5	1.1E+00	c**	5.0E+00	c**	1.8E-01	c**	7.7E-01	c**	2.8E-01	c**	5.0E+00	8.9E-05	c**	1.6E-03		
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1	6.9E+02	Trichloroethylene	79-01-6	9.4E-01	c**	6.0E+00	c**	4.8E-01	c**	3.0E+00	c**	4.9E-01	c**	5.0E+00	1.8E-04	c**	1.8E-03		
		3.0E-01	I				V		1		1.2E+03	Trichlorofluoromethane	75-69-4	2.3E+04	ns	3.5E+05	nms					5.2E+03	n		3.3E+00	n			
		1.0E-01	I						1	0.1		Trichlorophenol, 2,4,5-	95-95-4	6.3E+03	n	8.2E+04	n					1.2E+03	n		4.4E+00	n			
		1.1E-02	I	3.1E-06	I	1.0E-03	P		1	0.1		Trichlorophenol, 2,4,6-	88-06-2	4.9E+01	c**	2.1E+02	c**	9.1E-01	c	4.0E+00	c	4.1E+00	c**		1.5E-02	c**			
				1.0E-02	I				1	0.1		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	6.3E+02	n	8.2E+03	n					1.6E+02	n		6.8E				

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c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs			
SFO (mg/kg-day) ¹	k _e (ug/m ³) ¹	IUR (ug/m ³) ¹	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³)	RfC _i (mg/m ³)	k _e (ug/L)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m ³)	key	Industrial Air (ug/m ³)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)			
3.0E-02	I		3.0E-02	I					1	0.019		Trinitrobenzene, 1,3,5-	99-35-4	2.2E+03	n	3.2E+04	n					5.9E+02	n		2.1E+00	n				
			5.0E-04	I					1	0.032		Trinitrotoluene, 2,4,6-	118-96-7	2.1E+01	c**	9.6E+01	c**					2.5E+00	c**		1.5E-02	c**				
			2.0E-02	P					1	0.1		Triphenylphosphine Oxide	791-28-6	1.3E+03	n	1.6E+04	n					3.6E+02	n		1.5E+00	n				
2.3E+00	C	6.6E-04	C		A				1	0.1		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	1.3E+03	n	1.6E+04	n					3.6E+02	n		8.0E+00	n				
			1.0E-02	X				V	1	0.1	4.7E+02	Tris(2-chloro-2-propyl)phosphate	13674-84-5	6.3E+02	n	8.2E+03	n					1.9E+02	n		6.5E-01	n				
									1			Tris(2,3-dibromopropyl)phosphate	126-72-7	2.8E-01	c	1.3E+00	c	4.3E-03	c	1.9E-02	c	6.8E-03	c		1.3E-04	c				
2.0E-02	P		7.0E-03	P					1	0.1		Tris(2-chloroethyl)phosphate	145-96-8	2.7E+01	c*	1.1E+02	c*					3.8E+00	c*		3.8E-03	c*				
3.2E-03	P		1.0E-01	P					1	0.1		Tris(2-ethylhexyl)phosphate	78-42-2	1.7E+02	c*	7.2E+02	c					2.4E+01	c*		1.2E+02	c*				
			8.0E-04	P					1			Tungsten	7440-33-7	6.3E+01	n	9.3E+02	n					1.6E+01	n		2.4E+00	n				
1.0E+00	C	2.9E-04	C		I	4.0E-05	A		1	0.1		Uranium (Soluble Salts)	NA	2.3E+02	n	3.5E+03	n	4.2E-02	n	1.8E-01	n	6.0E+01	n	3.0E+01	2.7E+01	n	1.4E+01			
		8.3E-03	P		I	7.0E-06	P	M	0.026			Urethane	51-79-6	1.2E-01	c	2.3E+00	c	3.5E-03	c	4.2E-02	c	2.5E-02	c		5.6E-06	c				
												Vanadium Pentoxide	1314-62-1	4.6E+02	c**	2.0E+03	c**	3.4E-04	c*	1.5E-03	c*	1.5E+02	n		n					
			5.0E-03	S	1.0E-04	A			0.026			Vanadium and Compounds	7440-62-2	3.9E+02	n	5.8E+03	n	1.0E-01	n	4.4E-01	n	8.6E+01	n		8.6E+01	n				
			1.0E-03	I			V		1			Vernolate	1929-77-7	7.8E+01	n	1.2E+03	n					1.1E+01	n		8.9E-03	n				
			2.5E-02	I					1	0.1		Vindozolin	50471-44-8	1.6E+03	n	2.1E+04	n					4.4E+02	n		3.4E-01	n				
			1.0E+00	H	2.0E-01	I	V		1		2.8E+03	Vinyl Acetate	108-05-4	9.1E+02	n	3.8E+03	ns	2.1E+02	n	8.8E+02	n	4.1E+02	n		8.7E-02	n				
		3.2E-05	H		3.0E-03	I	V		1		2.5E+03	Vinyl Bromide	593-60-2	1.2E-01	c*	5.2E-01	c*	8.8E-02	c*	3.8E-01	c*	1.8E-01	c*		5.1E-05	c*				
7.2E-01	I	4.4E-06	I		3.0E-03	I	1.0E-01	I	V	M	1	3.9E+03	Vinyl Chloride	75-01-4	5.9E-02	c	1.7E+00	c	1.7E-01	c	2.8E+00	c	1.9E-02	c	2.0E+00	6.5E-06	c	6.9E-04		
			3.0E-04	I					1	0.1		Warfarin	81-81-2	1.9E+01	n	2.5E+02	n					5.6E+00	n		5.9E-03	n				
			2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, p-	106-42-3	5.6E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n				
			2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, m-	108-38-3	5.5E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n				
			2.0E-01	S	1.0E-01	S	V		1		4.3E+02	Xylene, o-	95-47-6	6.5E+02	ns	2.8E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n		1.9E-01	n				
			2.0E-01	I	1.0E-01	I	V		1		2.6E+02	Xylenes	1330-20-7	5.8E+02	ns	2.5E+03	ns	1.0E+02	n	4.4E+02	n	1.9E+02	n	1.0E+04	1.9E-01	n	9.9E+00			
			3.0E-04	I					1			Zinc Phosphide	1314-84-7	2.3E+01	n	3.5E+02	n					6.0E+00	n		n					
			3.0E-01	I					1			Zinc and Compounds	7440-66-6	2.3E+04	n	3.5E+05	nm					6.0E+03	n		3.7E+02	n				
			5.0E-02	I					1	0.1		Zineb	12122-67-7	3.2E+03	n	4.1E+04	n					9.9E+02	n		2.9E+00	n				
			8.0E-05	X					1			Zirconium	7440-67-7	6.3E+00	n	9.3E+01	n					1.6E+00	n		4.8E+00	n				

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Toxicity and Chemical-specific Information														Contaminant				Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day) ¹	k _e (y)	IUR (ug/m ³ -day) ¹	k _e (y)	RfD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³)	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)		
8.7E-03	I	2.2E-06	I	4.0E-03	I	9.0E-03	I	V	1	0.1	1.1E+05	1.4E+09	8.7E+03	Acetate	30560-19-1	8.0E+01	2.8E+02	1.1E+01	6.2E+01	3.1E+02	1.3E+03	8.2E+01	2.5E+02		
				2.0E-02	I				1	0.1		1.4E+09		Acetaldehyde	75-07-0				1.1E+01	1.6E+03	6.6E+03		1.3E+03		
				9.0E-01	I	3.1E+01	A	V	1		1.1E+05	1.4E+09	1.4E+04	Acetone	67-64-1					7.0E+04		4.4E+05	6.1E+04		
				2.0E-03	X				1	0.1		1.4E+09		Acetone Cyanohydrin	75-86-5							2.8E+06	2.8E+06		
				6.0E-02	I	V			1		1.3E+05	1.4E+09	1.3E+04	Acetonitrile	75-05-8							8.1E+02	8.1E+02		
3.8E+00	C	1.3E-03	C	1.0E-01	I			V	1		2.5E+03	1.4E+09	6.0E+04	Acetophenone	98-86-2	1.8E-01	6.5E-01	2.9E+03	1.4E-01	7.8E+03			7.8E+03		
				5.0E-04	I	2.0E-05	I	V	1		2.3E+04	1.4E+09	6.9E+03	Acetylaminofluorene, 2-	53-96-3					3.9E+01		1.4E-01	1.4E-01		
									1			1.4E+09		Acrolein	107-02-8										
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I	M	1	0.1		1.4E+09		Acrylamide	79-06-1	3.1E-01	1.2E+00	1.4E+04	2.4E-01	1.6E+02	6.6E+02	8.5E+06	1.3E+02		
				5.0E-01	I	1.0E-03	I	V	1		1.1E+05	1.4E+09	9.5E+04	Acrylic Acid	79-10-7					3.9E+04		9.9E+01	9.9E+01		
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V	1		1.1E+04	1.4E+09	7.7E+03	Acrylonitrile	107-13-1	1.3E+00		3.2E-01	2.5E-01	3.1E+03		1.6E+01	1.6E+01		
						6.0E-03	P		1	0.1		1.4E+09		Adiponitrile	111-69-3							8.5E+06	8.5E+06		
5.6E-02	C			1.0E-02	I				1	0.1		1.4E+09		Alachlor	15972-60-8	1.2E+01	4.4E+01		9.7E+00	7.8E+02	3.3E+03		6.3E+02		
				1.0E-03	I				1	0.1		1.4E+09		Aldicarb	116-06-3					7.8E+01	3.3E+02		6.3E+01		
				1.0E-03	I				1	0.1		1.4E+09		Aldicarb Sulfone	1646-88-4					7.8E+01	3.3E+02		6.3E+01		
1.7E+01	I	4.9E-03	I	3.0E-05	I			V	1			1.4E+09	1.7E+06	Aldicarb sulfoxide	1646-87-3	4.1E-02		9.8E-01	3.9E-02	2.3E+00			2.3E+00		
									1		1.4E+09	1.7E+06		Aldrin	309-00-2										
2.1E-02	C	6.0E-06	C	5.0E-03	I	1.0E-04	X	V	1		1.1E+05	1.4E+09	3.4E+04	Allyl Alcohol	107-18-6					3.9E+02		3.6E+00	3.5E+00		
				1.0E-03	I	V			1		1.4E+03	1.4E+09	1.6E+03	Allyl Chloride	107-05-1	3.3E+01		7.4E-01	7.2E-01	7.8E+04		1.7E+00	1.7E+00		
				1.0E+00	P	5.0E-03	P		1			1.4E+09		Aluminum	7429-90-5							7.1E+06	7.7E+04		
				4.0E-04	I				1			1.4E+09		Aluminum Phosphide	20859-73-8					3.1E+01			3.1E+01		
2.1E+01	C	6.0E-03	C	9.0E-03	I				1	0.1		1.4E+09		Ametrin	834-12-8					7.0E+02	3.0E+03		5.7E+02		
									1	0.1		1.4E+09		Aminobiphenyl, 4-	92-67-1	3.3E-02	1.2E-01	6.4E+02	2.6E-02						
				8.0E-02	P				1	0.1		1.4E+09		Aminophenol, m-	591-27-5					6.3E+03	2.6E+04		5.1E+03		
				2.0E-02	P				1	0.1		1.4E+09		Aminophenol, p-	123-30-8					1.6E+03	6.6E+03		1.3E+03		
				2.5E-03	I				1	0.1		1.4E+09		Amitraz	33089-61-1					2.0E+02	8.2E+02		1.6E+02		
				1.0E-01	I	V			1			1.4E+09		Ammonia	7664-41-7										
				2.0E-01	I				1			1.4E+09		Ammonium Sulfamate	7773-06-0					1.6E+04			1.6E+04		
				3.0E-03	X	V			1		1.4E+04	1.4E+09	2.6E+04	Amyl Alcohol, tert-	75-85-4							8.2E+01	8.2E+01		
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I		1	0.1		1.4E+09		Aniline	62-53-3	1.2E+02	4.3E+02	2.4E+06	9.5E+01	5.5E+02	2.3E+03	1.4E+06	4.4E+02		
4.0E-02	P			2.0E-03	X				1	0.1		1.4E+09		Anthraquinone, 9,10-	84-65-1	1.7E+01	6.2E+01		1.4E+01	1.6E+02	6.6E+02		1.3E+02		
				4.0E-04	I				0.15			1.4E+09		Antimony (metallic)	7440-36-0					3.1E+01			3.1E+01		
				5.0E-04	H				0.15			1.4E+09		Antimony Pentoxide	1314-60-9					3.9E+01			3.9E+01		
				4.0E-04	H				0.15			1.4E+09		Antimony Tetroxide	1332-81-6					3.1E+01			3.1E+01		
				2.0E-04	I				0.15			1.4E+09		Antimony Trioxide	1309-64-4							2.8E+05	2.8E+05		
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C		1	0.03		1.4E+09		Arsenic, Inorganic	7440-38-2	7.7E-01	5.5E+00	8.9E+02	6.8E-01	3.9E+01	3.3E+02	2.1E+04	3.5E+01		
				3.5E-06	C	5.0E-05	I		1			1.4E+09		Arsine	7784-42-1					2.7E-01		7.1E+04	2.7E-01		
				5.0E-02	I				1	0.1		1.4E+09		Asulam	3337-71-1					3.9E+03	1.6E+04		3.2E+03		
2.3E-01	C			3.5E-02	I				1	0.1		1.4E+09		Atrazine	1912-24-9	3.0E+00	1.1E+01		2.4E+00	2.7E+03	1.2E+04		2.2E+03		
8.8E-01	C	2.5E-04	C	4.0E-04	I				1	0.1		1.4E+09		Auramine	492-80-8	7.9E-01	2.8E+00	1.5E+04	6.2E-01	3.1E+01	1.3E+02		2.5E+01		
									1	0.1		1.4E+09		Avermectin B1	65195-55-3					2.3E+02	9.9E+02	1.4E+07	1.9E+02		
1.1E-01	I	3.1E-05	I	3.0E-03	A	1.0E-02	A		1	0.1		1.4E+09		Azinphos-methyl	86-50-0					2.3E+02	9.9E+02	1.4E+07	1.9E+02		
				1.0E+00	P	7.0E-06	P		1	0.1		1.4E+09	5.2E+05	Azobenzene	103-33-3	6.3E+00		4.7E+01	5.6E+00	7.8E+04	3.3E+05	9.9E+03	8.6E+03		
									1			1.4E+09		Azodicarbonamide	123-77-3										
5.0E-01	C	1.5E-01	C	2.0E-01	I	5.0E-04	H		0.07			1.4E+09		Barium	7440-39-3					1.6E+04		7.1E+05	1.5E+04		
				2.0E-02	C	2.0E-04	C	M	0.025			1.4E+09		Barium Chromate	10294-40-3	3.1E-01		9.2E+00	3.0E-01	1.6E+03		2.8E+05	1.6E+03		
				3.0E-01	I			V	1			1.4E+09	3.1E+05	Benfluralin	1861-40-1					2.3E+04			2.3E+04		
				5.0E-02	I				1	0.1		1.4E+09		Benomyl	17804-35-2					3.9E+03	1.6E+04		3.2E+03		
				2.0E-01	I				1	0.1		1.4E+09		Bensulfuron-methyl	83055-99-6					1.6E+04	6.6E+04		1.3E+04		
				3.0E-02	I				1	0.1		1.4E+09		Bentazon	25057-89-0					2.3E+03	9.9E+03		1.9E+03		
				1.0E-01	I			V	1		1.2E+03	1.4E+09	2.3E+04	Benzaldehyde	100-52-7					7.8E+03			7.8E+03		
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V	1		1.8E+03	1.4E+09	3.5E+03	Benzene	71-43-2	1.3E+01		1.3E+00	1.2E+00	3.1E+02		1.1E+02	8.2E+01		
1.0E-01	X			3.0E-04	X				1	0.1		1.4E+09		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	7.0E+00	2.5E+01								

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																											
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1							
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e (mg/m ³) ⁻¹	v _o (m ³ /kg)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)			
			4.0E-02 3.0E-03	I P		V		1		1	0.1	1.0E+03 1.4E+09	1.4E+09 1.4E+09	3.5E+04	Bis(2-chloro-1-methylethyl) ether Bis(2-chloroethoxy)methane	108-60-1 111-91-1						3.1E+03 2.3E+02		9.9E+02		3.1E+03 1.9E+02	
1.1E+00 2.2E+02	I I	3.3E-04 6.2E-02	I I			V V		1 1		1	0.1	5.1E+03 4.2E+03	1.4E+09 1.4E+09	4.3E+04 1.9E+03	Bis(2-chloroethyl)ether Bis(chloromethyl)ether Bisphenol A	111-44-4 542-88-1 80-05-7	6.3E-01 3.2E-03		3.6E-01 8.5E-05	2.3E-01 8.3E-05		3.9E+03 1.6E+04			3.2E+03		
			2.0E-01 2.0E+00 4.0E-02	I P C	2.0E-02 2.0E-02 1.3E-02	H P C		1 1 1				1.4E+09 1.4E+09 1.4E+09			Boron And Borates Only Boron Trichloride Boron Trifluoride	7440-42-8 10294-34-5 7637-07-2					1.6E+04 1.6E+05 3.1E+03		2.8E+07 2.8E+07 1.8E+07	1.6E+04 1.6E+05 3.1E+03			
7.0E-01 2.0E+00	I X	4.0E-03 6.0E-04	I X			V V		1 1		1		1.4E+09 2.4E+03 6.8E+02	1.4E+09 1.4E+09 1.4E+09	5.9E+03 8.4E+03	Bromate Bromo-2-chloroethane, 1- Bromobenzene	15541-45-4 107-04-0 108-86-1	9.9E-01 3.5E-01			9.9E-01 2.6E-02		3.1E+02 6.3E+02		1.6E+04 5.2E+02	3.1E+02 2.9E+02		
			4.0E-02 6.2E-02 7.9E-03	X I I	2.0E-02 3.7E-05 1.1E-06	I I C		1 1 1		1		4.0E+03 9.3E+02 9.2E+02	1.4E+09 1.4E+09 1.4E+09	3.6E+03 4.0E+03 9.7E+03	Bromochloromethane Bromodichloromethane Bromoform	74-97-5 75-27-4 75-25-2	1.1E+01 8.8E+01		3.0E-01 2.5E+01	2.9E-01 1.9E+01		1.6E+03 1.6E+03		1.5E+02	1.5E+02 1.6E+03 1.6E+03		
			1.4E-03 5.0E-03 2.0E-02	I H I	5.0E-03 H I	I V I		1 1 1		1	0.1	3.6E+03 1.4E+09 1.4E+09	1.4E+09 1.4E+09 1.4E+09	1.4E+03 1.2E+05 1.4E+09	Bromomethane Bromophos Bromoxynil	74-83-9 2104-96-3 1689-84-5					1.1E+02 3.9E+02 1.6E+03		7.3E+00 3.9E+02 6.6E+03		6.8E+00 3.9E+02 1.3E+03		
3.4E+00	C	3.0E-05	I			V		1		1		1.4E+09 6.7E+02 7.6E+03	4.7E+05 1.4E+09 1.4E+09	8.7E+02 3.0E+04	Bromoxynil Octanoate Butadiene, 1,3- Butanol, N-	1689-99-2 106-99-0 71-36-3	2.0E-01		8.1E-02	5.8E-02		1.6E+03 7.8E+03		1.8E+00	1.6E+03 7.8E+03		
1.9E-03	P		2.0E-01 2.0E+00 5.0E-02	I P I	2.2E-03 3.0E+01 I	V P V		1 1 1		1	0.1	1.4E+09 2.1E+04 1.4E+09	1.4E+09 1.4E+09 1.4E+09	8.6E+04	Butyl Benzyl Phthalate Butyl alcohol, sec- Butylate	85-68-7 78-92-2 2008-41-5	3.7E+02	1.3E+03		2.9E+02		1.6E+04 1.6E+05 3.9E+03	6.6E+04 9.1E+05	1.3E+04 1.3E+05 3.9E+03			
2.0E-04 3.6E-03	C P	5.7E-08 I	3.0E-01 5.0E-02	P P		V V		1 1		1	0.1	1.4E+09 1.4E+09 1.1E+02	1.4E+09 1.4E+09 1.4E+09	8.1E+03	Butylated hydroxyanisole Butylated hydroxytoluene Butylbenzene, n-	25013-16-5 128-37-0 104-51-8	3.5E+03 1.9E+02	1.2E+04 6.9E+02	6.7E+07 1.5E+02		2.3E+04 3.9E+03	9.9E+04		1.9E+04 3.9E+03			
			1.0E-01 1.0E-01 2.0E-02	X X A		V V A		1 1 1		1	0.1	1.5E+02 1.8E+02 1.4E+09	1.4E+09 1.4E+09 1.4E+09	7.4E+03 7.4E+03	Butylbenzene, sec- Butylbenzene, tert- Cacodylic Acid	135-98-8 98-06-6 75-60-5					7.8E+03 7.8E+03 1.6E+03		6.6E+03	7.8E+03 7.8E+03 1.3E+03			
1.8E-03 1.8E-03 5.0E-01	I I C	1.0E-03 5.0E-04 1.5E-01	I I C	1.0E-05 1.0E-05 2.0E-04	A A C			0.025 0.05 0.025		0.001 0.001		1.4E+09			Cadmium (Diet) Cadmium (Water) Calcium Chromate	7440-43-9 7440-43-9 13765-19-0			2.1E+03 2.1E+03		7.8E+01 7.8E+01	8.2E+02 8.2E+02	1.4E+04 1.4E+04	7.1E+01 7.1E+01			
5.0E-01	C	1.5E-01	C	2.0E-02	C	M		0.025				1.4E+09			Caprolactam Captan Captan	105-60-2 2425-06-1 133-06-2	3.1E-01		9.2E+00	3.0E-01	1.6E+03 3.9E+03		2.8E+05	1.6E+03 3.9E+03			
1.5E-01 2.3E-03	C C	4.3E-05 6.6E-07	C C	2.0E-03 1.3E-01	I I	I I		1 1		1	0.1	1.4E+09 1.4E+09			Carbaryl Carbofuran Carbon Disulfide	63-25-2 1563-66-2 75-15-0	4.6E+00 3.0E+02	1.6E+01 1.1E+03	8.9E+04 5.8E+06	3.6E+00 2.4E+02	1.6E+02 1.0E+04	6.6E+02 4.3E+04		1.3E+02 8.2E+03			
			1.0E-01 5.0E-03 1.0E-01	I I I		V I I		1 1 1		1	0.1	1.4E+09 1.4E+09 7.4E+02	1.4E+09 1.4E+09 1.2E+03		Carbon Tetrachloride Carbonyl Sulfide Carbosulfan	56-23-5 463-58-1 55285-14-8	9.9E+00		7.0E-01	6.5E-01		3.1E+02 7.8E+03		1.6E+02 6.7E+01	1.0E+02 6.3E+02		
			1.0E-01 1.0E-01	I I		V V		1 1		1	0.1	1.4E+09 1.4E+09			Carboxin Ceric oxide Chloral Hydrate	5234-68-4 1306-38-3 302-17-0					7.8E+03 7.8E+03		3.3E+04	6.3E+03 7.8E+03			
4.0E-01 3.5E-01	H I	1.0E-04 I	5.0E-04 I			V V		1 1		1	0.1	1.4E+09 1.4E+09			Chloramben Chloranil Chlordane	133-90-4 118-75-2 12789-03-6	1.7E+00 2.0E+00	6.1E+00 1.8E+01		1.3E+00 1.7E+00		3.9E+01 4.1E+02	6.6E+02	3.4E+01			
1.0E+01	I	4.6E-03	C	3.0E-04 7.0E-04 2.0E-02	I A I			1 1 1		1	0.1	1.4E+09 1.4E+09 1.4E+09			Chlordecone (Kepone) Chlorfenvinphos Chlorimuron, Ethyl-	143-50-0 470-90-6 90982-32-4	7.0E-02	2.5E-01	8.3E+02	5.4E-02	2.3E+01 5.5E+01 1.6E+03	9.9E+01 2.3E+02 6.6E+03		1.9E+01 4.4E+01 1.3E+03			
			1.0E-01 3.0E-02 3.0E-02	I I I	1.5E-04 2.0E-04 I	A I I		1 1 1		1		2.8E+03 1.4E+09 1.4E+09	1.4E+09 1.4E+09 1.4E+09	1.2E+03	Chlorine Chlorine Dioxide Chlorite (Sodium Salt)	7782-50-5 10049-04-4 7758-19-2					7.8E+03 2.3E+03 2.3E+03		1.8E-01 2.8E+05	1.8E-01 2.3E+03 2.3E+03			
4.6E-01	H	3.0E-04	I	2.0E-02	H	I		1		1	0.1	1.2E+03 7.9E+02	1.4E+09 1.4E+09	1.0E+03 1.1E+03	Chloro-1,1-difluoroethane, 1- Chloro-1,3-butadiene, 2- Chloro-2-methylaniline HCl, 4-	75-68-3 126-99-8 3165-93-3	1.5E+00	5.4E+00	1.0E-02	1.0E-02		1.6E+03		5.4E+04 2.2E+01	5.4E+04 2.2E+01		
1.0E-01 2.7E-01	P X	7.7E-05 I	C I	3.0E-03 I	X I			1 1		1	0.1	1.4E+09 1.2E+04	1.4E+09 1.4E+09	1.6E+04	Chloro-2-methylaniline, 4- Chloroacetaldehyde, 2- Chloroacetic Acid	95-69-2 107-20-0 79-11-8	7.0E+00 2.6E+00	2.5E+01	5.0E+04 5.4E+00		2.3E+02 9.9E+02			1.9E+02			
2.0E-01	P		3.0E-05	I		I		1		1	0.1	1.4E+09			Chloroacetophenone, 2- Chloroaniline, p- Chlorobenzene	532-27-4 106-47-8 108-90-7	3.5E+00	1.2E+01		2.7E+00	3.1E+02 1.6E+03	1.3E+03		4.3E+04 3.4E+02	4.3E+04 2.5E+02 2.8E+02		
1.1E-01	C	3.1E-05	C	2.0E-02 3.0E-02	I X			1 1		1	0.1	1.4E+09			Chlorobenzilate Chlorobenzoic Acid, p-	510-15-6 74-11-3	6.3E+00	2.2E+01	1.2E+05	4.9E+00	1.6E+03 2.3E+03	6.6E+03 9.9E+03		1.3E+03 1.9E+03			

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e (mg/m ³) ⁻¹	muta- gen	GI/ABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	
			3.0E-03	P	3.0E-01	P	V		1		2.9E+02	1.4E+09	6.8E+03	Chlorobenzotrifluoride, 4-	98-56-6					2.3E+02		2.1E+03	2.1E+02	
			4.0E-02	P		V			1		7.3E+02	1.4E+09	1.8E+03	Chlorobutane, 1-	109-69-3					3.1E+03			3.1E+03	
					5.0E+01	I	V		1		1.7E+03	1.4E+09	9.4E+02	Chlorodifluoromethane	75-45-6							4.9E+04	4.9E+04	
			2.0E-02	P		V			1		1.1E+05	1.4E+09	7.8E+04	Chloroethanol, 2-	107-07-3					1.6E+03			1.6E+03	
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1	2.5E+03	1.4E+09	2.6E+03	Chloroform	67-66-3	2.2E+01		3.2E-01	3.2E-01	7.8E+02		2.7E+02	2.0E+02	
					9.0E-02	I	V		1		1.3E+03	1.4E+09	1.2E+03	Chloromethane	74-87-3							1.1E+02	1.1E+02	
2.4E+00	C	6.9E-04	C					V		1	9.3E+03	1.4E+09	5.3E+03	Chloromethyl Methyl Ether	107-30-2	2.9E-01		2.2E-02	2.0E-02					
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1	1.4E+09		Chloronitrobenzene, o-	88-73-3	2.3E+00	8.2E+00		1.8E+00	2.3E+02	9.9E+02	1.4E+04	1.9E+02	
6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1	1.4E+09		Chloronitrobenzene, p-	100-00-5	1.1E+02	3.9E+02		8.6E+01	7.8E+01	3.3E+02	8.5E+05	6.3E+01	
				5.0E-03	I		V			1	2.2E+04	1.4E+09	1.2E+05	Chlorophenol, 2-	95-57-8					3.9E+02			3.9E+02	
				4.0E-04	C	V				1	6.2E+02	1.4E+09	4.7E+03	Chloropicrin	76-06-2							2.0E+00	2.0E+00	
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1	1.4E+09		Chlorothalonil	1897-45-6	2.2E+02	8.0E+02	4.3E+06	1.8E+02	1.2E+03	4.9E+03		9.5E+02	
				2.0E-02	I	V				1	9.1E+02	1.4E+09	8.1E+03	Chlorotoluene, o-	95-49-8					1.6E+03			1.6E+03	
2.4E+02	C	6.9E-02	C	2.0E-02	X		V			1	2.5E+02	1.4E+09	7.3E+03	Chlorotoluene, p-	106-43-4	2.9E-03	1.0E-02	5.5E+01	2.3E-03	1.6E+03			1.6E+03	
				2.0E-01	I					1	0.1	1.4E+09		Chlorozotocin	54749-90-5					1.6E+04	6.6E+04		1.3E+04	
										1	0.1	1.4E+09		Chlorpropham	101-21-3									
				1.0E-03	A					1	0.1	1.4E+09		Chlorpyrifos	2921-88-2					7.8E+01	3.3E+02		6.3E+01	
				1.0E-02	H					1	0.1	1.4E+09		Chlorpyrifos Methyl	5598-13-0					7.8E+02	3.3E+03		6.3E+02	
				5.0E-02	I					1	0.1	1.4E+09		Chlorsulfuron	64902-72-3					3.9E+03	1.6E+04		3.2E+03	
				1.0E-02	I					1	0.1	1.4E+09		Chlorthal-dimethyl	1861-32-1					7.8E+02	3.3E+03		6.3E+02	
				8.0E-04	H					1	0.1	1.4E+09		Chlorthiophos	60238-56-4					6.3E+01	2.6E+02		5.1E+01	
				1.5E+00	I				0.013			1.4E+09		Chromium(III), Insoluble Salts	16065-83-1					1.2E+05			1.2E+05	
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I	M	0.025		1.4E+09			Chromium(VI)	18540-29-9	3.1E-01		1.6E+01	3.0E-01	2.3E+02		1.4E+05	2.3E+02	
									0.013		1.4E+09			Chromium, Total	7440-47-3									
				1.3E-02	I				1	0.1	1.4E+09			Clofentazine	74115-24-5					1.0E+03	4.3E+03		8.2E+02	
				9.0E-03	P	3.0E-04	P	6.0E-06	P		1	1.4E+09		Cobalt	7440-48-4			4.2E+02	4.2E+02	2.3E+01		8.5E+03	2.3E+01	
				6.2E-04	I			V	M	1	1.4E+09			Coke/Oven Emissions, Copper	8007-45-2									
				4.0E-02	H				1	1.4E+09				Copper	7440-50-8					3.1E+03			3.1E+03	
				5.0E-02	I	6.0E-01	C			1	0.1	1.4E+09		Cresol, m-	108-39-4					3.9E+03	1.6E+04	8.5E+08	3.2E+03	
				5.0E-02	I	6.0E-01	C			1	0.1	1.4E+09		Cresol, o-	95-48-7					3.9E+03	1.6E+04	8.5E+08	3.2E+03	
				1.0E-01	A	6.0E-01	C			1	0.1	1.4E+09		Cresol, p-	106-44-5					7.8E+03	3.3E+04	8.5E+08	6.3E+03	
				1.0E-01	A					1	0.1	1.4E+09		Cresol, p-chloro-m-	59-50-7					7.8E+03	3.3E+04		6.3E+03	
1.9E+00	H			1.0E-01	A	6.0E-01	C			1	0.1	1.4E+09		Cresols	1319-77-3					7.8E+03	3.3E+04	8.5E+08	6.3E+03	
				1.0E-03	P		V			1	1.7E+04	1.4E+09	1.9E+04	Crotonaldehyde, trans-	123-73-9	3.7E-01			3.7E-01	7.8E+01			7.8E+01	
2.2E-01	C	6.3E-05	C	1.0E-01	I	4.0E-01	I	V		1	2.7E+02	1.4E+09	6.2E+03	Cumene	98-82-8	3.2E+00	1.1E+01	6.1E+04	2.5E+00	7.8E+03		2.6E+03	1.9E+03	
8.4E-01	H			2.0E-03	H					1	0.1	1.4E+09		Cupferron	135-20-6	8.3E-01	2.9E+00		6.5E-01	1.6E+02	6.6E+02		1.3E+02	
														Cyanazine	21725-46-2									
				1.0E-03	I					1	1.4E+09			Cyanides										
				5.0E-03	I					1	1.4E+09			~Calcium Cyanide	592-01-8					7.8E+01			7.8E+01	
										1	1.4E+09			~Copper Cyanide	544-92-3					3.9E+02			3.9E+02	
				6.0E-04	I	8.0E-04	S	V		1	9.7E+05	1.4E+09	3.5E+03	~Cyanide (CN-)	57-12-5					4.7E+01		2.9E+00	2.7E+00	
				1.0E-03	I		V			1	1.4E+09			~Cyanogen	460-19-5					7.8E+01			7.8E+01	
				9.0E-02	I		V			1	1.4E+09			~Cyanogen Bromide	506-68-3					7.0E+03			7.0E+03	
				5.0E-02	I		V			1	1.4E+09			~Cyanogen Chloride	506-77-4					3.9E+03			3.9E+03	
				6.0E-04	I	8.0E-04	I	V		1	1.0E+07	1.4E+09	5.2E+04	~Hydrogen Cyanide	74-90-8					4.7E+01		4.4E+01	2.3E+01	
				2.0E-03	I					1	1.4E+09			~Potassium Cyanide	151-50-8					1.6E+02			1.6E+02	
				5.0E-03	I				0.04		1.4E+09			~Potassium Silver Cyanide	506-61-6					3.9E+02			3.9E+02	
				1.0E-01	I				0.04		1.4E+09			~Silver Cyanide	506-64-9					7.8E+03			7.8E+03	
				1.0E-03	I				1		1.4E+09			~Sodium Cyanide	143-33-9					7.8E+01			7.8E+01	
				2.0E-04	P					1	1.4E+09			~Thiocyanates	NA					1.6E+01			1.6E+01	
				2.0E-04	X		V			1	1.4E+09			~Thiocyanic Acid	463-56-9					1.6E+01			1.6E+01	
				5.0E-02	I					1	1.4E+09			~Zinc Cyanide	557-21-1					3.9E+03			3.9E+03	
2.3E-02	H			6.0E+00	I	V				1	1.2E+02	1.4E+09	1.0E+03	Cyclohexane	110-82-7	3.0E+01	1.1E+02		2.4E+01			6.5E+03	6.5E+03	
										1	0.1	1.4E+09		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3					3.9E+05		3.0E+04	2.8E+04	
				5.0E+00	I	7.0E-01	P	V		1	5.1E+03	1.4E+09	4.2E+04	Cyclohexanone	108-94-1									
										1	2.8E+02	1.4E+09	1.5E+03	Cyclohexene	110-83-8					3.9E+02		1.5E+03	3.1E+02	
				2.0E-01</																				

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																										
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³ -d) ⁻¹	IUR (ug/m ³ -d) ⁻¹	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³ -d) ⁻¹	RfC _i (mg/m ³ -d) ⁻¹	k _e (mg/m ³ -d) ⁻¹	v _o (m ³ /kg)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)		
			3.0E-02	I						1	0.1		1.4E+09			Dalapon	75-99-0					2.3E+03	9.9E+03		1.9E+03	
1.8E-02	C	5.1E-06	1.5E-01	I						1	0.1		1.4E+09			Daminozide	1596-84-5	3.9E+01	1.4E+02	7.5E+05	3.0E+01	1.2E+04	4.9E+04		9.5E+03	
7.0E-04	I		7.0E-03	I						1	0.1		1.4E+09			Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	9.9E+02	3.5E+03		7.8E+02	5.5E+02	2.3E+03		4.4E+02	
			4.0E-05	I						1	0.1		1.4E+09			Demeton	8065-48-3					3.1E+00	1.3E+01		2.5E+00	
1.2E-03	I		6.0E-01	I						1	0.1		1.4E+09			Di(2-ethylhexyl)adipate	103-23-1	5.8E+02	2.1E+03		4.5E+02	4.7E+04	2.0E+05		3.8E+04	
6.1E-02	H									1	0.1		1.4E+09			Diallate	2303-16-4	1.1E+01	4.1E+01		8.9E+00					
			7.0E-04	A						1	0.1		1.4E+09			Diazinon	333-41-5					5.5E+01	2.3E+02		4.4E+01	
1.0E-02	X		1.0E-02	X						1			1.4E+09	5.2E+05		Dibenzothiophene	132-65-0					7.8E+02			7.8E+02	
8.0E-01	P	6.0E-03	2.0E-04	P	2.0E-04	I	V	M		1		9.8E+02	1.4E+09	3.2E+04	Dibromo-3-chloropropane, 1,2-	96-12-8	1.9E-01		5.4E-03	5.3E-03	1.6E+01		6.7E+00		4.7E+00	
			4.0E-04	X						1		1.6E+02	1.4E+09	1.9E+04	Dibromobenzene, 1,3-	108-36-1					3.1E+01				3.1E+01	
1.0E-02	I		1.0E-02	I						1		1.4E+09	2.2E+04		Dibromobenzene, 1,4-	106-37-6					7.8E+02				7.8E+02	
8.4E-02	I		2.0E-02	I						1		8.0E+02	1.4E+09	8.0E+03	Dibromochloromethane	124-48-1	8.3E+00			8.3E+00	1.6E+03				1.6E+03	
2.0E+00	I	6.0E-04	9.0E-03	I	9.0E-03	I	V			1		1.3E+03	1.4E+09	8.6E+03	Dibromoethane, 1,2-	106-93-4	3.5E-01		4.0E-02	3.6E-02	7.0E+02		8.1E+01		7.3E+01	
			4.0E-03	X	V					1		2.8E+03	1.4E+09	5.6E+03	Dibromomethane (Methylene Bromide)	74-95-3							2.4E+01		2.4E+01	
			3.0E-04	P						1	0.1		1.4E+09			Dibutyltin Compounds	NA					2.3E+01	9.9E+01		1.9E+01	
			3.0E-02	I						1	0.1		1.4E+09			Dicamba	1918-00-9					2.3E+03	9.9E+03		1.9E+03	
		4.2E-03	4.2E-03	P						1		5.5E+02	1.4E+09	3.2E+03	Dichloro-2-butene, 1,4-	764-41-0			2.1E-03	2.1E-03						
		4.2E-03	P							1		5.2E+02	1.4E+09	1.1E+04	Dichloro-2-butene, cis-1,4-	1476-11-5				7.4E-03	7.4E-03					
5.0E-02	I		4.0E-03	I	2.0E-01	H	V			1	0.1	7.6E+02	1.4E+09	1.1E+04	Dichloro-2-butene, trans-1,4-	110-57-6	1.4E+01	4.9E+01		7.4E-03	7.4E-03	3.1E+02	1.3E+03	2.4E+03	2.5E+02	
			9.0E-02	I						1		3.8E+02	1.4E+09	1.2E+04	Dichloroacetic Acid	79-43-6					7.0E+03				1.8E+03	
5.4E-03	C	1.1E-05	7.0E-02	A	8.0E-01	I	V			1		1.4E+09	1.0E+04		Dichlorobenzene, 1,4-	106-46-7	1.3E+02		2.7E+00	2.6E+00	5.5E+03		8.7E+03		3.4E+03	
4.5E-01	I	3.4E-04	9.0E-03	X						1	0.1	1.4E+09	1.4E+09		Dichlorobenzidine, 3,3'-	91-94-1	1.5E+00	5.5E+00	1.1E+04	1.2E+00	7.0E+02	3.0E+03			5.7E+02	
			2.0E-01	I	1.0E-01	X	V			1		8.5E+02	1.4E+09	8.4E+02	Dichlorodifluoromethane	75-71-8					1.6E+04		8.8E+01		8.7E+01	
5.7E-03	C	1.6E-06	2.0E-01	P						1		1.7E+03	1.4E+09	2.1E+03	Dichloroethane, 1,1-	75-34-3	1.2E+02		3.7E+00	3.6E+00	1.6E+04				1.6E+04	
9.1E-02	I	2.6E-05	6.0E-03	X	7.0E-03	P	V			1		3.0E+03	1.4E+09	4.6E+03	Dichloroethane, 1,2-	107-06-2	7.6E+00		4.9E-01	4.6E-01	4.7E+02	3.3E+01			3.1E+01	
			5.0E-02	I	2.0E-01	I	V			1		1.2E+03	1.4E+09	1.2E+03	Dichloroethylene, 1,1'	75-35-4					3.9E+03		2.4E+02		2.3E+02	
			2.0E-03	I						1		2.4E+03	1.4E+09	2.5E+03	Dichloroethylene, 1,2 cis-	156-59-2					1.6E+02				1.6E+02	
			2.0E-02	I	V					1		1.9E+03	1.4E+09	1.8E+03	Dichloroethylene, 1,2 trans-	156-60-5					1.6E+03				1.6E+03	
			3.0E-03	I						1	0.1	1.4E+09			Dichlorophenol, 2,4-	120-83-2					2.3E+02	9.9E+02			1.9E+02	
			1.0E-02	I						1	0.05	1.4E+09			Dichlorophenoxy Acetic Acid, 2,4-	94-75-7					7.8E+02	6.6E+03			7.0E+02	
			8.0E-03	I						1	0.1	1.4E+09			Dichlorophenoxybutyric Acid, 4-(2,4-	94-82-6					6.3E+02	2.6E+03			5.1E+02	
3.6E-02	C	1.0E-05	9.0E-02	A	4.0E-03	I	V			1		1.4E+03	1.4E+09	3.8E+03	Dichloropropane, 1,2-	78-87-5	1.9E+01		1.1E+00	1.0E+00	7.0E+03		1.6E+01		1.6E+01	
			2.0E-02	P						1		1.5E+03	1.4E+09	6.8E+03	Dichloropropane, 1,3-	142-28-9					1.6E+03				1.6E+03	
			3.0E-03	I						1	0.1	1.4E+09			Dichloropropanol, 2,3-	616-23-9					2.3E+02	9.9E+02			1.9E+02	
1.0E-01	I	4.0E-06	3.0E-02	I	2.0E-02	I	V			1		1.6E+03	1.4E+09	3.6E+03	Dichloropropene, 1,3-	542-75-6	7.0E+00	2.5E+00	1.8E+00	2.3E+03		7.4E+01			7.2E+01	
2.9E-01	I	8.3E-05	5.0E-04	I	5.0E-04	I				1	0.1	1.4E+09			Dichloros	62-73-7	2.4E+00	8.5E+00	4.6E+04	1.9E+00	3.9E+01	1.6E+02	7.1E+05		3.2E+01	
			1.0E-04	I						1	0.1	1.4E+09			Dicrotophos	141-66-2					7.8E+00	3.3E+01			6.3E+00	
1.6E+01	I	4.6E-03	8.0E-02	P	3.0E-04	X	V			1		2.6E+02	1.4E+09	4.1E+03	Dicyclopentadiene	77-73-6	4.3E-02	1.5E-01	8.3E+02	3.4E-02	6.3E+03		1.3E+00		1.3E+00	
			5.0E-05	I						1	0.1	1.4E+09			Dieldrin	60-57-1					3.9E+00	1.6E+01			3.2E+00	
			5.0E-03	I						1	0.1				Diesel Engine Exhaust	NA										
			2.0E-03	P	2.0E-04	P				1	0.1	1.4E+09			Diethanolamine	111-42-2					1.6E+02	6.6E+02	2.8E+05			1.3E+02
			3.0E-02	P	1.0E-04	P				1	0.1	1.4E+09			Diethylene Glycol Monobutyl Ether	112-34-5					2.3E+03	9.9E+03	1.4E+05			1.9E+03
			6.0E-02	P	3.0E-04	P				1	0.1	1.4E+09			Diethylene Glycol Monoethyl Ether	211 90 0					4.7E+03	2.0E+04	4.3E+05			3.8E+03
3.5E+02	C	1.0E-01	1.0E-03	P						1		1.1E+05	1.4E+09	1.4E+05	Diethylformamide	617-84-5	2.0E-03	7.1E-03	3.8E+01	1.6E-03	7.8E+01				7.8E+01	
										1	0.1	1.4E+09			Diethylstilbestrol	56-53-1					6.3E+03					
			8.0E-02	I						1	0.1	1.4E+09			Difenzoquat	43222-48-6					6.3E+03	2.6E+04				5.1E+03
			2.0E-02	I						1	0.1	1.4E+09			Diflubenzuron	35367-38-5					1.6E+03	6.6E+03				1.3E+03
4.4E-02	C	1.3E-05	4.0E+01	I	V					1		1.4E+03	1.4E+09	1.2E+03	Difluoroethane, 1,1-	75-37-6	1.6E+01		2.7E+01	9.9E+00			4.8E+04		4.8E+04	
				P						1		1.4E+09	1.2E+05		Dihydrosafrole	94-58-6										
			7.0E-01	P						1		2.3E+03	1.4E+09	3.1E+03	Diisopropyl Ether	108-20-3							2.2E+03		2.2E+03	
			8.0E-02	I						1		5.3E+02	1.4E+09	3.8E+04	Diisopropyl Methylphosphonate	1445-75-6					6.3E+03				6.3E+03	
			2.0E-02	I						1	0.1	1.4E+09			Dimethipin	55290-64-7					1.6E+03	6.6E+03				1.3E+03
			2.0E-04	I						1	0.1	1.4E+09			Dimethoate	60-51-5					1.6E+01	6.6E+01				1.3E+01
1.6E+00	P									1	0.1	1.4E+09			Dimethoxybenzidine, 3,3'-	119-90-4	4.3E-01	1.5E+00		3.4E-01						
1.7E-03	P		6.0E-02	P						1	0.1	1.4E+09			Dimethyl methylphosphonate	756-79-6	4.1E+02	1.5E+03		3.2E+02	4.7E+03	2.0E+04			3.8E+03	
4.6E+00	C	1.3E-03		C						1	0.1	1.4E+09			Dimethylamino azobenzene [p-]	60-11-7	1.5E-01	5.4E-01	2.9E+03	1.2E-01						
5.8E-01	H									1	0.1	1.4E+09			Dimethylaniline HCl, 2,4-	21436-96-4	1.2E+00	4.3E+00		9.4E-01						
2.0E-01	P		2.0E-03	X						1	0.1	1.4E+09			Dimethylaniline, 2,4-	95-68-1	3.5E+00	1.2E+01		2.7E+00	1.6E+02	6.6E+02			1.3E+02	
			2.0E-03	I						1		8.3E+02	1.4E+09	3.1E+04	Dimethylaniline, N,N-	121-69-7					1.6E+02				1.6E+02	
										1	0.1	1.4E+09			Dimethylbenzidine, 3,3'-	119-93-7	6.3E-02	2.2E-01		4.9E-02						
			1.0E-01	P	3.0E-02	I	V			1		1.1E+05	1.4E+09	1.3E+05	Dimethylformamide	68-1										

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																									
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e (y)	IUR (ug/m ³) ⁻¹	k _e (y)	RfD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³) ⁻¹	k _e (y)	mutagen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion Child THQ=1 (mg/kg)	Dermal Child THQ=1 (mg/kg)	Inhalation Child THQ=1 (mg/kg)	Noncarcinogenic Child THI=1 (mg/kg)		
5.5E+02	C	1.6E-01	C	2.0E-02	I			V	1	0.1	1.9E+05	1.4E+09	1.7E+05	Dimethylhydrazine, 1,2-Dimethylphenol, 2,4-Dimethylphenol, 2,6-Dimethylphenol, 3,4-Dimethylvinylchloride	540-73-8 105-67-9	1.3E-03		2.9E-03	8.8E-04	1.6E+03	6.6E+03		1.3E+03		
				6.0E-04	I			V	1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitro-o-cresol, 4,6-Dinitro-o-cyclohexyl Phenol, 4,6-Dinitrobenzene, 1,2-Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	534-52-1 131-89-5 528-29-0 99-65-0 100-25-4 51-28-5					4.7E+01	2.0E+02		3.8E+01		
4.5E-02	C	1.3E-05	C	1.0E-03	I			V	1	0.1	1.3E+03	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	513-37-1	1.5E+01		2.1E-01	2.0E-01	6.3E+00	2.6E+01		5.1E+00		
				8.0E-05	X				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	534-52-1 131-89-5 528-29-0					6.3E+00	2.6E+01		5.1E+00		
				2.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	99-65-0 100-25-4 51-28-5					1.6E+02	6.6E+02		1.3E+02		
				1.0E-04	P				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	528-29-0					7.8E+00	3.3E+01		6.3E+00		
				1.0E-04	P				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	100-25-4 51-28-5					7.8E+00	3.3E+01		6.3E+00		
				2.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	51-28-5					1.6E+02	6.6E+02		1.3E+02		
6.8E-01	I			2.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	NA	1.0E+00	3.6E+00		8.0E-01	1.6E+02	6.5E+02		1.3E+02		
3.1E-01	C	8.9E-05	C	2.0E-03	I				1	0.102	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	121-14-2	2.2E+00	7.8E+00	4.3E+04	1.7E+00	2.3E+01	1.0E+02		1.9E+01		
1.5E+00	P			3.0E-04	X				1	0.099	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	606-20-2	4.6E-01	1.7E+00		3.6E-01	2.3E+01	1.0E+02		1.9E+01		
				2.0E-03	S				1	0.006	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	35572-78-2					1.6E+02	1.1E+04		1.5E+02		
				2.0E-03	S				1	0.009	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	19406-51-0					1.6E+02	7.3E+03		1.5E+02		
4.5E-01	X			9.0E-04	X				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	25321-14-6	1.5E+00	5.5E+00		1.2E+00	7.0E+01	3.0E+02		5.7E+01		
				1.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4/2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 4-Amino-4,6-Dinitrotoluene, Technical grade	88-85-7					7.8E+01	3.3E+02		6.3E+01		
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	V	1		1.2E+05	1.4E+09	4.0E+04	Dinoseb Dioxane, 1,4-Dioxins	123-91-1	7.0E+00		2.2E+01	5.3E+00	2.3E+03		1.2E+03		8.1E+02	
6.2E+03	I	1.3E+00	I	7.0E-10	I	4.0E-08	C	V	1	0.03	1.4E+09	1.4E+09	2.0E+06	Hexachlorodibenzo p dioxin, Mixture TCDD, 2,3,7,8-Diphenamid	NA 1746-01-6 957-51-7	1.1E-04 5.3E-06	1.3E-03 6.3E-05	2.9E+00 1.4E-04	1.0E-04 4.8E-06	5.5E-05 2.3E+03	7.7E-04 9.9E+03	8.2E-02		5.1E-05 1.9E+03	
				8.0E-04	X				1	0.1	1.4E+09	1.4E+09	9.5E+02	Diphenyl Sulfone Diphenylamine Dimethylhydrazine, 1,2-Diquat	127-63-9 122-39-4 122-66-7					6.3E+01	2.6E+02		5.1E+01		
8.0E-01	I	2.2E-04	I	2.5E-02	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Diphenyl Sulfone Diphenylamine Dimethylhydrazine, 1,2-Diquat	122-66-7	8.7E-01	3.1E+00	1.7E+04	6.8E-01	2.0E+03	8.2E+03		1.6E+03		
				2.2E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Diphenyl Sulfone Diphenylamine Dimethylhydrazine, 1,2-Diquat	122-66-7					1.7E+02	7.3E+02		1.4E+02		
7.1E+00	C	1.4E-01	C	2.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Diphenyl Sulfone Diphenylamine Dimethylhydrazine, 1,2-Diquat	1937-37-7 2602-46-2	9.8E-02 9.4E-02	3.5E-01 3.3E-01	2.7E+01 2.7E+01	7.6E-02 7.3E-02						
7.4E+00	C	1.4E-01	C	2.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Diphenyl Sulfone Diphenylamine Dimethylhydrazine, 1,2-Diquat	2602-46-2										
6.7E+00	C	1.4E-01	C	4.0E-05	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Direct Brown 95 Disulfoton Dithiane, 1,4-Diuron	16071-86-6 298-04-4 505-29-3	1.0E-01	3.7E-01	2.7E+01	8.1E-02	3.1E+00 7.8E+02	1.3E+01		2.5E+00 7.8E+02		
				1.0E-02	I			V	1		1.4E+09	1.4E+09	4.5E+04	Disulfoton Dithiane, 1,4-Diuron	298-04-4 505-29-3					3.1E+00 7.8E+02	1.3E+01		2.5E+00 7.8E+02		
				2.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Disulfoton Dithiane, 1,4-Diuron	330-54-1					1.6E+02	6.6E+02		1.3E+02		
				4.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Disulfoton Dithiane, 1,4-Diuron	2439-10-3					3.1E+02	1.3E+03		2.5E+02		
				2.5E-02	I			V	1		1.4E+09	1.2E+05	9.5E+02	Disulfoton Dithiane, 1,4-Diuron	759-94-4					2.0E+03	8.2E+03		2.0E+03		
				6.0E-03	I			V	1		1.4E+09	4.1E+05	9.5E+02	Disulfoton Dithiane, 1,4-Diuron	115-29-7					4.7E+02			4.7E+02		
				2.0E-02	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Disulfoton Dithiane, 1,4-Diuron	145-73-3					1.6E+03	6.6E+03		1.3E+03		
				3.0E-04	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Disulfoton Dithiane, 1,4-Diuron	72-20-8					2.3E+01	9.9E+01		1.9E+01		
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V	1		1.1E+04	1.4E+09	1.9E+04	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	106-89-8 106-88-7 111-77-3	7.0E+01		4.4E+01	2.7E+01	4.7E+02		2.0E+01 1.6E+02		1.9E+01 1.6E+02 2.5E+03	
				4.0E-02	P	2.0E-02	I	V	1	0.1	1.4E+09	1.4E+09	9.5E+02	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	106-89-8 106-88-7 111-77-3					3.1E+03	1.3E+04		2.5E+03		
				5.0E-03	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	16672-87-0					3.9E+02	1.6E+03		3.2E+02		
				5.0E-04	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	563-12-2					3.9E+01	1.6E+02		3.2E+01		
				1.0E-01	P	6.0E-02	P	V	1		2.4E+04	1.4E+09	6.2E+04	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	111-15-9					7.8E+03		3.8E+03		2.6E+03	
				9.0E-02	P	2.0E-01	I	V	1		1.1E+05	1.4E+09	9.8E+04	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	110-80-5					7.0E+03		2.1E+04		5.2E+03	
				9.0E-01	I	7.0E-02	P	V	1		1.1E+04	1.4E+09	8.6E+03	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	141-78-6					7.0E+04		6.3E+02		6.2E+02	
				5.0E-03	P	8.0E-03	P	V	1		2.5E+03	1.4E+09	6.3E+03	Epichlorohydrin Epoxycyclobutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	140-88-5					3.9E+02		5.3E+01		4.7E+01	
				1.0E+01	I	V			1		2.1E+03	1.4E+09	1.3E+03	Ethyl Chloride (Chloroethane) Ethyl Ether	75-00-3 60-29-7					1.6E+04		1.4E+04		1.4E+04	
				2.0E-01	I	V			1		1.0E+04	1.4E+09	3.1E+03	Ethyl Chloride (Chloroethane) Ethyl Ether	75-00-3 60-29-7									1.6E+04	
				3.0E-01	P	V			1		1.1E+03	1.4E+09	5.8E+03	Ethyl Chloride (Chloroethane) Ethyl Ether	97-63-2									1.8E+03	
				1.0E-05	I				1	0.1	1.4E+09	1.4E+09	9.5E+02	Ethyl-p-nitrophenyl Phosphonate Ethylbenzene	2104-64-5 100-41-4					7.8E-01	3.3E+00		6.3E-01		
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V	1		4.8E+02	1.4E+09	5.7E+03	Ethyl-p-nitrophenyl Phosphonate Ethylbenzene	100-41-4 109-78-4	6.3E+01		6.4E+00	5.8E+00	7.8E-01	3.3E+00		5.9E+03		3.4E+03 4.4E+03
				7.0E-02	P				1	0.1	1.4E+09	1.4E+09	9.5E+02	Ethyl-p-nitrophenyl Phosphonate Ethylbenzene	109-78-4					5.5E+03	2.3E+04				4.4E+03
				9.0E-02	P			V	1		1.9E+05	1.4E+09	1.8E+05	Ethylene Diamine Ethylene Glycol Ethylene Glycol Monobutyl Ether	107-15-3 107-21-1 111-76-2					7.0E+03				7.0E+03	
				2.0E+00	I	4.0E-01	C		1	0.1	1.4E+09	1.4E+09	9.5E+02	Ethylene Diamine Ethylene Glycol Ethylene Glycol Monobutyl Ether	107-15-3 107-21-1 111-76-2					1.6E+05	6.6E+05	5.7E+08		1.3E+05 6.3E+03	
				1.0E-01	I	1.6E+00	I		1	0.1	1.4E+09	1.4E+09	9.5E+02	Ethylene Diamine Ethylene Glycol Ethylene Glycol Monobutyl Ether	111-76-2					7.8E+03	3.3E+04	2.3E+09		1.9E+02 6.3E+03	
3.1E-01	C	8.8E-05	C	3.0E-02	C	V			1		1.2E+05	1.4E+09	6.1E+03	Ethylene Oxide Ethylene Thiourea	75-21-8 96-45-7	2.2E+00 1.5E+01		1.9E-01 2.9E+05	1.8E-01 1.2E+01	6.3E+00	2.6E+01		1.9E+02 5.1E+00		
4.5E-02	C	1.3E-05	C	8.0E-05	I				1	0.1</															

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																							
Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹ y	k _e IUR (ug/m ³) ⁻¹ y	RfD _o (mg/kg-day)	k _e IUR (mg/m ³) ⁻¹ y	RfC _i (mg/m ³) ⁻¹ y	k _e IUR (mg/m ³) ⁻¹ y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	
			4.0E-02	C	1.3E-02	C		1			1.4E+09		Fluoride	16984-48-8					3.1E+03			1.8E+07	3.1E+03
			6.0E-02	I	1.3E-02	C		1			1.4E+09		Fluorine (Soluble Fluoride)	7782-41-4					4.7E+03			1.8E+07	4.7E+03
			8.0E-02	I				1	0.1		1.4E+09		Fluridone	59756-60-4					6.3E+03	2.6E+04			5.1E+03
			2.0E-02	I				1	0.1		1.4E+09		Flurprimidol	56425-91-3					1.6E+03	6.6E+03			1.3E+03
			7.0E-04	I				1	0.1		1.4E+09		Flusilazole	85509-19-9					5.5E+01	2.3E+02			4.4E+01
			6.0E-02	I				1	0.1		1.4E+09		Flutolanil	66332-96-5					4.7E+03	2.0E+04			3.8E+03
			1.0E-02	I				1	0.1		1.4E+09		Fluvalinate	69409-94-5					7.8E+02	3.3E+03			6.3E+02
3.5E-03	I		1.0E-01	I				1	0.1		1.4E+09		Folpet	133-07-3	2.0E+02	7.1E+02		1.6E+02	7.8E+03	3.3E+04			6.3E+03
1.9E-01	I							1	0.1		1.4E+09		Fomesafen	72178-02-0	3.7E+00	1.3E+01		2.9E+00					
								1	0.1		1.4E+09		Fonofos	944-22-9					1.6E+02	6.6E+02			1.3E+02
			1.3E-05	I	2.0E-01	I	9.8E-03	A	V	1	4.2E+04	1.4E+09	7.8E+04	Formaldehyde	50-00-0			1.7E+01	1.7E+01	1.6E+04		8.0E+02	7.6E+02
			9.0E-01	P	3.0E-04	X	V	1		1	1.1E+05	1.4E+09	9.3E+04	Formic Acid	64-18-6					7.0E+04		2.9E+01	2.9E+01
			3.0E+00	I				1	0.1		1.4E+09		Fosetyl-AL	39148-24-8					2.3E+05	9.9E+05			1.9E+05
													Furans										
			1.0E-03	X			V	1	0.03		1.4E+09	2.0E+05	~Dibenzofuran	132-64-9					7.8E+01	1.1E+03			7.3E+01
			1.0E-03	I			V	1	0.03	6.2E+03	1.4E+09	2.6E+03	~Furan	110-00-9					7.8E+01	1.1E+03			7.3E+01
			9.0E-01	I	2.0E+00	I	V	1	0.03	1.7E+05	1.4E+09	1.2E+04	~Tetrahydrofuran	109-99-9					7.0E+04	9.9E+05	2.5E+04		1.8E+04
3.8E+00	H							1	0.1		1.4E+09		Furazolidone	67-45-8	1.8E-01	6.5E-01		1.4E-01					
			3.0E-03	I	5.0E-02	H	V	1		1.0E+04	1.4E+09	4.9E+04	Furfural	98-01-1					2.3E+02		2.5E+03		2.1E+02
1.5E+00	C	4.3E-04	C					1	0.1		1.4E+09		Furium	531-82-8	4.6E-01	1.6E+00	8.9E+03	3.6E-01					
3.0E-02	I	8.6E-06	C					1	0.1		1.4E+09		Furmecycloz	60568-05-0	2.3E+01	8.2E+01	4.4E+05	1.8E+01					
			4.0E-04	I				1	0.1		1.4E+09		Glufosinate, Ammonium	77182-82-2					3.1E+01	1.3E+02			2.5E+01
								1	0.1		1.4E+09		Glutaraldehyde	111-30-8							1.1E+05		1.1E+05
			4.0E-04	I	1.0E-03	H	V	1		1.1E+05	1.4E+09	8.4E+04	Glycidyl	765-34-4					3.1E+01		8.8E+01		2.3E+01
			1.0E-01	I				1	0.1		1.4E+09		Glyphosate	1071-83-6					7.8E+03	3.3E+04			6.3E+03
			1.0E-02	X			V	1			1.4E+09	1.5E+05	Guanidine	113-00-8					7.8E+02				7.8E+02
			2.0E-02	P				1	0.1		1.4E+09		Guanidine Chloride	50-01-1					1.6E+03	6.6E+03			1.3E+03
			5.0E-05	I				1	0.1		1.4E+09		Haloxyp, Methyl	69806-40-2					3.9E+00	1.6E+01			3.2E+00
4.5E+00	I	1.3E-03	I	5.0E-04	I		V	1			1.4E+09	4.8E+05	Heptachlor	76-44-8	1.5E-01		1.0E+00	1.3E-01	3.9E+01				3.9E+01
9.1E+00	I	2.6E-03	I	1.3E-05	I		V	1			1.4E+09	8.4E+05	Heptachlor Epoxide	1024-57-3	7.6E-02		9.1E-01	7.0E-02	1.0E+00				1.0E+00
			2.0E-03	I			V	1			1.4E+09	3.8E+05	Hexabromobenzene	87-82-1					1.6E+02				1.6E+02
			2.0E-04	I				1	0.1		1.4E+09		Hexabromodiphenyl ether, 2,2',4,4',5,5'-(BDE-153)	68631-49-2					1.6E+01	6.6E+01			1.3E+01
1.6E+00	I	4.6E-04	I	8.0E-04	I		V	1			1.4E+09	6.8E+04	Hexachlorobenzene	118-74-1	4.3E-01		4.1E-01	2.1E-01	6.3E+01				6.3E+01
7.8E-02	I	2.2E-05	I	1.0E-03	P		V	1		1.7E+01	1.4E+09	1.1E+04	Hexachlorobutadiene	87-68-3	8.9E+00		1.4E+00	1.2E+00	7.8E+01				7.8E+01
6.3E+00	I	1.8E-03	I	8.0E-03	A			1	0.1		1.4E+09		Hexachlorocyclohexane, Alpha-	319-84-6	1.1E-01	3.9E-01	2.1E+03	8.6E-02	6.3E+02	2.6E+03			5.1E+02
1.8E+00	I	5.3E-04	I					1	0.1		1.4E+09		Hexachlorocyclohexane, Beta-	319-85-7	3.9E-01	1.4E+00	7.2E+03	3.0E-01					
1.1E+00	C	3.1E-04	C	3.0E-04	I			1	0.04		1.4E+09		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	6.3E-01	5.6E+00	1.2E+04	5.7E-01	2.3E+01	2.5E+02			2.1E+01
1.8E+00	I	5.1E-04	I					1	0.1		1.4E+09		Hexachlorocyclohexane, Technical	608-73-1	3.9E-01	1.4E+00	7.5E+03	3.0E-01					
4.0E-02	I	1.1E-05	C	6.0E-03	I	2.0E-04	I	V	1	1.6E+01	1.4E+09	8.5E+03	Hexachlorocyclopentadiene	77-47-4					4.7E+02		1.8E+00		1.8E+00
			7.0E-04	I	3.0E-02	I	V	1			1.4E+09	8.0E+03	Hexachloroethane	67-72-1	1.7E+01		2.0E+00	1.8E+00	5.5E+01		2.5E+02		4.5E+01
			3.0E-04	I				1	0.1		1.4E+09		Hexachlorophene	70-30-4					2.3E+01	9.9E+01			1.9E+01
1.1E-01	I		3.0E-03	I				1	0.015		1.4E+09		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	6.3E+00	1.5E+02		6.1E+00	2.3E+02	6.6E+03			2.3E+02
					1.0E-05	I	V	1		3.4E+03	1.4E+09	3.0E+05	Hexamethylene Diisocyanate, 1,6-	822-06-0							3.1E+00		3.1E+00
			4.0E-04	P				1	0.1		1.4E+09		Hexamethylphosphoramide	680-31-9					3.1E+01	1.3E+02			2.5E+01
			7.0E-01	I	V			1		1.4E+02	1.4E+09	8.3E+02	Hexane, N-	110-54-3							6.1E+02		6.1E+02
			2.0E+00	P				1	0.1		1.4E+09		Hexanedioic Acid	124-04-9					1.6E+05	6.6E+05			1.3E+05
			5.0E-03	I	3.0E-02	I	V	1		3.3E+03	1.4E+09	1.3E+04	Hexanone, 2-	591-78-6					3.9E+02		4.2E+02		2.0E+02
			3.3E-02	I				1	0.1		1.4E+09		Hexazinone	51235-04-2					2.6E+03	1.1E+04			2.1E+03
			2.5E-02	I				1	0.1		1.4E+09		Hexythiazox	78587-05-0					2.0E+03	8.2E+03			1.6E+03
			3.0E-04	I				1	0.1		1.4E+09		Hydramethylnon	67485-29-4					2.3E+01	9.9E+01			1.9E+01
3.0E+00	I	4.9E-03	I			3.0E-05	P	V	1		1.4E+09		Hydrazine	302-01-2	2.3E-01		7.8E+02	2.3E-01			4.3E+04		4.3E+04
3.0E+00	I	4.9E-03	I					1			1.4E+09		Hydrazine Sulfate	10034-93-2	2.3E-01		7.8E+02	2.3E-01					
					2.0E-02	I	V	1			1.4E+09		Hydrogen Chloride	7647-01-0							2.8E+07		2.8E+07
			4.0E-02	C	1.4E-02	C	V	1			1.4E+09		Hydrogen Fluoride	7664-39-3					3.1E+03		2.0E+07		3.1E+03
			2.0E-03	I	V			1			1.4E+09		Hydrogen Sulfide	7783-06-4							2.8E+06		2.8E+06
6.0E-02	P		4.0E-02	P				1	0.1		1.4E+09		Hydroquinone	123-31-9	1.2E+01	4.1E+01		9.0E+00	3.1E+03	1.3E+04			2.5E+03
			1.3E-02	I				1	0.1		1.4E+09		Imazalil	35554-44-0					1.0E+03	4.3E+03			8.2E+02
			2.5E-01	I				1	0.1		1.4E+09		Imazaquin	81335-37-7					2.0E+04	8.2E+04			1.6E+04
			2.5E-01	I				1	0.1		1.4E+09		Imazethapyr	81335-77-5					2.0E+04	8.2E+04			1.6E+04
			1.0E-02	A				1			1.4E+09		Iodine	7553-56-2					7.8E+02				7.8E+02
			4.0E-02	I				1	0.1		1.4E+09		Iprodione	36734-19-7					3.1E+03	1.3E+04			2.5E+03
			7.0E-01	P				1			1.4E+09		Iron	7439-89-6					5.5E+04				5.5E+04
			3.0E-01	I			V	1		1.0E+04	1.4E+09	2.8E+04	Isobutyl Alcohol	78-83-1					2.3E+04				2.3E+04
9.5E-04	I		2.0E-01	I	2.0E+00	C		1	0.1		1.4E+09		Isophorone	78-59-1	7.3E+02	2.6E+03		5.7E+02	1.6E+04	6.6E+04	2.8E+09		1.3E+04

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Toxicity and Chemical-specific Information													Contaminant			Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e (mg/m ³) ⁻¹	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	
			1.5E-02	I		V			1			1.4E+09	4.2E+05	Isopropalin	33820-53-0					1.2E+03			1.2E+03	
			2.0E+00	P	2.0E-01	P	V		1		1.1E+05	1.4E+09	2.8E+04	Isopropanol	67-63-0					1.6E+05			5.6E+03	
			1.0E-01	I					1	0.1		1.4E+09		Isopropyl Methyl Phosphonic Acid	1832-54-8					7.8E+03	3.3E+04		6.3E+03	
			5.0E-02	I					1	0.1		1.4E+09		Isosaxben	82558-50-7					3.9E+03	1.6E+04		3.2E+03	
					3.0E-01	A	V		1			1.4E+09		JP-7	NA							4.3E+08	4.3E+08	
			2.0E-03	I					1	0.1		1.4E+09		Lactofen	77501-63-4					1.6E+02	6.6E+02		1.3E+02	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M	0.025			1.4E+09		Lead Compounds										
8.5E-03	C	1.2E-05	C						1			1.4E+09		~Lead Chromate	7758-97-6	3.1E-01		9.2E+00	3.0E-01	1.6E+03		2.8E+05	1.6E+03	
														~Lead Phosphate	7446-27-7	8.2E+01		3.2E+05	8.2E+01					
2.8E-01	C	8.0E-05	C						1	0.1		1.4E+09		~Lead acetate	301-04-2	2.5E+00	8.8E+00	4.8E+04	1.9E+00					
									1			1.4E+09		~Lead and Compounds	7439-92-1								4.0E+02	
8.5E-03	C	1.2E-05	C						1	0.1		1.4E+09		~Lead subacetate	1335-32-6	8.2E+01	2.9E+02	3.2E+05	6.4E+01					
			1.0E-07	I		V			1		2.4E+00	1.4E+09	1.9E+03	~Tetraethyl Lead	78-00-2					7.8E-03			7.8E-03	
			5.0E-06	P		V			1		3.8E+02	1.4E+09	2.6E+04	Lewisite	541-25-3					3.9E-01			3.9E-01	
			2.0E-03	I					1	0.1		1.4E+09		Linuron	330-55-2					1.6E+02	6.6E+02		1.3E+02	
			2.0E-03	P					1			1.4E+09		Lithium	7439-93-2					1.6E+02			1.6E+02	
			5.0E-04	I					1	0.1		1.4E+09		MCPA	94-74-6					3.9E+01	1.6E+02		3.2E+01	
			1.0E-02	I					1	0.1		1.4E+09		MCPB	94-81-5					7.8E+02	3.3E+03		6.3E+02	
			1.0E-03	I					1	0.1		1.4E+09		MCPP	93-65-2					7.8E+01	3.3E+02		6.3E+01	
			2.0E-02	I					1	0.1		1.4E+09		Malathion	121-75-5					1.6E+03	6.6E+03		1.3E+03	
			1.0E-01	I	7.0E-04	C			1	0.1		1.4E+09		Maleic Anhydride	108-31-6					7.8E+03	3.3E+04	9.9E+05	6.3E+03	
			5.0E-01	I					1	0.1		1.4E+09		Maleic Hydrazide	123-33-1					3.9E+04	1.6E+05		3.2E+04	
			1.0E-04	P					1	0.1		1.4E+09		Malononitrile	109-77-3					7.8E+00	3.3E+01		6.3E+00	
			3.0E-02	H					1	0.1		1.4E+09		Mancozeb	8018-01-7					2.3E+03	9.9E+03		1.9E+03	
			5.0E-03	I					1	0.1		1.4E+09		Maneb	12427-38-2					3.9E+02	1.6E+03		3.2E+02	
			1.4E-01	I	5.0E-05	I			1					Manganese (Diet)	7439-96-5									
			2.4E-02	S	5.0E-05	I			0.04			1.4E+09		Manganese (Non-diet)	7439-96-5					1.9E+03		7.1E+04	1.8E+03	
			9.0E-05	H					1	0.1		1.4E+09		Mephosfolan	950-10-7					7.0E+00	3.0E+01		5.7E+00	
			3.0E-02	I					1	0.1		1.4E+09		Mepiquat Chloride	24307-26-4					2.3E+03	9.9E+03		1.9E+03	
														Mercury Compounds										
			3.0E-04	I	3.0E-04	S			0.07			1.4E+09		~Mercuric Chloride (and other Mercury salts)	7487-94-7					2.3E+01		4.3E+05	2.3E+01	
					3.0E-04	I	V		1		3.1E+00	1.4E+09	3.5E+04	~Mercury (elemental)	7439-97-6							1.1E+01	1.1E+01	
			1.0E-04	I					1			1.4E+09		~Methyl Mercury	22967-92-6					7.8E+00			7.8E+00	
			8.0E-05	I					1	0.1		1.4E+09		~Phenylmercuric Acetate	62-38-4					6.3E+00	2.6E+01		5.1E+00	
			3.0E-05	I		V			1			1.4E+09	1.9E+06	Merphos	150-50-5					2.3E+00			2.3E+00	
			3.0E-05	I					1	0.1		1.4E+09		Merphos Oxide	78-48-8					2.3E+00	9.9E+00		1.9E+00	
			6.0E-02	I					1	0.1		1.4E+09		Metallaxyl	57837-19-1					4.7E+03	2.0E+04		3.8E+03	
			1.0E-04	I	3.0E-02	P	V		1		4.6E+03	1.4E+09	6.8E+03	Methacrylonitrile	126-98-7					7.8E+00		2.1E+02	7.5E+00	
			5.0E-05	I					1	0.1		1.4E+09		Methamidophos	10265-92-6					3.9E+00	1.6E+01		3.2E+00	
			2.0E+00	I	2.0E+01	I	V		1		1.1E+05	1.4E+09	2.9E+04	Methanol	67-56-1					1.6E+05		6.1E+05	1.2E+05	
			1.0E-03	I					1	0.1		1.4E+09		Methidathion	950-37-8					7.8E+01	3.3E+02		6.3E+01	
			2.5E-02	I					1	0.1		1.4E+09		Methomyl	16752-77-5					2.0E+03	8.2E+03		1.6E+03	
4.9E-02	C	1.4E-05	C						1	0.1		1.4E+09		Methoxy-5-nitroaniline, 2-	99-59-2	1.4E+01	5.0E+01	2.7E+05	1.1E+01					
			5.0E-03	I					1	0.1		1.4E+09		Methoxychlor	72-43-5					3.9E+02	1.6E+03		3.2E+02	
			8.0E-03	P	1.0E-03	P	V		1		1.2E+05	1.4E+09	1.2E+05	Methoxyethanol Acetate, 2-	110-49-6					6.3E+02		1.3E+02	1.1E+02	
			5.0E-03	P	2.0E-02	I	V		1		1.1E+05	1.4E+09	1.0E+05	Methoxyethanol, 2-	109-86-4					3.9E+02		2.1E+03	3.3E+02	
			1.0E+00	X		V			1		2.9E+04	1.4E+09	8.1E+03	Methyl Acetate	79-20-9					7.8E+04			7.8E+04	
					2.0E-02	P	V		1		6.8E+03	1.4E+09	7.0E+03	Methyl Acrylate	96-33-3							1.5E+02	1.5E+02	
			6.0E-01	I	5.0E+00	I	V		1		2.8E+04	1.4E+09	1.2E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3					4.7E+04		6.4E+04	2.7E+04	
1.0E-03	X		1.0E-03	P	2.0E-05	X	V		1		1.8E+05	1.4E+09	5.0E+04	Methyl Hydrazine	60-34-4			1.4E-01	1.4E-01	7.8E+01		1.1E+00	1.0E+00	
					3.0E+00	I	V		1		3.4E+03	1.4E+09	1.1E+04	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1							3.3E+04	3.3E+04	
					1.0E-03	C	V		1		1.0E+04	1.4E+09	4.4E+03	Methyl Isocyanate	624-83-9							4.6E+00	4.6E+00	
			1.4E+00	I	7.0E-01	I	V		1		2.4E+03	1.4E+09	6.3E+03	Methyl Methacrylate	80-62-6					1.1E+05		4.6E+03	4.4E+03	
			2.5E-04	I					1	0.1		1.4E+09		Methyl Parathion	298-00-0					2.0E+01	8.2E+01		1.6E+01	
			6.0E-02	X					1	0.1		1.4E+09		Methyl Phosphonic Acid	993-13-5					4.7E+03	2.0E+04		3.8E+03	
			6.0E-03	H	4.0E-02	H	V		1		3.9E+02	1.4E+09	2.4E+04	Methyl Styrene (Mixed Isomers)	25013-15-4					4.7E+02		1.0E+03	3.2E+02	
9.9E-02	C	2.8E-05	C						1	0.1		1.4E+09		Methyl methanesulfonate	66-27-3	7.0E+00	2.5E+01	1.4E+05	5.5E+00					
1.8E-03	C	2.6E-07	C			3.0E+00	I	V	1		8.9E+03	1.4E+09	4.9E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	3.9E+02		5.3E+01	4.7E+01			1.5E+04	1.5E+	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1				
SFO (mg/kg-day) ¹	k _e (ug/m ³) ¹	IUR (ug/m ³) ¹	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³) ¹	RfC _i (mg/m ³) ¹	k _e (mg/m ³) ¹	mutagen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	
1.0E-01 2.2E+01	X C	6.3E-03 C	3.0E-04 C	X C				M	1 1	0.1 0.1	1.4E+09 1.4E+09			Methylbenzene-1,4-diamine sulfate, 2-Methylcholanthrene, 3-	615-50-9 56-49-5	7.0E+00 7.0E-03	2.5E+01 2.7E-02	2.2E+02 2.2E+02	5.4E+00 5.5E-03	2.3E+01 9.9E+01			1.9E+01	
2.0E-03 1.0E-01 4.6E-02	I P I	1.0E-08 4.3E-04 1.3E-05	6.0E-03 2.0E-03 C	I P C	6.0E-01 C	I P	V M	M M	1 1 1	0.1 0.1 0.1	1.4E+09 1.4E+09 1.4E+09	3.3E+03 2.2E+03		Methylene Chloride Methylene-bis(2-chloroaniline), 4,4'- Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	75-09-2 101-14-4 101-61-1	7.7E+01 1.5E+00 1.5E+01	2.2E+02 6.0E+00 5.4E+01	5.7E+01 3.2E+03 2.9E+05	5.7E+01 1.2E+00 1.2E+01	4.7E+02 1.6E+02	6.6E+02	1.4E+03	3.5E+02 1.3E+02	
1.6E+00	C	4.6E-04	C		2.0E-02 6.0E-04	C I			1 1	0.1 0.1	1.4E+09 1.4E+09	1.4E+09 1.3E+04		Methylenebisbenzenamine, 4,4'- Methylenediphenyl Diisocyanate Methylstyrene, Alpha-	101-77-9 101-68-8 98-83-9	4.3E-01 1.5E+00	8.3E+03	3.4E-01		2.8E+07 8.5E+05	2.8E+07 8.5E+05	2.8E+07 8.5E+05		
					7.0E-02 1.5E-01 2.5E-02 2.5E-01	H I I I			1 1 1 1	0.1 0.1 0.1 0.1	1.4E+09 1.4E+09 1.4E+09 1.4E+09	1.4E+09 1.4E+09 1.4E+09 1.4E+09		Metolachlor Metribuzin Metsulfuron-methyl	51218-45-2 21087-64-9 74223-64-6					5.5E+03				
1.8E+01	C	5.1E-03	C		3.0E+00 2.0E-04 2.0E-03	P I I	V V		1 1 1	0.1 0.1	1.4E+09 1.4E+09 1.4E+09	1.4E+09 8.6E+05		Mineral oils Mirex Molinate	8012-95-1 2385-85-5 2212-67-1	3.9E-02		4.7E-01	3.6E-02	2.3E+05 1.6E+01 1.6E+02	6.6E+02	2.3E+05 1.6E+01 1.3E+02		
					5.0E-03 1.0E-01 2.0E-03	I I P			1 1 1	0.1	1.4E+09 1.4E+09 1.4E+09	1.4E+09		Molybdenum Monochloramine Monomethylaniline	7439-98-7 10599-90-3 100-61-8					3.9E+02 7.8E+03 1.6E+02	6.6E+02	3.9E+02 7.8E+03 1.3E+02		
					2.5E-02 3.0E-04 2.0E-03	I X I			1 1 1	0.1 0.1	1.4E+09 1.4E+09 1.4E+09	1.4E+09 5.7E+04		Myclobutanil N,N'-Diphenyl-1,4-benzenediamine Naled	88671-89-0 74-31-7 300-76-5					2.0E+03 2.3E+01 1.6E+02	8.2E+03 9.9E+01	1.6E+03 1.9E+01 1.6E+02		
1.8E+00	C	0.0E+00	C		3.0E-02 1.0E-01	X I	1.0E-01 P V		1 1	0.1 0.1	1.4E+09 1.4E+09	1.4E+09		Naphtha, High Flash Aromatic (HFAN) Naphthylamine, 2- Napropamide	64742-95-6 91-59-8 15299-99-7	3.9E-01	1.4E+00		3.0E-01	2.3E+03 7.8E+03	1.4E+08 3.3E+04	2.3E+03 6.3E+03		
					2.6E-04 2.6E-04 2.6E-04	C C C	1.1E-02 1.1E-02 1.1E-02	C C C	1 1 1	0.1 0.1	1.4E+09 1.4E+09 1.4E+09	1.4E+09		Nickel Acetate Nickel Carbonate Nickel Carbonyl	373-02-4 3333-67-3 13463-39-3		1.5E+04 1.5E+04 1.5E+04	1.5E+04 1.5E+04 1.5E+04	8.6E+02 8.6E+02 8.6E+02	3.6E+03 3.6E+03 2.0E+04	2.0E+04 2.0E+04 2.0E+04	6.7E+02 6.7E+02 8.2E+02		
					2.6E-04 2.6E-04 2.4E-04	C C I	1.1E-02 1.1E-02 1.1E-02	C C C	0.04 0.04 0.04		1.4E+09 1.4E+09 1.4E+09	1.4E+09		Nickel Hydroxide Nickel Oxide Nickel Refinery Dust	12054-48-7 1313-99-1 NA		1.5E+04 1.5E+04 1.6E+04	1.5E+04 1.5E+04 1.6E+04	8.6E+02 8.6E+02 8.6E+02	2.0E+04 2.8E+04 2.0E+04	8.2E+02 8.4E+02 8.2E+02			
1.7E+00	C	4.8E-04	I		2.6E-04 4.8E-04 2.6E-04	C I C	2.0E-02 1.1E-02 1.1E-02	I C C	0.04 0.04 0.1		1.4E+09 1.4E+09 1.4E+09	1.4E+09		Nickel Soluble Salts Nickel Subulfide Nickelocene	7440-02-0 12035-72-2 1271-28-9	4.1E-01	1.5E+04 8.0E+03 1.5E+04	1.5E+04 4.1E-01 1.5E+04	1.6E+03 8.6E+02 8.6E+02	1.3E+05 2.0E+04 3.6E+03	1.5E+03 8.2E+02 6.7E+02			
					1.6E+00 1.0E-01	I I			1 1		1.4E+09 1.4E+09	1.4E+09		Nitrate Nitrate + Nitrite (as N) Nitrite	14797-55-8 NA 14797-65-0					1.3E+05 7.8E+03		1.3E+05 7.8E+03		
2.0E-02	P				1.0E-02 4.0E-03 2.0E-03	X P I	5.0E-05 6.0E-03 9.0E-03	X P V	1 1 1	0.1 0.1	1.4E+09 1.4E+09 1.4E+09	1.4E+09 7.3E+04		Nitroaniline, 2- Nitroaniline, 4- Nitrobenzene	88-74-4 100-01-6 98-95-3	3.5E+01	1.2E+02	5.1E+00	2.7E+01 5.1E+00	7.8E+02 3.1E+02 1.6E+02	3.3E+03 1.3E+03 8.5E+06	7.1E+04 8.5E+06 6.9E+02	6.3E+02 2.5E+02 1.3E+02	
1.3E+00	C	3.7E-04	C		3.0E+03 7.0E-02	P H			1 1	0.1 0.1	1.4E+09 1.4E+09	1.4E+09		Nitrocellulose Nitrofurantoin Nitrofurazone	9004-70-0 67-20-9 59-87-0	5.3E-01	1.9E+00	1.0E+04	4.2E-01	2.3E+08 5.5E+03	9.9E+08 2.3E+04	1.9E+08 4.4E+03		
1.7E-02	P				1.0E-04 1.0E-01	P I			1 1	0.1 0.1	1.4E+09 1.4E+09	1.4E+09		Nitroglycerin Nitroguanidine Nitromethane	55-63-0 556-88-7 75-52-5	4.1E+01	1.5E+02		3.2E+01	7.8E+00 7.8E+03	3.3E+01 3.3E+04	6.3E+00 6.3E+03		
					8.8E-06 2.7E-03	P H	5.0E-03 2.0E-02	P V	1 1	1.8E+04 4.9E+03	1.4E+09 1.4E+09	1.7E+04 1.3E+04		Nitropropane, 2- Nitroso-N-ethylurea, N- Nitroso-N-methylurea, N-	79-46-9 759-73-9 684-93-5		5.4E+00	5.4E+00	1.4E-02 4.5E-03 1.0E-03	1.4E-02 4.5E-03 1.0E-03	2.7E+02			
2.7E+01 1.2E+02	C C	7.7E-03 3.4E-02	C C					M M	1 1	0.1 0.1	1.4E+09 1.4E+09	1.4E+09		Nitroso-di-N-butylamine, N- Nitroso-di-N-propylamine, N- Nitrosodiethanolamine, N-	924-16-3 621-64-7 1116-54-7	1.3E-01 9.9E-02 2.5E-01	4.3E-01 3.5E-01 8.8E-01	9.9E-02 1.9E+03 4.8E+03	9.9E-02 7.8E-02 1.9E-01					
1.5E+02 7.0E+00 2.8E+00	I I I	1.6E-03 2.0E-03 8.0E-04	I C C				V		1 1 1	0.1 0.1 0.1	1.4E+09 1.4E+09 1.4E+09	2.4E+05		Nitrosodiethylamine, N- Nitrosodimethylamine, N- Nitrosodiphenylamine, N-	55-18-5 62-75-9 86-30-6	1.0E-03 3.0E-03 1.4E+02	4.0E-03 6.0E-03 5.0E+02	3.2E+01 2.0E-03 1.5E+06	8.1E-04 2.0E-03 1.1E+02	6.3E-01	3.4E+00	5.3E-01		
2.2E+01 6.7E+00 9.4E+00	I C C	6.3E-03 1.9E-03 2.7E-03	C C C				V		1 1 1	0.1 0.1	1.4E+09 1.4E+09 1.4E+09	1.2E+05		Nitrosomethylethylamine, N- Nitrosomorpholine [N-] Nitrosopiperidine [N-]	10595-95-6 59-89-2 100-75-4	3.2E-02 1.0E-01 7.4E-02	5.4E-02 3.7E-01 2.6E-01	2.0E-02 8.1E-02 5.8E-02						
2.1E+00	I	6.1E-04	I		1.0E-04 9.0E-04	X P			1 1	0.1 0.1	1.4E+09 1.4E+09	1.4E+09		Nitrosopyrrolidine, N- Nitrotoluene, m- Nitrotoluene, o-	930-55-2 99-08-1 88-72-2	3.3E-01	1.2E+00	6.3E+03	2.6E-01	7.8E+00 7.0E+01	3.3E+01	6.3E+00 7.0E+01		
1.6E-02	P				4.0E-03 3.0E-04 4.0E-02	P X I	2.0E-02 P V		1 1 1	0.1 0.1	1.4E+09 1.4E+09 1.4E+09	1.0E+03		Nitrotoluene, p- Nonane, n- Norflurazon	99-99-0 111-84-2 27314-13-2	4.3E+01	1.5E+02		3.4E+01	3.1E+02 2.3E+01 3.1E+03	1.3E+03 2.2E+01 1.3E+04	2.5E+02 1.1E+01 2.5E+03		
					3.0E-03 5.0E-02	I I			1 1	0.1 0.006	1.4E+09 1.4E+09			Octabromodiphenyl Ether Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	32536-52-0 2691-41-0					2.3E+02 3.9E+03	9.9E+02 2.7E+05	1.9E+02 3.9E+03		

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																										
Toxicity and Chemical-specific Information															Contaminant				Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (ug/m ³) ⁻¹	RfD _o (mg/kg-day)	k _e (mg/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e (mg/m ³) ⁻¹	v _o (mg/m ³) ⁻¹	mutagen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)		
				2.0E-03	H					1	0.1		1.4E+09		Octamethylpyrophosphoramide	152-16-9					1.6E+02	6.6E+02		1.3E+02		
				5.0E-02	I					1	0.1		1.4E+09		Oryzalin	19044-88-3					3.9E+03	1.6E+04		3.2E+03		
				5.0E-03	I					1	0.1		1.4E+09		Oxadiazon	19666-30-9					3.9E+02	1.6E+03		3.2E+02		
				2.5E-02	I					1	0.1		1.4E+09		Oxamyl	23135-22-0					2.0E+03	8.2E+03		1.6E+03		
				3.0E-03	I					1	0.1		1.4E+09		Oxyfluorfen	42874-03-3					2.3E+02	9.9E+02		1.9E+02		
				1.3E-02	I					1	0.1		1.4E+09		Padlobutrazol	76738-62-0					1.0E+03	4.3E+03		8.2E+02		
				4.5E-03	I					1	0.1		1.4E+09		Paraquat Dichloride	1910-42-5					3.5E+02	1.5E+03		2.8E+02		
				6.0E-03	H					1	0.1		1.4E+09		Parathion	56-38-2					4.7E+02	2.0E+03		3.8E+02		
				5.0E-02	H			V		1			1.4E+09	4.5E+04	Pebulate	1114-71-2					3.9E+03			3.9E+03		
				4.0E-02	I					1	0.1		1.4E+09		Pendimethalin	40487-42-1					3.1E+03	1.3E+04		2.5E+03		
				2.0E-03	I			V		1		3.1E-01	1.4E+09	5.1E+05	Pentabromodiphenyl Ether	32534-81-9					1.6E+02			1.6E+02		
				1.0E-04	I					1	0.1		1.4E+09		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9					7.8E+00	3.3E+01		6.3E+00		
				8.0E-04	I			V		1			1.4E+09	8.1E+04	Pentachlorobenzene	608-93-5					6.3E+01			6.3E+01		
9.0E-02	P							V		1		4.6E+02	1.4E+09	9.7E+03	Pentachloroethane	76-01-7	7.7E+00			7.7E+00						
2.6E-01	H			3.0E-03	I			V		1			1.4E+09	4.3E+05	Pentachloronitrobenzene	82-68-8	2.7E+00			2.7E+00	2.3E+02				2.3E+02	
4.0E-01	I	5.1E-06	C	5.0E-03	I					1	0.25		1.4E+09		Pentachlorophenol	87-86-5	1.7E+00	2.5E+00	7.5E+05	1.0E+00	3.9E+02	6.6E+02			2.5E+02	
4.0E-03	X			2.0E-03	P					1	0.1		1.4E+09		Pentaerythritol tetranitrate (PETN)	78-11-5	1.7E+02	6.2E+02		1.4E+02	1.6E+02	6.6E+02			1.3E+02	
						1.0E+00	P	V		1		3.9E+02	1.4E+09	7.8E+02	Pentane, n-Perchlorates	109-66-0							8.1E+02	8.1E+02		
				7.0E-04	I					1			1.4E+09		*Ammonium Perchlorate	7790-98-9					5.5E+01				5.5E+01	
				7.0E-04	I					1			1.4E+09		*Lithium Perchlorate	7791-03-9					5.5E+01				5.5E+01	
				7.0E-04	I					1			1.4E+09		*Perchlorate and Perchlorate Salts	14797-73-0					5.5E+01				5.5E+01	
				7.0E-04	I					1			1.4E+09		*Potassium Perchlorate	7778-74-7					5.5E+01				5.5E+01	
				7.0E-04	I					1			1.4E+09		*Sodium Perchlorate	7601-89-0					5.5E+01				5.5E+01	
				2.0E-02	P			V		1			1.4E+09	1.3E+05	Perfluorobutane Sulfonate	375-73-5					1.6E+03				1.6E+03	
2.2E-03	C	6.3E-07	C	5.0E-02	I					1	0.1		1.4E+09		Permethrin	52645-53-1					3.9E+03	1.6E+04			3.2E+03	
				2.5E-01	I					1	0.1		1.4E+09		Phenacetin	62-44-2	3.2E+02	1.1E+03	6.1E+06	2.5E+02	2.0E+04	8.2E+04			1.6E+04	
															Phenmedipham	13684-63-4										
				3.0E-01	I	2.0E-01	C			1	0.1		1.4E+09		Phenol	108-95-2					2.3E+04	9.9E+04	2.8E+08		1.9E+04	
				5.0E-04	X					1	0.1		1.4E+09		Phenothiazine	92-84-2					3.9E+01	1.6E+02			3.2E+01	
				6.0E-03	I					1	0.1		1.4E+09		Phenylendiamine, m-	108-45-2					4.7E+02	2.0E+03			3.8E+02	
4.7E-02	H									1	0.1		1.4E+09		Phenylendiamine, o-	95-54-5	1.5E+01	5.3E+01		1.2E+01						
1.9E-03	H			1.9E-01	H					1	0.1		1.4E+09		Phenylendiamine, p-	106-50-3					1.5E+04	6.3E+04			1.2E+04	
										1	0.1		1.4E+09		Phenylphenol, 2-	90-43-7	3.6E+02	1.3E+03		2.8E+02						
				2.0E-04	H					1	0.1		1.4E+09		Phorate	298-02-2					1.6E+01	6.6E+01			1.3E+01	
						3.0E-04	I	V		1		1.6E+03	1.4E+09	9.8E+02	Phosgene	75-44-5							3.1E-01	3.1E-01		
				2.0E-02	I					1	0.1		1.4E+09		Phosphet	732-11-6					1.6E+03	6.6E+03			1.3E+03	
															Phosphates, Inorganic											
				4.9E+01	P					1			1.4E+09		*Aluminum metaphosphate	13776-88-0					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Ammonium biphosphate	68333-79-9					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Calcium pyrophosphate	7790-76-3					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Diammonium phosphate	7783-28-0					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Dicalcium phosphate	7757-93-9					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Dimagnesium phosphate	7782-75-4					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Dipotassium phosphate	7758-11-4					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Disodium phosphate	7558-79-4					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Monoaluminum phosphate	13530-50-2					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Monoammonium phosphate	7722-76-1					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Monocalcium phosphate	7758-23-8					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Monomagnesium phosphate	7757-86-0					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Monopotassium phosphate	7778-77-0					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Monosodium phosphate	7558-80-7					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Polyphosphoric acid	8017-16-1					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Potassium tripolyphosphate	13845-36-8					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Sodium acid pyrophosphate	7758-16-9					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Sodium aluminum phosphate (acidic)	7785-88-8					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Sodium aluminum phosphate (anhydrous)	10279-59-1					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Sodium aluminum phosphate (tetrahydrate)	10305-76-7					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Sodium hexametaphosphate	10124-56-8					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Sodium polyphosphate	68915-31-1					3.8E+06				3.8E+06	
				4.9E+01	P					1			1.4E+09		*Sodium trimetaphosphate	7785-84-4					3.8E+06				3.8E+06	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (ug/m ³) ⁻¹	RfD _o (mg/kg-day)	k _e (ug/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e (ug/m ³) ⁻¹	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	
				4.9E+01	P				1			1.4E+09		*Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5						3.8E+06			3.8E+06
				4.9E+01	P				1			1.4E+09		*Tricalcium phosphate	7758-87-4						3.8E+06			3.8E+06
				4.9E+01	P				1			1.4E+09		*Trimagnesium phosphate	7757-87-1						3.8E+06			3.8E+06
				4.9E+01	P				1			1.4E+09		*Tripotassium phosphate	7778-53-2						3.8E+06			3.8E+06
				4.9E+01	P				1			1.4E+09		*Trisodium phosphate	7601-54-9						3.8E+06			3.8E+06
				3.0E-04	A	3.0E-04	I	V	1			1.4E+09		Phosphine	7803-51-2						2.3E+01		4.3E+05	2.3E+01
				4.9E+01	P	1.0E-02	I		1			1.4E+09		Phosphoric Acid	7664-38-2						3.8E+06		1.4E+07	3.0E+06
				2.0E-05	I		V		1			1.4E+09	6.9E+03	Phosphorus, White	7723-14-0						1.6E+00			1.6E+00
														Phthalates										
1.4E-02	I	2.4E-06	C	2.0E-02	I				1	0.1		1.4E+09		*Bis(2-ethylhexyl)phthalate	117-81-7	5.0E+01	1.8E+02	1.6E+06	3.9E+01	1.6E+03	6.6E+03			1.3E+03
				1.0E+00	I				1	0.1		1.4E+09		*Butylphthalyl Butylglycolate	85-70-1					7.8E+04	3.3E+05			6.3E+04
				1.0E-01	I				1	0.1		1.4E+09		*Dibutyl Phthalate	84-74-2					7.8E+03	3.3E+04			6.3E+03
				8.0E-01	I				1	0.1		1.4E+09		*Diethyl Phthalate	84-66-2					6.3E+04	2.6E+05			5.1E+04
				1.0E-01	I		V		1			1.4E+09	2.1E+04	*Dimethylterephthalate	120-61-6					7.8E+03				7.8E+03
				1.0E-02	P				1	0.1		1.4E+09		*Octyl Phthalate, di-N-	117-84-0					7.8E+02	3.3E+03			6.3E+02
				1.0E+00	H				1	0.1		1.4E+09		*Phthalic Acid, P-	100-21-0					7.8E+04	3.3E+05			6.3E+04
				2.0E+00	I	2.0E-02	C		1	0.1		1.4E+09		*Phthalic Anhydride	85-44-9					1.6E+05	6.6E+05	2.8E+07		1.3E+05
				7.0E-02	I				1	0.1		1.4E+09		Picloram	1918-02-1					5.5E+03	2.3E+04			4.4E+03
				1.0E-04	X				1	0.1		1.4E+09		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					7.8E+00	3.3E+01			6.3E+00
				9.0E-04	X				1	0.1		1.4E+09		Picric Acid (2,4,6-Trinitrophenol)	88-89-1					7.0E+01	3.0E+02			5.7E+01
				1.0E-02	I				1	0.1		1.4E+09		Pirimiphos, Methyl	29232-93-7					7.8E+02	3.3E+03			6.3E+02
3.0E+01	C	8.6E-03	C	7.0E-06	H				1	0.1		1.4E+09		Polybrominated Biphenyls	59536-65-1	2.3E-02	8.2E-02	4.4E+02	1.8E-02	5.5E-01	2.3E+00			4.4E-01
														Polychlorinated Biphenyls (PCBs)										
7.0E-02	S	2.0E-05	S	7.0E-05	I		V		1	0.14		1.4E+09	7.1E+05	*Aroclor 1016	12674-11-2	9.9E+00	2.5E+01	1.0E+02	6.7E+00	5.5E+00	1.6E+01			4.1E+00
2.0E+00	S	5.7E-04	S				V		1	0.14		1.4E+09	2.0E+05	*Aroclor 1221	11104-28-2	3.5E-01	8.8E-01	1.0E+00	2.0E-01					
2.0E+00	S	5.7E-04	S				V		1	0.14		1.4E+09	1.1E+05	*Aroclor 1232	11141-16-5	3.5E-01	8.8E-01	5.5E-01	1.7E-01					
2.0E+00	S	5.7E-04	S				V		1	0.14		1.4E+09	5.9E+05	*Aroclor 1242	53469-21-9	3.5E-01	8.8E-01	2.9E+00	2.3E-01					
2.0E+00	S	5.7E-04	S				V		1	0.14		1.4E+09	6.3E+05	*Aroclor 1248	12672-29-6	3.5E-01	8.8E-01	3.1E+00	2.3E-01					
2.0E+00	S	5.7E-04	S	2.0E-05	I		V		1	0.14		1.4E+09	8.4E+05	*Aroclor 1254	11097-69-1	3.5E-01	8.8E-01	4.1E+00	2.4E-01	1.6E+00	4.7E+00			1.2E+00
2.0E+00	S	5.7E-04	S				V		1	0.14		1.4E+09	1.3E+06	*Aroclor 1260	11096-82-5	3.5E-01	8.8E-01	6.5E+00	2.4E-01					
				6.0E-04	X		V		1	0.14		1.4E+09	9.6E+05	*Aroclor 5460	11126-42-4					4.7E+01	1.4E+02			3.5E+01
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	3.3E+06	*Heptachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 189)	39635-31-9	1.8E-01	4.5E-01	8.2E+00	1.3E-01	1.8E+00	5.5E+00	4.6E+03	1.4E+00	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	2.2E+06	*Hexachlorobiphenyl, 2,3,4,4',5,5'-(PCB 167)	52663-72-6	1.8E-01	4.5E-01	5.4E+00	1.2E-01	1.8E+00	5.5E+00	3.1E+03	1.4E+00	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	1.5E+06	*Hexachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 157)	69782-90-7	1.8E-01	4.5E-01	3.6E+00	1.2E-01	1.8E+00	5.5E+00	2.0E+03	1.4E+00	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	1.5E+06	*Hexachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 156)	38380-08-4	1.8E-01	4.5E-01	3.8E+00	1.2E-01	1.8E+00	5.5E+00	2.1E+03	1.4E+00	
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V	1	0.14		1.4E+09	2.2E+06	*Hexachlorobiphenyl, 3,3',4,4',5,5'-(PCB 169)	32774-16-6	1.8E-04	4.5E-04	5.4E-03	1.2E-04	1.8E-03	5.5E-03	3.1E+00	1.4E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	1.0E+06	*Pentachlorobiphenyl, 2',3,4,4',5,5'-(PCB 123)	65510-44-3	1.8E-01	4.5E-01	2.5E+00	1.2E-01	1.8E+00	5.5E+00	1.4E+03	1.4E+00	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	8.3E+05	*Pentachlorobiphenyl, 2,3',4,4',5,5'-(PCB 118)	31508-00-6	1.8E-01	4.5E-01	2.0E+00	1.2E-01	1.8E+00	5.5E+00	1.2E+03	1.4E+00	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	8.5E+05	*Pentachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 105)	32598-14-4	1.8E-01	4.5E-01	2.1E+00	1.2E-01	1.8E+00	5.5E+00	1.2E+03	1.4E+00	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14		1.4E+09	1.5E+06	*Pentachlorobiphenyl, 2,3,4,4',5,5'-(PCB 114)	74472-37-0	1.8E-01	4.5E-01	3.6E+00	1.2E-01	1.8E+00	5.5E+00	2.0E+03	1.4E+00	
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V	1	0.14		1.4E+09	1.0E+06	*Pentachlorobiphenyl, 3,3',4,4',5,5'-(PCB 126)	57465-28-8	5.3E-05	1.4E-04	7.5E-04	3.7E-05	5.5E-04	1.6E-03	4.3E-01	4.1E-04	
2.0E+00	I	5.7E-04	I				V		1	0.14		1.4E+09	5.3E+05	*Polychlorinated Biphenyls (high risk)	1336-36-3	3.5E-01	8.8E-01	2.6E+00	2.3E-01					
4.0E-01	I	1.0E-04	I				V		1	0.14				*Polychlorinated Biphenyls (low risk)	1336-36-3									
7.0E-02	I	2.0E-05	I				V		1	0.14				*Polychlorinated Biphenyls (lowest risk)	1336-36-3									
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E		1	0.14		1.4E+09		*Tetrachlorobiphenyl, 3,3',4,4',5,5'-(PCB 77)	32598-13-3	5.3E-02	1.4E-01	1.0E+03	3.8E-02	5.5E-01	1.6E+00	5.7E+05	4.1E-01	
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V	1	0.14		1.4E+09	7.3E+05	*Tetrachlorobiphenyl, 3,4,4',5,5'-(PCB 81)	70362-50-4	1.8E-02	4.5E-02	1.8E-01	1.2E-02	1.8E-01	5.5E-01	1.0E+02	1.4E-01	
				6.0E-04	I		V		1	0.1		1.4E+09		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9							8.5E+05	8	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																																																																																																																																																																																																																																																																																																																																		
Toxicity and Chemical-specific Information														Contaminant				Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1																																																																																																																																																																																																																																																																																																												
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹ y	k _e RfD ₀ (mg/kg-day)	k _e RfC ₁ (mg/m ³) y	k _e RfC ₂ (mg/m ³) y	k _e RfC ₃ (mg/m ³) y	k _e RfC ₄ (mg/m ³) y	k _e RfC ₅ (mg/m ³) y	k _e RfC ₆ (mg/m ³) y	k _e RfC ₇ (mg/m ³) y	k _e RfC ₈ (mg/m ³) y	k _e RfC ₉ (mg/m ³) y	k _e RfC ₁₀ (mg/m ³) y	k _e RfC ₁₁ (mg/m ³) y	k _e RfC ₁₂ (mg/m ³) y	k _e RfC ₁₃ (mg/m ³) y	k _e RfC ₁₄ (mg/m ³) y	k _e RfC ₁₅ (mg/m ³) y	k _e RfC ₁₆ (mg/m ³) y	k _e RfC ₁₇ (mg/m ³) y	k _e RfC ₁₈ (mg/m ³) y	k _e RfC ₁₉ (mg/m ³) y	k _e RfC ₂₀ (mg/m ³) y	k _e RfC ₂₁ (mg/m ³) y	k _e RfC ₂₂ (mg/m ³) y	k _e RfC ₂₃ (mg/m ³) y	k _e RfC ₂₄ (mg/m ³) y	k _e RfC ₂₅ (mg/m ³) y	k _e RfC ₂₆ (mg/m ³) y	k _e RfC ₂₇ (mg/m ³) y	k _e RfC ₂₈ (mg/m ³) y	k _e RfC ₂₉ (mg/m ³) y	k _e RfC ₃₀ (mg/m ³) y	k _e RfC ₃₁ (mg/m ³) y	k _e RfC ₃₂ (mg/m ³) y	k _e RfC ₃₃ (mg/m ³) y	k _e RfC ₃₄ (mg/m ³) y	k _e RfC ₃₅ (mg/m ³) y	k _e RfC ₃₆ (mg/m ³) y	k _e RfC ₃₇ (mg/m ³) y	k _e RfC ₃₈ (mg/m ³) y	k _e RfC ₃₉ (mg/m ³) y	k _e RfC ₄₀ (mg/m ³) y	k _e RfC ₄₁ (mg/m ³) y	k _e RfC ₄₂ (mg/m ³) y	k _e RfC ₄₃ (mg/m ³) y	k _e RfC ₄₄ (mg/m ³) y	k _e RfC ₄₅ (mg/m ³) y	k _e RfC ₄₆ (mg/m ³) y	k _e RfC ₄₇ (mg/m ³) y	k _e RfC ₄₈ (mg/m ³) y	k _e RfC ₄₉ (mg/m ³) y	k _e RfC ₅₀ (mg/m ³) y	k _e RfC ₅₁ (mg/m ³) y	k _e RfC ₅₂ (mg/m ³) y	k _e RfC ₅₃ (mg/m ³) y	k _e RfC ₅₄ (mg/m ³) y	k _e RfC ₅₅ (mg/m ³) y	k _e RfC ₅₆ (mg/m ³) y	k _e RfC ₅₇ (mg/m ³) y	k _e RfC ₅₈ (mg/m ³) y	k _e RfC ₅₉ (mg/m ³) y	k _e RfC ₆₀ (mg/m ³) y	k _e RfC ₆₁ (mg/m ³) y	k _e RfC ₆₂ (mg/m ³) y	k _e RfC ₆₃ (mg/m ³) y	k _e RfC ₆₄ (mg/m ³) y	k _e RfC ₆₅ (mg/m ³) y	k _e RfC ₆₆ (mg/m ³) y	k _e RfC ₆₇ (mg/m ³) y	k _e RfC ₆₈ (mg/m ³) y	k _e RfC ₆₉ (mg/m ³) y	k _e RfC ₇₀ (mg/m ³) y	k _e RfC ₇₁ (mg/m ³) y	k _e RfC ₇₂ (mg/m ³) y	k _e RfC ₇₃ (mg/m ³) y	k _e RfC ₇₄ (mg/m ³) y	k _e RfC ₇₅ (mg/m ³) y	k _e RfC ₇₆ (mg/m ³) y	k _e RfC ₇₇ (mg/m ³) y	k _e RfC ₇₈ (mg/m ³) y	k _e RfC ₇₉ (mg/m ³) y	k _e RfC ₈₀ (mg/m ³) y	k _e RfC ₈₁ (mg/m ³) y	k _e RfC ₈₂ (mg/m ³) y	k _e RfC ₈₃ (mg/m ³) y	k _e RfC ₈₄ (mg/m ³) y	k _e RfC ₈₅ (mg/m ³) y	k _e RfC ₈₆ (mg/m ³) y	k _e RfC ₈₇ (mg/m ³) y	k _e RfC ₈₈ (mg/m ³) y	k _e RfC ₈₉ (mg/m ³) y	k _e RfC ₉₀ (mg/m ³) y	k _e RfC ₉₁ (mg/m ³) y	k _e RfC ₉₂ (mg/m ³) y	k _e RfC ₉₃ (mg/m ³) y	k _e RfC ₉₄ (mg/m ³) y	k _e RfC ₉₅ (mg/m ³) y	k _e RfC ₉₆ (mg/m ³) y	k _e RfC ₉₇ (mg/m ³) y	k _e RfC ₉₈ (mg/m ³) y	k _e RfC ₉₉ (mg/m ³) y	k _e RfC ₁₀₀ (mg/m ³) y	k _e RfC ₁₀₁ (mg/m ³) y	k _e RfC ₁₀₂ (mg/m ³) y	k _e RfC ₁₀₃ (mg/m ³) y	k _e RfC ₁₀₄ (mg/m ³) y	k _e RfC ₁₀₅ (mg/m ³) y	k _e RfC ₁₀₆ (mg/m ³) y	k _e RfC ₁₀₇ (mg/m ³) y	k _e RfC ₁₀₈ (mg/m ³) y	k _e RfC ₁₀₉ (mg/m ³) y	k _e RfC ₁₁₀ (mg/m ³) y	k _e RfC ₁₁₁ (mg/m ³) y	k _e RfC ₁₁₂ (mg/m ³) y	k _e RfC ₁₁₃ (mg/m ³) y	k _e RfC ₁₁₄ (mg/m ³) y	k _e RfC ₁₁₅ (mg/m ³) y	k _e RfC ₁₁₆ (mg/m ³) y	k _e RfC ₁₁₇ (mg/m ³) y	k _e RfC ₁₁₈ (mg/m ³) y	k _e RfC ₁₁₉ (mg/m ³) y	k _e RfC ₁₂₀ (mg/m ³) y	k _e RfC ₁₂₁ (mg/m ³) y	k _e RfC ₁₂₂ (mg/m ³) y	k _e RfC ₁₂₃ (mg/m ³) y	k _e RfC ₁₂₄ (mg/m ³) y	k _e RfC ₁₂₅ (mg/m ³) y	k _e RfC ₁₂₆ (mg/m ³) y	k _e RfC ₁₂₇ (mg/m ³) y	k _e RfC ₁₂₈ (mg/m ³) y	k _e RfC ₁₂₉ (mg/m ³) y	k _e RfC ₁₃₀ (mg/m ³) y	k _e RfC ₁₃₁ (mg/m ³) y	k _e RfC ₁₃₂ (mg/m ³) y	k _e RfC ₁₃₃ (mg/m ³) y	k _e RfC ₁₃₄ (mg/m ³) y	k _e RfC ₁₃₅ (mg/m ³) y	k _e RfC ₁₃₆ (mg/m ³) y	k _e RfC ₁₃₇ (mg/m ³) y	k _e RfC ₁₃₈ (mg/m ³) y	k _e RfC ₁₃₉ (mg/m ³) y	k _e RfC ₁₄₀ (mg/m ³) y	k _e RfC ₁₄₁ (mg/m ³) y	k _e RfC ₁₄₂ (mg/m ³) y	k _e RfC ₁₄₃ (mg/m ³) y	k _e RfC ₁₄₄ (mg/m ³) y	k _e RfC ₁₄₅ (mg/m ³) y	k _e RfC ₁₄₆ (mg/m ³) y	k _e RfC ₁₄₇ (mg/m ³) y	k _e RfC ₁₄₈ (mg/m ³) y	k _e RfC ₁₄₉ (mg/m ³) y	k _e RfC ₁₅₀ (mg/m ³) y	k _e RfC ₁₅₁ (mg/m ³) y	k _e RfC ₁₅₂ (mg/m ³) y	k _e RfC ₁₅₃ (mg/m ³) y	k _e RfC ₁₅₄ (mg/m ³) y	k _e RfC ₁₅₅ (mg/m ³) y	k _e RfC ₁₅₆ (mg/m ³) y	k _e RfC ₁₅₇ (mg/m ³) y	k _e RfC ₁₅₈ (mg/m ³) y	k _e RfC ₁₅₉ (mg/m ³) y	k _e RfC ₁₆₀ (mg/m ³) y	k _e RfC ₁₆₁ (mg/m ³) y	k _e RfC ₁₆₂ (mg/m ³) y	k _e RfC ₁₆₃ (mg/m ³) y	k _e RfC ₁₆₄ (mg/m ³) y	k _e RfC ₁₆₅ (mg/m ³) y	k _e RfC ₁₆₆ (mg/m ³) y	k _e RfC ₁₆₇ (mg/m ³) y	k _e RfC ₁₆₈ (mg/m ³) y	k _e RfC ₁₆₉ (mg/m ³) y	k _e RfC ₁₇₀ (mg/m ³) y	k _e RfC ₁₇₁ (mg/m ³) y	k _e RfC ₁₇₂ (mg/m ³) y	k _e RfC ₁₇₃ (mg/m ³) y	k _e RfC ₁₇₄ (mg/m ³) y	k _e RfC ₁₇₅ (mg/m ³) y	k _e RfC ₁₇₆ (mg/m ³) y	k _e RfC ₁₇₇ (mg/m ³) y	k _e RfC ₁₇₈ (mg/m ³) y	k _e RfC ₁₇₉ (mg/m ³) y	k _e RfC ₁₈₀ (mg/m ³) y	k _e RfC ₁₈₁ (mg/m ³) y	k _e RfC ₁₈₂ (mg/m ³) y	k _e RfC ₁₈₃ (mg/m ³) y	k _e RfC ₁₈₄ (mg/m ³) y	k _e RfC ₁₈₅ (mg/m ³) y	k _e RfC ₁₈₆ (mg/m ³) y	k _e RfC ₁₈₇ (mg/m ³) y	k _e RfC ₁₈₈ (mg/m ³) y	k _e RfC ₁₈₉ (mg/m ³) y	k _e RfC ₁₉₀ (mg/m ³) y	k _e RfC ₁₉₁ (mg/m ³) y	k _e RfC ₁₉₂ (mg/m ³) y	k _e RfC ₁₉₃ (mg/m ³) y	k _e RfC ₁₉₄ (mg/m ³) y	k _e RfC ₁₉₅ (mg/m ³) y	k _e RfC ₁₉₆ (mg/m ³) y	k _e RfC ₁₉₇ (mg/m ³) y	k _e RfC ₁₉₈ (mg/m ³) y	k _e RfC ₁₉₉ (mg/m ³) y	k _e RfC ₂₀₀ (mg/m ³) y	k _e RfC ₂₀₁ (mg/m ³) y	k _e RfC ₂₀₂ (mg/m ³) y	k _e RfC ₂₀₃ (mg/m ³) y	k _e RfC ₂₀₄ (mg/m ³) y	k _e RfC ₂₀₅ (mg/m ³) y	k _e RfC ₂₀₆ (mg/m ³) y	k _e RfC ₂₀₇ (mg/m ³) y	k _e RfC ₂₀₈ (mg/m ³) y	k _e RfC ₂₀₉ (mg/m ³) y	k _e RfC ₂₁₀ (mg/m ³) y	k _e RfC ₂₁₁ (mg/m ³) y	k _e RfC ₂₁₂ (mg/m ³) y	k _e RfC ₂₁₃ (mg/m ³) y	k _e RfC ₂₁₄ (mg/m ³) y	k _e RfC ₂₁₅ (mg/m ³) y	k _e RfC ₂₁₆ (mg/m ³) y	k _e RfC ₂₁₇ (mg/m ³) y	k _e RfC ₂₁₈ (mg/m ³) y	k _e RfC ₂₁₉ (mg/m ³) y	k _e RfC ₂₂₀ (mg/m ³) y	k _e RfC ₂₂₁ (mg/m ³) y	k _e RfC ₂₂₂ (mg/m ³) y	k _e RfC ₂₂₃ (mg/m ³) y	k _e RfC ₂₂₄ (mg/m ³) y	k _e RfC ₂₂₅ (mg/m ³) y	k _e RfC ₂₂₆ (mg/m ³) y	k _e RfC ₂₂₇ (mg/m ³) y	k _e RfC ₂₂₈ (mg/m ³) y	k _e RfC ₂₂₉ (mg/m ³) y	k _e RfC ₂₃₀ (mg/m ³) y	k _e RfC ₂₃₁ (mg/m ³) y	k _e RfC ₂₃₂ (mg/m ³) y	k _e RfC ₂₃₃ (mg/m ³) y	k _e RfC ₂₃₄ (mg/m ³) y	k _e RfC ₂₃₅ (mg/m ³) y	k _e RfC ₂₃₆ (mg/m ³) y	k _e RfC ₂₃₇ (mg/m ³) y	k _e RfC ₂₃₈ (mg/m ³) y	k _e RfC ₂₃₉ (mg/m ³) y	k _e RfC ₂₄₀ (mg/m ³) y	k _e RfC ₂₄₁ (mg/m ³) y	k _e RfC ₂₄₂ (mg/m ³) y	k _e RfC ₂₄₃ (mg/m ³) y	k _e RfC ₂₄₄ (mg/m ³) y	k _e RfC ₂₄₅ (mg/m ³) y	k _e RfC ₂₄₆ (mg/m ³) y	k _e RfC ₂₄₇ (mg/m ³) y	k _e RfC ₂₄₈ (mg/m ³) y	k _e RfC ₂₄₉ (mg/m ³) y	k _e RfC ₂₅₀ (mg/m ³) y	k _e RfC ₂₅₁ (mg/m ³) y	k _e RfC ₂₅₂ (mg/m ³) y	k _e RfC ₂₅₃ (mg/m ³) y	k _e RfC ₂₅₄ (mg/m ³) y	k _e RfC ₂₅₅ (mg/m ³) y	k _e RfC ₂₅₆ (mg/m ³) y	k _e RfC ₂₅₇ (mg/m ³) y	k _e RfC ₂₅₈ (mg/m ³) y	k _e RfC ₂₅₉ (mg/m ³) y	k _e RfC ₂₆₀ (mg/m ³) y	k _e RfC ₂₆₁ (mg/m ³) y	k _e RfC ₂₆₂ (mg/m ³) y	k _e RfC ₂₆₃ (mg/m ³) y	k _e RfC ₂₆₄ (mg/m ³) y	k _e RfC ₂₆₅ (mg/m ³) y	k _e RfC ₂₆₆ (mg/m ³) y	k _e RfC ₂₆₇ (mg/m ³) y	k _e RfC ₂₆₈ (mg/m ³) y	k _e RfC ₂₆₉ (mg/m ³) y	k _e RfC ₂₇₀ (mg/m ³) y	k _e RfC ₂₇₁ (mg/m ³) y	k _e RfC ₂₇₂ (mg/m ³) y	k _e RfC ₂₇₃ (mg/m ³) y	k _e RfC ₂₇₄ (mg/m ³) y	k _e RfC ₂₇₅ (mg/m ³) y	k _e RfC ₂₇₆ (mg/m ³) y	k _e RfC ₂₇₇ (mg/m ³) y	k _e RfC ₂₇₈ (mg/m ³) y	k _e RfC ₂₇₉ (mg/m ³) y	k _e RfC ₂₈₀ (mg/m ³) y	k _e RfC ₂₈₁ (mg/m ³) y	k _e RfC ₂₈₂ (mg/m ³) y	k _e RfC ₂₈₃ (mg/m ³) y	k _e RfC ₂₈₄ (mg/m ³) y	k _e RfC ₂₈₅ (mg/m ³) y	k _e RfC ₂₈₆ (mg/m ³) y	k _e RfC ₂₈₇ (mg/m ³) y	k _e RfC ₂₈₈ (mg/m ³) y	k _e RfC ₂₈₉ (mg/m ³) y	k _e RfC ₂₉₀ (mg/m ³) y	k _e RfC ₂₉₁ (mg/m ³) y	k _e RfC ₂₉₂ (mg/m ³) y	k _e RfC ₂₉₃ (mg/m ³) y	k _e RfC ₂₉₄ (mg/m ³) y	k _e RfC ₂₉₅ (mg/m ³) y	k _e RfC ₂₉₆ (mg/m ³) y	k _e RfC ₂₉₇ (mg/m ³) y	k _e RfC ₂₉₈ (mg/m ³) y	k _e RfC ₂₉₉ (mg/m ³) y	k _e RfC ₃₀₀ (mg/m ³) y	k _e RfC ₃₀₁ (mg/m ³) y	k _e RfC ₃₀₂ (mg/m ³) y	k _e RfC ₃₀₃ (mg/m ³) y	k _e RfC ₃₀₄ (mg/m ³) y	k _e RfC ₃₀₅ (mg/m ³) y	k _e RfC ₃₀₆ (mg/m ³) y	k _e RfC ₃₀₇ (mg/m ³) y	k _e RfC ₃₀₈ (mg/m ³) y	k _e RfC ₃₀₉ (mg/m ³) y	k _e RfC ₃₁₀ (mg/m ³) y	k _e RfC ₃₁₁ (mg/m ³) y	k _e RfC ₃₁₂ (mg/m ³) y	k _e RfC ₃₁₃ (mg/m ³) y	k _e RfC ₃₁₄ (mg/m ³) y	k _e RfC ₃₁₅ (mg/m ³) y	k _e RfC ₃₁₆ (mg/m ³) y	k _e RfC ₃₁₇ (mg/m ³) y	k _e RfC ₃₁₈ (mg/m ³) y	k _e RfC ₃₁₉ (mg/m ³) y	k

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³ -day) ⁻¹	IUR (ug/m ³ -day) ⁻¹	k _e (mg/kg-day)	RfD _o (mg/kg-day)	k _e (mg/m ³ -day)	RfC _i (mg/m ³ -day)	k _e (mg/m ³ -day)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	
			1.3E-02	I					1	0.1		1.4E+09		Terbacil	5902-51-2						1.0E+03	4.3E+03		8.2E+02
			2.5E-05	H				V			3.1E+01	1.4E+09	2.6E+05	Terbufos	13071-79-9						2.0E+00			2.0E+00
			1.0E-03	I					1	0.1		1.4E+09		Terbutryn	886-50-0						7.8E+01	3.3E+02		6.3E+01
			1.0E-04	I					1	0.1		1.4E+09		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1						7.8E+00	3.3E+01		6.3E+00
			3.0E-04	I				V				1.4E+09	5.1E+04	Tetrachlorobenzene, 1,2,4,5-	95-94-3						2.3E+01			2.3E+01
2.6E-02	I	7.4E-06	I	3.0E-02	I			V			6.8E+02	1.4E+09	5.7E+03	Tetrachloroethane, 1,1,1,2-	630-20-6	2.7E+01		2.2E+00	2.0E+00	2.3E+03			2.3E+03	
2.0E-01	I	5.8E-05	C	2.0E-02	I			V			1.9E+03	1.4E+09	1.5E+04	Tetrachloroethane, 1,1,2,2-	79-34-5	3.5E+00		7.3E-01	6.0E-01	1.6E+03			1.6E+03	
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V			1.7E+02	1.4E+09	2.4E+03	Tetrachloroethylene	127-18-4	3.3E+02		2.5E+01	2.4E+01	4.7E+02		9.8E+01	8.1E+01	
			3.0E-02	I					1	0.1		1.4E+09		Tetrachlorophenol, 2,3,4,6-	58-90-2					2.3E+03	9.9E+03			1.9E+03
2.0E+01	H							V				1.4E+09	1.1E+05	Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	3.5E-02			3.5E-02					
			5.0E-04	I					1	0.1		1.4E+09		Tetraethyl Dithiopyrophosphate	3689-24-5						3.9E+01	1.6E+02		3.2E+01
			8.0E+01	I	V				1		2.1E+03	1.4E+09	1.2E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2								1.0E+05	1.0E+05
			2.0E-03	P					1	0.0007		1.4E+09		Tetryl (Trinitrophenylmethyl nitramine)	479-45-8					1.6E+02	1.0E+05			1.6E+02
			7.0E-06	X					1			1.4E+09		Thallium (I) Nitrate	10102-45-1					5.5E-01				5.5E-01
			1.0E-05	X					1			1.4E+09		Thallium (Soluble Salts)	7440-28-0					7.8E-01				7.8E-01
			6.0E-06	X				V				1.4E+09		Thallium Acetate	563-68-8					4.7E-01				4.7E-01
			2.0E-05	X				V				1.4E+09		Thallium Carbonate	6533-73-9					1.6E+00				1.6E+00
			6.0E-06	X					1			1.4E+09		Thallium Chloride	7791-12-0					4.7E-01				4.7E-01
			2.0E-05	X					1			1.4E+09		Thallium Sulfate	7446-18-6					1.6E+00				1.6E+00
			1.3E-02	I					1	0.1		1.4E+09		Thifensulfuron-methyl	79277-27-3					1.0E+03	4.3E+03			8.2E+02
			1.0E-02	I					1	0.1		1.4E+09		Thiobencarb	28249-77-6					7.8E+02	3.3E+03			6.3E+02
			7.0E-02	X					1	0.0075		1.4E+09		Thiodiglycol	111-48-8					5.5E+03	3.1E+05			5.4E+03
			3.0E-04	H					1	0.1		1.4E+09		Thiofanox	39196-18-4					2.3E+01	9.9E+01			1.9E+01
			8.0E-02	I					1	0.1		1.4E+09		Thiophanate, Methyl	23564-05-8					6.3E+03	2.6E+04			5.1E+03
			5.0E-03	I					1	0.1		1.4E+09		Thiram	137-26-8					3.9E+02	1.6E+03			3.2E+02
			6.0E-01	H					1			1.4E+09		Tin	7440-31-5					4.7E+04				4.7E+04
			1.0E-04	A	V				1			1.4E+09		Titanium Tetrachloride	7550-45-0								1.4E+05	1.4E+05
			8.0E-02	I	5.0E+00	I	V		1		8.2E+02	1.4E+09	4.3E+03	Toluene	108-88-3					6.3E+03		2.2E+04		4.9E+03
1.8E-01	X		2.0E-04	X					1	0.1		1.4E+09		Toluene 2,5-diamine	95-70-5	3.9E+00	1.4E+01		3.0E+00	1.6E+01	6.6E+01			1.3E+01
3.0E-02	P		4.0E-03	X					1	0.1		1.4E+09		Toluidine, p-	106-49-0	2.3E+01	8.2E+01		1.8E+01	3.1E+02	1.3E+03			2.5E+02
			3.0E+00	P				V			3.4E-01	1.4E+09	1.1E+03	Total Petroleum Hydrocarbons (Aliphatic High)	NA					2.3E+05				2.3E+05
			6.0E-01	P	V				1		1.4E+02	1.4E+09	8.3E+02	Total Petroleum Hydrocarbons (Aliphatic Low)	NA								5.2E+02	5.2E+02
			1.0E-02	X	1.0E-01	P	V		1		6.9E+00	1.4E+09	1.0E+03	Total Petroleum Hydrocarbons (Aliphatic Medium)	NA					7.8E+02			1.1E+02	9.6E+01
			4.0E-02	P					1	0.1		1.4E+09		Total Petroleum Hydrocarbons (Aromatic High)	NA					3.1E+03	1.3E+04			2.5E+03
			4.0E-03	P	3.0E-02	P	V		1		1.8E+03	1.4E+09	3.5E+03	Total Petroleum Hydrocarbons (Aromatic Low)	NA					3.1E+02			1.1E+02	8.2E+01
			4.0E-03	P	3.0E-03	P	V		1		1.4E+09	5.2E+04		Total Petroleum Hydrocarbons (Aromatic Medium)	NA					3.1E+02			1.6E+02	1.1E+02
1.1E+00	I	3.2E-04	I						1	0.1		1.4E+09		Toxaphene	8001-35-2	6.3E-01	2.2E+00	1.2E+04	4.9E-01					
			7.5E-03	I					1	0.1		1.4E+09		Tralometrin	66841-25-6					5.9E+02	2.5E+03			4.7E+02
			3.0E-04	A				V				1.4E+09	3.4E+03	Tri-n-butyltin	688-73-3					2.3E+01				2.3E+01
			8.0E+01	X					1	0.1		1.4E+09		Triacetin	102-76-1					6.3E+06	2.6E+07			5.1E+06
			3.0E-02	I					1	0.1		1.4E+09		Triadimefon	43121-43-3					2.3E+03	9.9E+03			1.9E+03
			1.3E-02	I				V				1.4E+09	3.6E+05	Triallate	2303-17-5					1.0E+03				1.0E+03
			1.0E-02	I					1	0.1		1.4E+09		Triasulfuron	82097-50-5					7.8E+02	3.3E+03			6.3E+02
			8.0E-03	I					1	0.1		1.4E+09		Tribenuron-methyl	101200-48-0					6.3E+02	2.6E+03			5.1E+02
			5.0E-03	I				V				1.4E+09	4.8E+04	Tribromobenzene, 1,2,4-	615-54-3					3.9E+02				3.9E+02
9.0E-03	P		1.0E-02	P					1	0.1		1.4E+09		Tributyl Phosphate	126-73-8	7.7E+01	2.7E+02		6.0E+01	7.8E+02	3.3E+03			6.3E+02
			3.0E-04	P					1	0.1		1.4E+09		Tributyltin Compounds	NA					2.3E+01	9.9E+01			1.9E+01
			3.0E-04	I					1	0.1		1.4E+09		Tributyltin Oxide	56-35-9					2.3E+01	9.9E+01			1.9E+01
			3.0E+01	I	3.0E+01	H	V		1		9.1E+02	1.4E+09	1.3E+03	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					2.3E+06		4.0E+04		4.0E+04
7.0E-02	I		2.0E-02	I					1	0.1		1.4E+09		Trichloroacetic Acid	76-03-9	9.9E+00	3.5E+01		7.8E+00	1.6E+03	6.6E+03			1.3E+03
2.9E-02	H								1	0.1		1.4E+09		Trichloroaniline HCl, 2,4,6-	33663-50-2	2.4E+01	8.5E+01		1.9E+01					
7.0E-03	X		3.0E-05	X					1	0.1		1.4E+09		Trichloroaniline, 2,4,6-	634-93-5	9.9E+01	3.5E+02		7.8E+01	2.3E+00	9.9E+00			1.9E+00
			8.0E-04	X				V				1.4E+09	3.2E+04	Trichlorobenzene, 1,2,3-	87-61-6					6.3E+01				

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																									
Toxicity and Chemical-specific Information														Contaminant				Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1			
SFO (mg/kg-day) ¹	k e y	IUR (ug/m ³) ¹	k e y	RfD _o (mg/kg-day)	k e y	RfC _i (mg/m ³) ¹	k e y	muta- gen	GI/ABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)		
				3.0E-03	X	3.0E-04	P	V		1	3.1E+02	1.4E+09	2.3E+03	Trichloropropene, 1,2,3-	96-19-5						2.3E+02		7.3E-01	7.3E-01	
				2.0E-02	A					1	0.1	1.4E+09		Tricresyl Phosphate (TCP)	1330-78-5						1.6E+03	6.6E+03		1.3E+03	
				3.0E-03	I					1	0.1	1.4E+09		Tridiphenane	58138-08-2						2.3E+02	9.9E+02		1.9E+02	
						7.0E-03	I	V		1		2.8E+04	1.4E+09	1.6E+04	Triethylamine	121-44-8							1.2E+02	1.2E+02	
				2.0E+00	P					1	0.1	1.4E+09		Triethylene Glycol	112-27-6						1.6E+05	6.6E+05		1.3E+05	
						2.0E+01	P	V		1		4.8E+03	1.4E+09	7.1E+02	Trifluoroethane, 1,1,1-	420-46-2							1.5E+04	1.5E+04	
7.7E-03	I			7.5E-03	I			V		1		1.4E+09	5.1E+05	Trifluralin	1582-09-8	9.0E+01			9.0E+01	5.9E+02				5.9E+02	
2.0E-02	P			1.0E-02	P					1	0.1	1.4E+09		Trimethyl Phosphate	512-56-1	3.5E+01	1.2E+02		2.7E+01	7.8E+02	3.3E+03			6.3E+02	
						5.0E-03	P	V		1		2.9E+02	1.4E+09	9.4E+03	Trimethylbenzene, 1,2,3-	526-73-8							4.9E+01	4.9E+01	
						7.0E-03	P	V		1		2.2E+02	1.4E+09	7.9E+03	Trimethylbenzene, 1,2,4-	95-63-6							5.8E+01	5.8E+01	
				1.0E-02	X			V		1		1.8E+02	1.4E+09	6.6E+03	Trimethylbenzene, 1,3,5-	108-67-8					7.8E+02			7.8E+02	
				1.0E-02	X			V		1		3.0E+01	1.4E+09	1.0E+03	Trimethylpentene, 2,4,4-	25167-70-8					7.8E+02			7.8E+02	
3.0E-02	I			3.0E-02	I					1	0.019	1.4E+09		Trinitrobenzene, 1,3,5-	99-35-4					2.3E+03	5.2E+04			2.2E+03	
				5.0E-04	I					1	0.032	1.4E+09		Tonitrotoluene, 2,4,6-	118-96-7	2.3E+01	2.6E+02		2.1E+01	3.9E+01	5.2E+02			3.6E+01	
				2.0E-02	P					1	0.1	1.4E+09		Triphenylphosphine Oxide	791-28-6					1.6E+03	6.6E+03			1.3E+03	
				2.0E-02	A					1	0.1	1.4E+09		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8					1.6E+03	6.6E+03			1.3E+03	
2.3E+00	C	6.6E-04	C	1.0E-02	X					1	0.1	1.4E+09		Tris(1-chloro-2-propyl)phosphate	13674-84-5					7.8E+02	3.3E+03			6.3E+02	
								V		1		4.7E+02	1.4E+09	9.0E+05	Tris(2,3-dibromopropyl)phosphate	126-72-7	3.0E-01		3.8E+00	2.8E-01					
2.0E-02	P			7.0E-03	P					1	0.1	1.4E+09		Tris(2-chloroethyl)phosphate	115-96-8	3.5E+01	1.2E+02		2.7E+01	5.5E+02	2.3E+03			4.4E+02	
3.2E-03	P			1.0E-01	P					1	0.1	1.4E+09		Tris(2-ethylhexyl)phosphate	78-42-2	2.2E+02	7.7E+02		1.7E+02	7.8E+03	3.3E+04			6.3E+03	
				8.0E-04	P					1		1.4E+09		Tungsten	7440-33-7					6.3E+01				6.3E+01	
1.0E+00	C	2.9E-04	C	3.0E-03	I	4.0E-05	A			1		1.4E+09		Uranium (Soluble Salts)	NA	1.5E-01	6.0E-01	4.8E+03	1.2E-01	2.3E+02		5.7E+04	2.3E+02		
		8.3E-03	P	9.0E-03	I	7.0E-06	P	M		0.026		1.4E+09		Urethane	51-79-6										
												1.4E+09		Vanadium Pentoxide	1314-62-1					7.0E+02	9.9E+03			6.6E+02	
				5.0E-03	S	1.0E-04	A			0.026		1.4E+09		Vanadium and Compounds	7440-62-2					3.9E+02		1.4E+05	3.9E+02		
				1.0E-03	I			V		1		1.4E+09	1.2E+05	Verdolate	1929-77-7					7.8E+01			7.8E+01		
				2.5E-02	I					1	0.1	1.4E+09		Vindozolin	50471-44-8					2.0E+03	8.2E+03			1.6E+03	
				1.0E+00	H	2.0E-01	I	V		1		2.8E+03	1.4E+09	4.4E+03	Vinyl Acetate	108-05-4					7.8E+04		9.2E+02	9.1E+02	
		3.2E-05	H			3.0E-03	I	V		1		2.5E+03	1.4E+09	1.4E+03	Vinyl Bromide	593-60-2			1.2E-01	1.2E-01			4.3E+00	4.3E+00	
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	1.4E+09	9.6E+02	Vinyl Chloride	75-01-4	9.4E-02		1.6E-01	5.9E-02	2.3E+02		1.0E+02	7.0E+01	
				3.0E-04	I					1	0.1	1.4E+09		Warfarin	81-81-2					2.3E+01	9.9E+01			1.9E+01	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	1.4E+09	5.6E+03	Xylene, p-	106-42-3					1.6E+04		5.8E+02	5.6E+02	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	1.4E+09	5.5E+03	Xylene, m-	108-38-3					1.6E+04		5.7E+02	5.5E+02	
				2.0E-01	S	1.0E-01	S	V		1		4.3E+02	1.4E+09	6.5E+03	Xylene, o-	95-47-6					1.6E+04		6.7E+02	6.5E+02	
				2.0E-01	I	1.0E-01	I	V		1		2.6E+02	1.4E+09	5.7E+03	Xylenes	1330-20-7					1.6E+04		6.0E+02	5.8E+02	
				3.0E-04	I					1		1.4E+09		Zinc Phosphide	1314-84-7					2.3E+01				2.3E+01	
				3.0E-01	I					1		1.4E+09		Zinc and Compounds	7440-66-6					2.3E+04				2.3E+04	
				5.0E-02	I					1	0.1	1.4E+09		Zineb	12122-67-7					3.9E+03	1.6E+04			3.2E+03	
				8.0E-05	X					1		1.4E+09		Zirconium	7440-67-7					6.3E+00				6.3E+00	

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Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e y	RfD ₀ (mg/kg-day)	k _e y	RfC ₁ (mg/m ³) ⁻¹	k _e y	muta- gen	LOGP	GIABS	FA	In	EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (µg/L)	Dermal SL TR=1E-06 (µg/L)	Inhalation SL TR=1E-06 (µg/L)	Carcinogenic SL TR=1E-06 (µg/L)	Ingestion SL Child THQ=1 (µg/L)	Dermal SL Child THQ=1 (µg/L)	Inhalation SL Child THQ=1 (µg/L)	Noncarcinogenic SL Child THI=1 (µg/L)	MCL (ug/L)	
8.7E-03	I	2.2E-06	I	4.0E-03	I	9.0E-03	I	V	-0.85	1	1	Yes	Acetophate	30560-19-1	9.0E+00	1.2E+04	2.6E+00	8.9E+00	8.0E+01	1.1E+05	1.9E+01	8.0E+01		
									-0.34	1	1	Yes	Acetaldehyde	75-07-0								1.9E+01		
									3.03	1	0.9	Yes	Acetochlor	34256-82-1					4.0E+02	2.9E+03	1.9E+01	3.5E+02		
									-0.24	1	1	Yes	Acetone	67-64-1					1.8E+04	4.4E+06	6.4E+04	1.4E+04		
									-0.03	1	1	Yes	Acetone Cyanohydrin	75-86-5										
									-0.34	1	1	Yes	Acetonitrile	75-05-8							1.3E+02	1.3E+02		
									1.58	1	1	Yes	Acetophenone	98-86-2					2.0E+03	4.6E+04		1.9E+03		
3.8E+00	C	1.3E-03	C	1.0E-01	I		V		3.12	1	1	Yes	Acetylaminofluorene, 2-	53-96-3	2.1E-02	6.7E-02		1.6E-02						
									-0.01	1	1	Yes	Acrolein	107-02-8					1.0E+01	1.7E+03	4.2E-02	4.2E-02		
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I	M	-0.67	1	1	Yes	Acrylamide	79-06-1	5.0E-02	2.3E+01		5.0E-02	4.0E+01	2.1E+04		4.0E+01		
									0.35	1	1	Yes	Acrylic Acid	79-10-7					1.0E+04	1.1E+06	2.1E+00	2.1E+00		
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V	0.25	1	1	Yes	Acrylonitrile	107-13-1	1.4E-01	1.4E+01	8.3E-02	5.2E-02	8.0E+02	8.9E+04	4.2E+00	4.1E+00		
									-0.32	1	1	Yes	Adiponitrile	111-69-3										
5.6E-02	C			1.0E-02	I				3.52	1	0.9	Yes	Alachlor	15972-60-8	1.4E+00	4.4E+00		1.1E+00	2.0E+02	6.9E+02		1.6E+02	2.0E+00	
				1.0E-03	I				1.13	1	1	Yes	Aldicarb	116-06-3					2.0E+01	1.4E+03		2.0E+01	3.0E+00	
				1.0E-03	I				-0.57	1	1	Yes	Aldicarb Sulfone	1646-88-4					2.0E+01	2.4E+04		2.0E+01	2.0E+00	
1.7E+01	I	4.9E-03	I	3.0E-05	I		V		-0.78	1	1	Yes	Aldicarb sulfoxide	1646-87-3									4.0E+00	
									6.5	1	1	No	Aldrin	309-00-2	4.6E-03		1.1E-03	9.2E-04	6.0E-01			6.0E-01		
2.1E-02	C	6.0E-06	C	5.0E-03	I	1.0E-04	X	V	0.17	1	1	Yes	Allyl Alcohol	107-18-6					1.0E+02	1.3E+04	2.1E-01	2.1E-01		
									1.93	1	1	Yes	Allyl Chloride	107-05-1	3.7E+00	3.5E+01	9.4E-01	7.3E-01			2.1E+00	2.1E+00		
				1.0E+00	P	5.0E-03	P			1	1	Yes	Aluminum	7429-90-5					2.0E+04	4.6E+06		2.0E+04		
				4.0E-04	I					1	1	Yes	Aluminum Phosphide	20859-73-8					8.0E+00	1.8E+03		8.0E+00		
2.1E+01	C	6.0E-03	C	9.0E-03	I				2.98	1	1	Yes	Ametryn	834-12-8	3.7E-03	1.5E-02		3.0E-03	1.8E+02	9.8E+02		1.5E+02		
									2.86	1	1	Yes	Aminobiphenyl, 4,4'-	92-67-1										
				8.0E-02	P				0.21	1	1	Yes	Aminophenol, m	581-27-5					1.6E+03	2.8E+05		1.6E+03		
				2.0E-02	P				0.04	1	1	Yes	Aminophenol, p	123-30-8					4.0E+02	9.1E+04		4.0E+02		
				2.5E-03	I				5.5	1	0.9	Yes	Amirtraz	33089-61-1					5.0E+01	9.8E+00		8.2E+00		
				1.0E-01	I	V			0.23	1	1	Yes	Ammonia	7664-41-7										
				2.0E-01	I					1	1	Yes	Ammonium Sulfamate	7773-06-0					4.0E+03	9.1E+05		4.0E+03		
									0.89	1	1	Yes	Amyl Alcohol, tert-	75-85-4							6.3E+00	6.3E+00		
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I		0.9	1	1	Yes	Aniline	62-53-3	1.4E+01	6.9E+02		1.3E+01	1.4E+02	7.7E+03		1.4E+02		
4.0E-02	P			2.0E-03	X				3.39	1	0.9	Yes	Anthraquinone, 9,10-	84-65-1	1.9E+00	5.1E+00		1.4E+00	4.0E+01	1.1E+02		3.0E+01		
				4.0E-04	I				0.15	1	1	Yes	Antimony (metallic)	7440-36-0					8.0E+00	2.7E+02		7.8E+00	6.0E+00	
				5.0E-04	H				0.15	1	1	Yes	Antimony Pentoxide	1314-60-9					1.0E+01	3.4E+02		9.7E+00		
				4.0E-04	H				0.15	1	1	Yes	Antimony Tetroxide	1332-81-6					8.0E+00	2.7E+02		7.8E+00		
				2.0E-04	I				0.15	1	1	Yes	Antimony Trioxide	1309-64-4										
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	1	Yes	Arsenic, Inorganic	7440-38-2	5.2E-02	9.7E+00		5.2E-02	6.0E+00	1.4E+03		6.0E+00	1.0E+01	
				3.5E-06	C	5.0E-05	I			1	1	Yes	Arsine	7784-42-1					7.0E-02	1.6E+01		7.0E-02		
				5.0E-02	I				-0.27	1	1	Yes	Asulam	3337-71-1					1.0E+03	8.0E+05		1.0E+03		
2.3E-01	C	3.5E-02	I	3.5E-02	I				2.61	1	1	Yes	Atrazine	1912-24-9	3.4E-01	2.8E+00		3.0E-01	7.0E+02	6.2E+03		6.3E+02	3.0E+00	
8.8E-01	C	2.5E-04	C	2.0E-03	X				2.98	1	0.9	Yes	Auramine	492-80-8	8.9E-02	2.7E-01		6.7E-02						
				4.0E-04	I				4.48	1	1	No	Avermectin B1	65195-55-3					8.0E+00			8.0E+00		
				3.0E-03	A	1.0E-02	A		2.75	1	1	Yes	Azinphos-methyl	86-50-0					6.0E+01	8.3E+02		5.6E+01		
1.1E-01	I	3.1E-05	I	1.0E+00	P	7.0E-06	P		3.82	1	1	Yes	Azobenzene	103-33-3	7.1E-01	7.3E-01	1.8E-01	1.2E-01						
				1.0E+00	P	7.0E-06	P		-1.7	1	1	Yes	Azodicarbonamide	123-77-3					2.0E+04	6.8E+07		2.0E+04		
5.0E-01	C	1.5E-01	C	2.0E-01	I	5.0E-04	H		0.07	1	1	Yes	Barium	7440-39-3					4.0E+03	6.4E+04		3.8E+03	2.0E+03	
				2.0E-02	C	2.0E-04	C		0.025	1	1	Yes	Barium Chromate	10294-40-3	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02		
				3.0E-01	I		V		5.29	1	0.8	Yes	Benfluralin	1861-40-1					6.0E+03	2.4E+03		1.7E+03		
				5.0E-02	I				2.12	1	1	Yes	Benomyl	17804-35-2					1.0E+03	3.0E+04		9.7E+02		
				2.0E-01	I				2.18	1	1	Yes	Bensulfuron-methyl	83055-99-6					4.0E+03	2.4E+05		3.9E+03		
				3.0E-02	I				2.34	1	1	Yes	Bentazon	25057-89-0					6.0E+02	9.4E+03		5.7E+02		
5.5E-02	I	7.8E-06	I	1.0E-01	I		V		1.48	1	1	Yes	Benzaldehyde	100-52-7					2.0E+03	4.9E+04		1.9E+03		
1.0E-01	X			4.0E-03	I	3.0E-02	I	V	2.13	1	1	Yes	Benzene	71-43-2	1.4E+00	9.8E+00	7.2E-01	4.6E-01	8.0E+01	6.1E+02	6.3E+01	3.3E+01	5.0E+00	
				3.0E-04	X				-3.727	1	1	No	Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	7.8E-01			7.8E-01	6.0E+00		6.0E+00			
				1.0E-03	P		V		2.52	1	1	Yes	Benzenethiol	108-98-5					2.0E+01	1.0E+02		1.7E+01		
2.3E+02	I	6.7E-02	I	3.0E-03	I				1.34	1	1	Yes	Benzidine	92-87-5	1.1E-04	5.0E-03		1.1E-04	6.0E+01	3.0E+03		5.9E+01		
				4.0E+00	I				1.87	1	1	Yes	Benzoic Acid	65-85-0					8.0E+04	1.2E+06		7.5E+04		
1.3E+01	I						V		3.9	1	1	Yes	Benzotrithloride	98-07-7	6.0E-03	6.0E-03		3.0E-03						
1.7E-01	I	4.9E-05	C	1.0E-01	P				1.1	1	1	Yes	Benzyl Alcohol	100-51-6					2.0E+03	8.9E+04		2.0E+03		
				2.0E-03	P	1.0E-03	P	V	2.3	1	1	Yes	Benzyl Chloride	100-44-7	4.6E-01	3.4E+00	1.1E-01	8.9E-02	4.0E+01	3.2E+02	2.1E+00	2.0E+00		
				2.4E-03	I	2.0E-03	I	2.0E-05	I	0.007	1	Yes	Beryllium and compounds	7440-41-7					4.0E+01	6.4E+01		2.5E+01	4.0E+00	
				9.0E-03	P				4.48	1	0.9	Yes	Bifenox	42576-02-3					1.8E+02	2.3E+02		1.0E+02		
				1.5E-02	I				6	1	0	Yes	Biphenthrin	82657-04-3					3.0E+02			3.0E+02		
8.0E-03	I			5.0E-01	I	4.0E-04	X	V	4.01	1	1	Yes	Biphenyl, 1,1'-	92-52-4	9.7E+00	6.5E+00		3.9E+00	1.0E+04	7.3E+03	8.3E-01	8.3E-01		

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																						
Toxicity and Chemical-specific Information											Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e IUR (ug/m ³) ⁻¹	RfD _a (mg/kg-day)	k _e RfC _i (mg/m ³) ⁻¹	k _e RfC _i (mg/m ³) ⁻¹	k _e RfC _i (mg/m ³) ⁻¹	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	Inhalation SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	
			4.0E-02 3.0E-03	I P	V P		2.48 1.3	1 1	1 1	Yes Yes	Bis(2-chloro-1-methylethyl) ether Bis(2-chloroethoxy)methane	108-60-1 111-91-1					8.0E+02 6.0E+01	6.5E+03 3.0E+03	7.1E+02 5.9E+01			
1.1E+00 2.2E+02	I I	3.3E-04 6.2E-02	I I		V V		1.29 0.57	1 1	1 1	Yes Yes	Bis(2-chloroethyl)ether Bis(chloromethyl)ether Bisphenol A	111-44-4 542-88-1 80-05-7	7.1E-02 3.5E-04	2.7E+00 3.4E-02	1.7E-02 9.1E-05	1.4E-02 7.2E-05						
			5.0E-02	I			3.32	1	1	Yes								1.0E+03	3.2E+03	7.7E+02		
			2.0E-01 2.0E+00 4.0E-02	I P C	2.0E-02 2.0E-02 1.3E-02	H P C	1.16 0.22	1 1	1 1	Yes Yes Yes	Boron And Borates Only Boron Trichloride Boron Trifluoride	7440-42-8 10294-34-5 7637-07-2					4.0E+03 4.0E+04 8.0E+02	9.1E+05 9.1E+06 1.8E+05	4.2E+01 4.2E+01 2.7E+01	4.0E+03 4.2E+01 2.6E+01		
7.0E-01 2.0E+00	I X	4.0E-03 6.0E-04	I X		V V		1.92 2.99	1 1	1 1	Yes Yes	Bromate Bromo-2-chloroethane, 1- Bromobenzene	15541-45-4 107-04-0 108-86-1	1.1E-01 3.9E-02	2.1E+01 5.7E-01	1.1E-01 9.4E-03	1.1E-01 7.4E-03	8.0E+01 1.6E+02	1.8E+04 5.4E+02	8.0E+01 1.3E+02	8.0E+01 6.2E+01	1.0E+01	
			4.0E-02	X	V		1.41	1	1	Yes	Bromochloromethane	74-97-5							8.3E+01	8.3E+01		
6.2E-02 7.9E-03	I I	3.7E-05 1.1E-06	C I	2.0E-02 2.0E-02	I I	V V	2 2.4	1 1	1 1	Yes Yes	Bromodichloromethane Bromoform	75-27-4 75-25-2	1.3E+00 9.9E+00	1.9E+01 1.4E+02	1.5E-01 5.1E+00	1.3E-01 3.3E+00	4.0E+02 4.0E+02	6.5E+03 6.2E+03	3.8E+02 3.8E+02	3.8E+02 3.8E+02	8.0E+01(F) 8.0E+01(F)	
			1.4E-03 5.0E-03 2.0E-02	I H I	5.0E-03 H I	V V	1.19 5.21 2.8	1 1	0.8 0.8	Yes Yes Yes	Bromomethane Bromophos Bromoxynil	74-83-9 2104-96-3 1689-84-5					2.8E+01 1.0E+02 4.0E+02	1.0E+03 5.5E+01 1.8E+03	1.0E+01 3.5E+01 3.3E+02	7.5E+00 3.5E+01 3.3E+02		
3.4E+00	C	3.0E-05	I		V V		5.4 1.99 0.88	1 1	0.8 1	Yes Yes Yes	Bromoxynil Octanoate Butadiene, 1,3- Butanol, N-	1689-99-2 106-99-0 71-36-3	2.3E-02	1.6E-01	1.9E-01	1.8E-02	4.0E+02 2.0E+03	2.1E+02 1.0E+05	4.2E+00 2.0E+03	1.4E+02 2.0E+03		
1.9E-03	P		2.0E-01 2.0E+00 5.0E-02	I P I	3.0E+01 P V		4.73 0.61 4.15	1 1	0.9 1	Yes Yes Yes	Butyl Benzyl Phthalate Butyl alcohol, sec- Butylate	85-68-7 78-92-2 2008-41-5	4.1E+01	2.7E+01		1.6E+01	4.0E+03 4.0E+04 1.0E+03	2.9E+03 3.0E+06 8.5E+02	1.7E+03 6.3E+04 4.6E+02	1.7E+03 2.4E+04 4.6E+02		
2.0E-04 3.6E-03	C P	5.7E-08 P	C	3.0E-01 5.0E-02	P P	V V	3.5 5.1 4.38	1 1	0.8 1	Yes Yes No	Butylated hydroxyanisole Butylated hydroxytoluene Butylbenzene, n-	25013-16-5 128-37-0 104-51-8	3.9E+02 2.2E+01	2.5E+02 4.0E+00		1.5E+02 3.4E+00	6.0E+03 1.0E+03	1.2E+03	1.0E+03 1.0E+03			
			1.0E-01 1.0E-01 2.0E-02	X X A	V V A		4.57 4.11 0.36	1 1	1 1	No Yes Yes	Butylbenzene, sec- Butylbenzene, tert- Cacodylic Acid	135-98-8 98-06-6 75-60-5					2.0E+03 2.0E+03 4.0E+02	1.1E+03 1.1E+03 6.7E+04	2.0E+03 6.9E+02 4.0E+02	2.0E+03 6.9E+02 4.0E+02		
5.0E-01	C	1.5E-01	C	1.8E-03 1.8E-03 5.0E-04	I I C	1.0E-05 1.0E-05 2.0E-02	A A C	0.025 0.05 0.025	1 1	Yes Yes Yes	Cadmium (Diet) Cadmium (Water) Calcium Chromate	7440-43-9 7440-48-9 13765-19-0					1.0E+01 4.0E+02	1.1E+02 2.3E+03	9.2E+00 3.4E+02	5.0E+00		
			5.0E-01	I	2.2E-03	C	-0.19	1	1	Yes	Caprolactam	105-60-2					1.0E+04	9.0E+05	9.9E+03			
1.5E-01 2.3E-03	C C	4.3E-05 6.6E-07	C C	2.0E-03 1.3E-01	I I		3.8 2.8	1 1	0.9 1	Yes Yes	Captafol Captan	2425-06-1 133-06-2	5.2E-01 3.4E+01	1.8E+00 3.6E+02		4.0E-01 3.1E+01	4.0E+01 2.6E+03	1.5E+02 3.0E+04	3.2E+01 2.4E+03			
			1.0E-01 5.0E-03 1.0E-01	I I I	V I I		2.36 2.32 1.94	1 1	1 1	Yes Yes Yes	Carbaryl Carbofuran Carbon Disulfide	63-25-2 1563-66-2 75-15-0					2.0E+03 1.0E+02 2.0E+03	2.4E+04 1.4E+03 2.0E+04	1.8E+03 9.4E+01 8.1E+02	4.0E+01		
7.0E-02	I	6.0E-06	I	4.0E-03 1.0E-01 1.0E-02	I I I	1.0E-01 I P	2.83 -1.33 5.57	1 1	1 0.8	Yes Yes Yes	Carbon Tetrachloride Carbonyl Sulfide Carbosulfan	56-23-5 463-58-1 55285-14-8	1.1E+00	4.3E+00	9.4E-01	4.6E-01	8.0E+01 2.0E+02	3.4E+02 6.9E+01	2.1E+02 2.1E+02	4.9E+01 2.1E+02 5.1E+01	5.0E+00	
			1.0E-01	I			2.14	1	1	Yes	Carboxin	5234-68-4					2.0E+03	4.1E+04	1.9E+03			
			1.5E-02	I			1.9	1	1	Yes	Ceric oxide	1306-38-3					3.0E+02	7.4E+03	2.9E+02			
4.0E-01 3.5E-01	H I	1.0E-04	I	5.0E-04 7.0E-04	I I	V V	2.22 6.26	1 1	1 0.7	Yes No	Chloramben Chloranil Chlordane	133-90-4 118-75-2 12789-03-6	1.9E-01 2.2E-01	3.5E+00	5.6E-02	1.8E-01 4.5E-02	1.0E+01		1.5E+00	1.3E+00	2.0E+00	
1.0E+01	I	4.6E-03	C	3.0E-04 7.0E-04 2.0E-02	I A I		5.41 3.81 2.5	1 1	0.8 0.9	Yes Yes Yes	Chlordecone (Kepone) Chlorfenvinphos Chlorimuron, Ethyl-	143-50-0 470-90-6 90982-32-4	7.8E-03	6.5E-03		3.5E-03	6.0E+00 1.4E+01 4.0E+02	5.4E+00 5.6E+01 1.5E+04	2.9E+00 1.1E+01 3.9E+02			
			1.0E-01 3.0E-02 3.0E-02	I I I	1.5E-04 2.0E-04 I	A I V	0.85	1	1	Yes	Chlorine	7782-50-5					2.0E+03 6.0E+02 6.0E+02	4.6E+05 1.4E+05	3.0E-01 4.2E-01	3.0E-01 4.2E-01 6.0E+02	1.0E+03	
			5.0E+01	I	V		2.05	1	1	Yes	Chloro-1,1-difluoroethane, 1- Chloro-1,3-butadiene, 2- Chloro-2-methylaniline HCl, 4-	75-68-3 126-99-8 3165-93-3					4.0E+02	1.8E+03	1.0E+05 4.2E+01	1.0E+05 3.7E+01		
4.6E-01	H	3.0E-04	I	2.0E-02	H	2.0E-02	I	V	2.53 2.27	1 1	Yes Yes						1.7E-01	5.1E+02	1.9E-02 1.7E-01			
1.0E-01 2.7E-01	P X	7.7E-05	C	3.0E-03	X		2.27 0.09 0.22	1 1	1 1	Yes Yes Yes	Chloro-2-methylaniline, 4- Chloroacetaldehyde, 2- Chloroacetic Acid	95-69-2 107-20-0 79-11-8	7.8E-01 2.9E-01	6.6E+00 4.6E+01		7.0E-01 2.9E-01	6.0E+01	5.6E+02		5.4E+01	6.0E+01	
			3.0E-05	I			1.93	1	1	Yes	Chloroacetophenone, 2-	532-27-4					8.0E+01	1.3E+03	1.0E+02	7.6E+01		
2.0E-01	P		4.0E-03 2.0E-02	I I	5.0E-02 P	V	1.83 2.84	1 1	1 1	Yes Yes	Chloroaniline, p- Chlorobenzene	106-47-8 108-90-7	3.9E-01	5.9E+00		3.7E-01	4.0E+02	1.3E+03	1.0E+02	7.8E+01	1.0E+02	
1.1E-01	C	3.1E-05	C	2.0E-02 3.0E-02	I X		4.74 2.65	1 1	0.8 1	Yes Yes	Chlorobenzilate Chlorobenzoic Acid, p-	510-15-6 74-11-3	7.1E-01	5.6E-01		3.1E-01	4.0E+02 6.0E+02	3.5E+02 3.4E+03	1.9E+02 5.1E+02			

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RfD _a (mg/kg-day)	k _e y	RfC ₁ (mg/m ³) ⁻¹	k _e y	muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (µg/L)	Dermal SL TR=1E-06 (µg/L)	Inhalation SL TR=1E-06 (µg/L)	Carcinogenic SL TR=1E-06 (µg/L)	Ingestion SL Child THQ=1 (µg/L)	Dermal SL Child THQ=1 (µg/L)	Inhalation SL Child THQ=1 (µg/L)	Noncarcinogenic SL Child THI=1 (µg/L)	MCL (ug/L)	
				3.0E-03	P	3.0E-01	P	V	3.6	1	1	Yes	Chlorobenzotrifluoride, 4-	98-56-6					6.0E+01	9.3E+01	6.3E+02	3.5E+01		
				4.0E-02	P			V	2.64	1	1	Yes	Chlorobutane, 1-	109-69-3					8.0E+02	3.1E+03		6.4E+02		
						5.0E+01	I	V	1.08	1	1	Yes	Chlorodifluoromethane	75-45-6							1.0E+05	1.0E+05		
				2.0E-02	P			V	0.03	1	1	Yes	Chloroethanol, 2-	107-07-3					4.0E+02	7.7E+04		4.0E+02		
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V	1.97	1	1	Yes	Chloroform	67-66-3	2.5E+00	2.9E+01	2.4E-01	2.2E-01	2.0E+02	2.5E+03	2.0E+02	9.7E+01	8.0E+01(F)	
						9.0E-02	I	V	0.91	1	1	Yes	Chloromethane	74-87-3							1.9E+02	1.9E+02		
2.4E+00	C	6.9E-04	C					V	0.32	1	1	Yes	Chloromethyl Methyl Ether	107-30-2	3.2E-02	3.7E+00	8.1E-03	6.5E-03						
3.0E-01	P			3.0E-03	P	1.0E-05	X		2.24	1	1	Yes	Chloronitrobenzene, o-	88-73-3	2.6E-01	2.6E+00		2.4E-01	6.0E+01	6.4E+02		5.5E+01		
6.3E-03	P			1.0E-03	P	6.0E-04	P		2.39	1	1	Yes	Chloronitrobenzene, p-	100-00-5	1.2E+01	9.7E+01		1.1E+01	2.0E+01	1.7E+02		1.8E+01		
				5.0E-03	I			V	2.15	1	1	Yes	Chlorophenol, 2-	95-57-8					1.0E+02	1.0E+03		9.1E+01		
						4.0E-04	C	V	2.09	1	1	Yes	Chloropicrin	76-06-2							8.3E-01	8.3E-01		
3.1E-03	C	8.9E-07	C	1.5E-02	I				3.05	1	0.9	Yes	Chlorothalonil	1897-45-6	2.5E+01	1.6E+02		2.2E+01	3.0E+02	2.1E+03		2.6E+02		
				2.0E-02	I			V	3.42	1	1	Yes	Chlorotoluene, o-	95-49-8					4.0E+02	5.8E+02		2.4E+02		
						2.0E-02	X		3.33	1	1	Yes	Chlorotoluene, p-	106-43-4					4.0E+02	6.6E+02		2.5E+02		
2.4E+02	C	6.9E-02	C					V	-1.02	1	1	Yes	Chlorozotocin	54749-90-5	3.2E-04	1.0E+00		3.2E-04	4.0E+03	9.8E+03		2.8E+03		
				2.0E-01	I				3.51	1	0.9	Yes	Chlorpropham	101-21-3										
						1.0E-03	A		4.96	1	0.8	Yes	Chlorpyrifos	2921-88-2					2.0E+01	1.5E+01		8.4E+00		
						1.0E-02	H		4.31	1	0.9	Yes	Chlorpyrifos Methyl	5598-13-0					2.0E+02	2.9E+02		1.2E+02		
						5.0E-02	I		2	1	1	Yes	Chlorsulfuron	64902-72-3					1.0E+03	5.7E+04		9.9E+02		
						1.0E-02	I		4.28	1	0.9	Yes	Chlorthal-dimethyl	1861-32-1					2.0E+02	3.3E+02		1.2E+02		
						8.0E-04	H		5.8	1	0.8	Yes	Chlorthiophos	60238-56-4					1.6E+01	3.4E+00		2.8E+00		
						1.5E+00	I			0.013	1	Yes	Chromium(III), Insoluble Salts	16065-83-1					3.0E+04	8.9E+04		2.2E+04		
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I	M		0.025	1	Yes	Chromium(VI)	18540-29-9	5.0E-02	1.2E-01		3.5E-02	6.0E+01	1.7E+02		4.4E+01		
									0.013	1	1	Yes	Chromium, Total	7440-47-3									1.0E+02	
				1.3E-02	I				3.1	1	0.9	Yes	Clofentezine	74115-24-5					2.6E+02	2.1E+03		2.3E+02		
9.0E-03	P			3.0E-04	P	6.0E-06	P			1	1	Yes	Cobalt	7440-48-4					6.0E+00	3.4E+03		6.0E+00		
6.2E-04	I							V	1	0			Coke Oven Emissions	8007-45-2										
				4.0E-02	H				1	1	1	Yes	Copper	7440-50-8					8.0E+02	1.8E+05		8.0E+02	1.3E+03	
						5.0E-02	I	6.0E-01	C	1.96	1	1	Yes	Cresol, m-	108-39-4					1.0E+03	1.2E+04		9.3E+02	
						5.0E-02	I	6.0E-01	C	1.95	1	1	Yes	Cresol, o-	95-48-7					1.0E+03	1.2E+04		9.3E+02	
						1.0E-01	A	6.0E-01	C	1.94	1	1	Yes	Cresol, p-	106-44-5					2.0E+03	2.5E+04		1.9E+03	
						1.0E-01	A		3.1	1	1	Yes	Cresol, p-chloro-m-	59-50-7					2.0E+03	5.2E+03		1.4E+03		
						1.0E-01	A	6.0E-01	C	1.95	1	0.9	Yes	Cresols	1319-77-3					2.0E+03	6.7E+03		1.5E+03	
1.9E+00	H			1.0E-03	P			V	0.6	1	1	Yes	Crotonaldehyde, trans-	123-73-9	4.1E-02	2.7E+00		4.0E-02	2.0E+01	1.5E+03		2.0E+01		
						1.0E-01	I	4.0E-01	I	3.66	1	1	Yes	Cumene	98-82-8					2.0E+03	1.9E+03	8.3E+02	4.5E+02	
2.2E-01	C	6.3E-05	C						-1.73	1	1	Yes	Cupferron	135-20-6	3.5E-01	1.3E+04		3.5E-01						
8.4E-01	H			2.0E-03	H				2.22	1	1	Yes	Cyanazine	21725-46-2	9.3E-02	1.6E+00		8.8E-02	4.0E+01	7.6E+02		3.8E+01		
													Cyanides											
						1.0E-03	I			1	1	Yes	*Calcium Cyanide	592-01-8					2.0E+01	4.6E+03		2.0E+01		
						5.0E-03	I			1	1	Yes	*Copper Cyanide	544-92-3					1.0E+02	2.3E+04		1.0E+02		
						6.0E-04	I	8.0E-04	S	1	1	Yes	*Cyanide (CN-)	57-12-5					1.2E+01	2.7E+03	1.7E+00	1.5E+00	2.0E+02	
						1.0E-03	I		V	0.07	1	1	Yes	*Cyanogen	460-19-5					2.0E+01	5.1E+03		2.0E+01	
						9.0E-02	I		V	1	1	Yes	*Cyanogen Bromide	506-68-3					1.8E+03	1.6E+06		1.8E+03		
						5.0E-02	I		V	1	1	Yes	*Cyanogen Chloride	506-77-4					1.0E+03	5.8E+05		1.0E+03		
						6.0E-04	I	8.0E-04	I	-0.25	1	1	Yes	*Hydrogen Cyanide	74-90-8					1.2E+01	2.7E+03	1.7E+00	1.5E+00	
						2.0E-03	I			1	1	Yes	*Potassium Cyanide	151-50-8					4.0E+01	4.6E+03		4.0E+01		
						5.0E-03	I			0.04	1	Yes	*Potassium Silver Cyanide	506-61-6					1.0E+02	4.6E+02		8.2E+01		
						1.0E-01	I			0.04	1	Yes	*Silver Cyanide	506-64-9					2.0E+03	1.8E+04		1.8E+03		
						1.0E-03	I			1	1	Yes	*Sodium Cyanide	143-33-9					2.0E+01	4.6E+03		2.0E+01	2.0E+02	
						2.0E-04	P			1	0	Yes	*Thiocyanates	NA					4.0E+00	9.1E+02		4.0E+00		
						2.0E-04	X		V	0.58	1	1	Yes	*Thiocyanic Acid	463-56-9					4.0E+00	9.1E+02		4.0E+00	
						5.0E-02	I			1	1	Yes	*Zinc Cyanide	557-21-1					1.0E+03	3.8E+05		1.0E+03		
						6.0E+00	I	V	3.44	1	1	Yes	Cyclohexane	110-82-7							1.3E+04	1.3E+04		
2.3E-02	H								4.72	1	0.9	Yes	Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	3.4E+00	8.3E+00		2.4E+00	1.0E+05	6.5E+06	1.5E+03	1.4E+03		
				5.0E+00	I	7.0E-01	P	V	0.81	1	1	Yes	Cyclohexanone	108-94-1										
						5.0E-03	P	1.0E+00	X	2.86	1	1	Yes	Cyclohexene	110-83-8					1.0E+02	2.5E+02	2.1E+03	7.0E+01	
						2.0E-01	I		V	1.49	1	1	Yes	Cyclohexylamine	108-91-8					4.0E+03	9.3E+04		3.8E+03	
						2.5E-02	I			5.95	1	0.7	Yes	Cyfluthrin	68359-37-5					5.0E+02	1.6E+02		1.2E+02	
						5.0E-03	I			6.9	1	0.5	No	Cyhalothrin	68085-85-8					1.0E+02			1.0E+02	
						1.0E-02	I			6.6	1	0.7	No	Cypermethrin	52315-07-8					2				

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																						
Toxicity and Chemical-specific Information											Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e IUR (ug/m ³) ⁻¹	RfD _a (mg/kg-day)	k _e RfC _i (mg/m ³) ⁻¹	k _e RfC _i (mg/m ³) ⁻¹	k _e RfC _i (mg/m ³) ⁻¹	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	Inhalation SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	
1.8E-02 7.0E-04	C I	5.1E-06 C	3.0E-02 1.5E-01 7.0E-03	I I I			0.78 -1.5 12.11	1 1 0	1 1 0	Yes Yes No	Dalapon Daminozide Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	75-99-0 1596-84-5 1163-19-5	4.3E+00 1.1E+02	1.3E+04		4.3E+00 1.1E+02	6.0E+02 3.0E+03 1.4E+02	5.5E+04 1.0E+07		6.0E+02 3.0E+03 1.4E+02	2.0E+02	
1.2E-03 6.1E-02	I H		4.0E-05 6.0E-01	I I			3.21 6.11 4.49	1 1 0.9	0.8 1 0.9	Yes Yes Yes	Demeton Di(2-ethylhexyl)adipate Diallate	8065-48-3 103-23-1 2303-16-4	6.5E+01 1.3E+00			6.5E+01 5.4E-01	8.0E-01 1.2E+04	8.8E-01		4.2E-01 1.2E+04	4.0E+02	
8.0E-01	P	6.0E-03	7.0E-04 1.0E-02 2.0E-04	A X P		V	3.81 4.38 2.96	1 1 1	0.9 1 1	Yes Yes Yes	Diazinon Dibenzothiophene Dibromo-3-chloropropane, 1,2-	333-41-5 132-65-0 96-12-8		3.1E-02	1.7E-01	3.4E-04	3.3E-04	1.4E+01 2.0E+02 4.0E+00	3.9E+01 9.6E+01 2.4E+01	4.2E-01	1.0E+01 6.5E+01 3.7E-01	2.0E-01
8.4E-02	I		4.0E-04 1.0E-02 2.0E-02	X I I		V	3.75 3.79 2.16	1 0.9 1	0.9 0.9 1	Yes Yes Yes	Dibromobenzene, 1,3- Dibromobenzene, 1,4- Dibromochloromethane	108-36-1 106-37-6 124-48-1	9.3E-01	1.4E+01		8.7E-01	8.0E+00 2.0E+02 4.0E+02	1.6E+01 3.7E+02 6.7E+03		5.3E+00 1.3E+02 3.8E+02	8.0E+01(F)	
2.0E+00	I	6.0E-04	9.0E-03 1.0E-02 3.0E-04	I I P	9.0E-03 4.0E-03 P	I X V	1.96 1.7 1	1 1 0	Yes No No	Yes Yes No	Dibromoethane, 1,2- Dibromomethane (Methylene Bromide) Dibutyltin Compounds	106-93-4 74-95-3 NA	3.9E-02	7.1E-01	9.4E-03	7.5E-03	1.8E+02 6.0E+00	3.6E+03	1.9E+01 8.3E+00	1.7E+01 8.3E+00 6.0E+00	5.0E-02	
			3.0E-02 4.2E-03 4.2E-03	I P P		V	2.21 2.6 2.6	1 1 1	1 1 1	Yes Yes Yes	Dicamba Dichloro-2-butene, 1,4- Dichloro-2-butene, cis-1,4-	1918-00-9 764-41-0 1476-11-5			1.3E-03 1.3E-03	1.3E-03	6.0E+02	1.0E+04		5.7E+02		
5.0E-02	I		4.0E-03 9.0E-02	I I	2.0E-01 2.0E-01	H V	0.92 3.43	1 1	1 1	Yes Yes	Dichloro-2-butene, trans-1,4- Dichloroacetic Acid Dichlorobenzene, 1,2-	110-57-6 79-43-6 95-50-1	1.6E+00	9.6E+01		1.5E+00	8.0E+01 1.8E+03	5.4E+03 2.9E+03	4.2E+02	7.9E+01 3.0E+02	6.0E+01 6.0E+02	
5.4E-03 4.5E-01	C I	1.1E-05 3.4E-04	7.0E-02 8.0E-01 9.0E-03	A I X	8.0E-01 I V	V	3.44 3.51 4.44	1 1 0.9	1 1 Yes	Yes Yes Yes	Dichlorobenzene, 1,4- Dichlorobenzidine, 3,3'- Dichlorobenzophenone, 4,4'-	106-46-7 91-94-1 90-98-2	1.4E+01 1.7E-01	2.1E+01 4.5E-01	5.1E-01	4.8E-01 1.3E-01	1.4E+03 1.8E+02	2.2E+03 1.4E+02	1.7E+03	5.7E+02 7.8E+01	7.5E+01	
5.7E-03 9.1E-02	C I	1.6E-06 2.6E-05	2.0E-01 2.0E-01 6.0E-03	I P X	1.0E-01 P V	X V	2.16 1.79 2.13	1 1 1	1 1 1	Yes Yes Yes	Dichlorodifluoromethane Dichloroethane, 1,1- Dichloroethane, 1,2-	75-71-8 75-34-3 107-06-2	1.4E+01 8.6E-01	1.8E+02 1.8E+01	3.5E+00 2.2E-01	2.8E+00 1.7E-01	4.0E+03 1.2E+02	3.8E+04 2.8E+03	2.1E+02 1.5E+01	2.0E+02 1.3E+01	5.0E+00	
			5.0E-02 2.0E-03 2.0E-02	I I I	2.0E-01 I V	V	2.13 1.86 2.09	1 1 1	1 1 1	Yes Yes Yes	Dichloroethylene, 1,1- Dichloroethylene, 1,2-cis- Dichloroethylene, 1,2-trans-	75-35-4 156-59-2 156-60-9					1.0E+03 4.0E+01 4.0E+02	8.5E+03 3.6E+02 3.6E+03	4.2E+02	2.8E+02 3.6E+01 3.6E+02	7.0E+00 7.0E+01 1.0E+02	
			3.0E-03 1.0E-02 8.0E-03	I I I	3.0E-03 I V	V	3.06 2.81 3.53	1 1 0.9	1 1 Yes	Yes Yes Yes	Dichlorophenol, 2,4- Dichlorophenoxy Acetic Acid, 2,4- Dichlorophenoxybutyric Acid, 4-(2,4-	120-83-2 94-75-7 94-82-6					6.0E+01 2.0E+02 1.6E+02	1.9E+02 1.4E+03 4.8E+02		4.6E+01 1.7E+02 1.2E+02	7.0E+01	
3.6E-02	C	1.0E-05	9.0E-02 2.0E-02 3.0E-03	A P I	4.0E-03 P V	I V	1.98 2 0.78	1 2 1	1 1 1	Yes Yes Yes	Dichloropropane, 1,2- Dichloropropane, 1,3- Dichloropropane, 1,2,3-	78-87-5 142-28-9 618-23-9	2.2E+00	2.4E+01	5.6E-01	4.4E-01	1.8E+03 4.0E+02 6.0E+01	2.2E+04 4.6E+03 5.0E+03	8.3E+00	8.3E+00 3.7E+02 5.9E+01	5.0E+00	
1.0E-01 2.9E-01	I I	4.0E-06 8.3E-05	3.0E-02 5.0E-04 1.0E-04	I I I	2.0E-02 I V	V	2.04 1.43 0	1 1 1	1 1 Yes	Yes Yes Yes	Dichloropropene, 1,3- Dichlorvos Dicrotophos	5421-75-6 62-73-7 141-66-2	7.8E-01 2.7E-01	7.8E+00 1.4E+01	1.4E+00	4.7E-01 2.6E-01	6.0E+02 1.0E+01 2.0E+00	6.6E+03 5.6E+02 1.1E+03	4.2E+01	3.9E+01 9.9E+00 2.0E+00		
1.6E+01	I	4.6E-03 3.0E-04	8.0E-02 5.0E-05	P I	3.0E-04 I	X V	3.16 5.4	1 0.8	1 Yes	Yes Yes	Dicyclopentadiene Dieldrin Diesel Engine Exhaust	77-73-6 60-57-1 NA	4.9E-03	2.7E-03		1.8E-03	1.6E+03 1.0E+00	3.5E+03 6.1E-01	6.3E-01	6.3E-01 3.8E-01		
			2.0E-03 3.0E-02 6.0E-02	P P P	2.0E-04 P P	P	-1.43 0.56 -0.54	1 1 1	1 1 Yes	Yes Yes Yes	Diethanolamine Diethylene Glycol Monobutyl Ether Diethylene Glycol Monoethyl Ether	111-42-2 112-34-5 111-90-0					4.0E+01 6.0E+02 1.2E+03	8.4E+04 8.7E+04 7.8E+05		4.0E+01 6.0E+02 1.2E+03		
3.5E+02	C	1.0E-01	1.0E-03 8.0E-02	P I		V	0.05 5.07 0.65	1 0.9 1	1 Yes Yes	Yes Yes Yes	Diethylformamide Diethylstilbestrol Difenzoquat	617-84-5 56-53-1 43222-48-6	2.2E-04	6.6E-05		5.1E-05	2.0E+01 1.6E+03	4.3E+03 7.3E+05		2.0E+01 1.6E+03		
4.4E-02	C	1.3E-05	2.0E-02 4.0E+01 3.58	I I V		V	3.88 0.75 3.58	1 1 1	0.9 1 1	Yes Yes Yes	Diffubenzuron Difluoroethane, 1,1- Dihydrosafrole	35367-38-5 75-37-6 94-58-6			1.8E+00	2.3E+00	4.3E-01	3.0E-01	4.0E+02 8.3E+04	1.0E+03 8.3E+04	2.9E+02 8.3E+04	
			7.0E-01 8.0E-02 2.0E-02	P I I		V	1.52 1.03 -0.17	1 1 1	1 1 Yes	Yes Yes Yes	Diisopropyl Ether Diisopropyl Methylphosphonate Dimethipin	108-20-3 1445-75-6 55290-64-7					1.6E+03 4.0E+02	1.3E+05 2.4E+05	1.5E+03	1.5E+03 4.0E+02		
1.6E+00 1.7E-03	P P		2.0E-04 6.0E-02	I P		V	0.78 1.81 -0.61	1 1 1	1 1 Yes	Yes Yes Yes	Dimethoate Dimethoxybenzidine, 3,3'- Dimethyl methylphosphonate	60-51-5 119-90-4 756-79-6	4.9E-02 4.6E+01	1.6E+00 2.8E+04		4.7E-02 4.6E+01	1.2E+03 8.1E+05		4.0E+00 1.2E+03	4.0E+00 1.2E+03		
4.6E+00 5.8E-01 2.0E-01	C H P	1.3E-03	2.0E-03	C X			4.58 2.17 1.68	1 1 1	1 1 Yes	Yes Yes Yes	Dimethylamino azobenzene [p-] Dimethylaniline HCl, 2,4- Dimethylaniline, 2,4-	60-11-7 21436-96-4 95-68-1	1.7E-02 1.3E-01 3.9E-01	7.2E-03 5.2E+02 7.1E+00		5.0E-03 1.3E-01 3.7E-01	4.0E+01	8.0E+02		3.8E+01		
1.1E+01	P		2.0E-03 1.0E-01	I P		V	2.31 2.34 -1.01	1 1 1	1 1 Yes	Yes Yes Yes	Dimethylaniline, N,N- Dimethylbenzidine, 3,3'- Dimethylformamide	121-69-7 119-93-7 68-12-2	7.1E-03	8.5E-02		6.5E-03	4.0E+01 2.0E+03	3.1E+02 1.8E+06	3.1E+02 6.3E+01	3.5E+01 6.1E+01		
			1.0E-04 X 2.0E-06	X X	V V		-1.19	1 1	1 1	Yes Yes	Dimethylhydrazine, 1,1-	57-14-7					2.0E+00	3.5E+03	4.2E-03	4.2E-03		

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information												Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e C	RfD _a (mg/kg-day)	k _e I	RfC _i (mg/m ³) ⁻¹	k _e I	v _o muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (μg/L)	Dermal SL TR=1E-06 (μg/L)	Inhalation SL TR=1E-06 (μg/L)	Carcinogenic SL TR=1E-06 (μg/L)	Ingestion SL Child THQ=1 (μg/L)	Dermal SL Child THQ=1 (μg/L)	Inhalation SL Child THQ=1 (μg/L)	Noncarcinogenic SL Child THI=1 (μg/L)	MCL (ug/L)		
5.5E+02	C	1.6E-01	C	2.0E-02	I		V	-0.54	1	1	Yes	Dimethylhydrazine, 1,2-Dimethylphenol, 2,4-	540-73-8 105-67-9	1.4E-04	5.0E-02	3.5E-05	2.8E-05	4.0E+02	3.1E+03		3.6E+02			
				6.0E-04	I			2.36	1	1	Yes	Dimethylphenol, 2,6-Dimethylphenol, 3,4-Dimethylvinylchloride	576-26-1 95-65-8 513-37-1					1.2E+01	8.5E+01		1.1E+01			
4.5E-02	C	1.3E-05	C	1.0E-03	I		V	2.23	1	1	Yes			1.7E+00	6.5E+00	4.3E-01	3.3E-01	2.0E+01	1.7E+02		1.8E+01			
				2.58	1	1	Yes																	
				8.0E-05	X			2.13	1	1	Yes	Dinitro-o-cresol, 4,6-Dinitro-o-cyclohexyl Phenol, 4,6-Dinitrobenzene, 1,2-Dinitrobenzene, 1,3-Dinitrobenzene, 1,4-Dinitrophenol, 2,4-Dinitrotoluene Mixture, 2,4,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 2,6-Dinitrotoluene, 2-Amino-4,6-Dinitrotoluene, 4-Amino-2,6-Dinitrotoluene, Technical grade	534-52-1 131-89-5 528-29-0 99-65-0 100-25-4 51-28-5					1.6E+00	2.6E+01		1.5E+00			
				2.0E-03	I			4.12	1	0.9	Yes							4.0E+01	5.4E+01		2.3E+01			
				1.0E-04	P			1.69	1	1	Yes							2.0E+00	5.3E+01		1.9E+00			
				1.0E-04	I			1.49	1	1	Yes							2.0E+00	7.3E+01		2.0E+00			
				1.0E-04	P			1.46	1	1	Yes							2.0E+00	7.6E+01		2.0E+00			
				2.0E-03	I			1.67	1	1	Yes							4.0E+01	1.2E+03		3.9E+01			
6.8E-01	I							2.18	1	1	Yes	Dinitrotoluene Mixture, 2,4,2,6-Dinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, 2,6-Dinitrotoluene, 2-Amino-4,6-Dinitrotoluene, 4-Amino-2,6-Dinitrotoluene, Technical grade	NA 121-14-2 606-20-2	1.1E-01	1.5E+00		1.1E-01	4.0E+01	7.5E+02		3.8E+01			
3.1E-01	C	8.9E-05	C	2.0E-03	I			1.98	1	1	Yes			2.5E-01	4.3E+00		2.4E-01	6.0E+00	9.3E+01		5.7E+00			
1.5E+00	P			3.0E-04	X			2.1	1	1	Yes			5.2E-02	7.4E-01		4.9E-02							
				2.0E-03	S			1.84	1	1	Yes							4.0E+01	1.0E+03		3.9E+01			
				2.0E-03	S			1.84	1	1	Yes							4.0E+01	1.0E+03		3.9E+01			
4.5E-01	X			9.0E-04	X			2.18	1	0.8	Yes			1.7E-01	2.6E-01		1.0E-01	1.8E+01	3.0E+01		1.1E+01			
				1.0E-03	I			3.56	1	0.9	Yes	Dinoseb	88-85-7					2.0E+01	5.4E+01		1.5E+01	7.0E+00		
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	-0.27	1	1	Yes	Dioxane, 1,4-Dioxins	123-91-1	7.8E-01	2.3E+02	1.1E+00	4.6E-01	6.0E+02	1.9E+05	6.3E+01	5.7E+01			
6.2E+03	I	1.3E+00	I					8.21	1	0	No	*Hexachlorodibenzo-p-dioxin, Mixture	NA	1.3E-05			1.3E-05							
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C	6.8	1	0.5	No	*TCDD, 2,3,7,8-Diphenamid	1746-01-6 957-51-7	6.0E-07		1.5E-07	1.2E-07	1.4E-05	6.0E+02	4.2E+03	8.3E-05	1.2E-05	3.0E-05	
				3.0E-02	I			2.17	1	1	Yes													
				8.0E-04	X			2.4	1	1	Yes	Diphenyl Sulfone	127-63-9					1.6E+01	2.0E+02		1.5E+01			
				2.5E-02	I			3.5	1	1	Yes	Diphenylamine	122-39-4					5.0E+02	8.4E+02		3.1E+02			
8.0E-01	I	2.2E-04	I					2.94	1	1	Yes	Diphenylhydrazine, 1,2-Diquat	122-66-7 85-00-7	9.7E-02	3.9E-01		7.8E-02							
				2.2E-03	I			-4.6	1	1	No	Direct Black 38	1937-37-7	1.1E-02			1.1E-02	4.4E+01			4.4E+01	2.0E+01		
7.1E+00	C	1.4E-01	C					4.9	1	1	No	Direct Blue 6	2602-46-2	1.1E-02			1.1E-02							
7.4E+00	C	1.4E-01	C					2.6	1	1	No			1.1E-02			1.1E-02							
6.7E+00	C	1.4E-01	C					-6.53	1	1	No	Direct Brown 95	16071-88-6	1.2E-02			1.2E-02							
				4.0E-05	I			4.02	1	0.9	Yes	Disulfoton	298-04-4					8.0E-01	1.3E+00		5.0E-01			
				1.0E-02	I		V	0.77	1	1	Yes	Dithiane, 1,4-Diuron	505-29-3 330-54-1					2.0E+02	1.6E+04		2.0E+02			
				2.0E-03	I			2.68	1	1	Yes	Diuron						4.0E+01	3.6E+02		3.6E+01			
				4.0E-03	I			1.15	1	1	Yes	Dodine	2439-10-3					8.0E+01	1.1E+04		8.0E+01			
				2.5E-02	I		V	3.21	1	1	Yes	EPTC	759-94-4					5.0E+02	1.5E+03		3.8E+02			
				6.0E-03	I		V	3.83	1	0.9	Yes	Endosulfan	115-29-7					1.2E+02	6.3E+02		1.0E+02			
				2.0E-02	I			1.91	1	1	Yes	Endothall	145173-3					4.0E+02	8.5E+03		3.8E+02	1.0E+02		
				3.0E-04	I			5.2	1	0.8	Yes	Endrin	72-20-8					6.0E+00	3.7E+00		2.3E+00	2.0E+00		
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	0.45	1	1	Yes	Epichlorohydrin	106-89-8	7.9E+00	7.9E+02	4.7E+00	2.9E+00	1.2E+02	1.3E+04	2.1E+00	2.0E+00			
				2.0E-02	I	2.0E-02	I	0.86	1	1	Yes	Epoxybutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	106-88-7 111-77-3					8.0E+02	3.9E+05		4.2E+01			
				4.0E-02	P			-1.18	1	1	Yes													
				5.0E-03	I			-0.22	1	1	Yes	Ethephon	16672-87-0					1.0E+02	4.2E+04		1.0E+02			
				5.0E-04	I			5.07	1	0.8	Yes	Ethion	563-12-2					1.0E+01	7.7E+00		4.3E+00			
				1.0E-01	P	6.0E-02	P	0.59	1	1	Yes	Ethoxyethanol Acetate, 2-Ethoxyethanol, 2-Ethoxyethanol, 2-Ethyl Acetate	111-15-9 110-80-5 141-78-6				2.0E+03	2.3E+05	1.3E+02	1.2E+02				
				9.0E-02	P	2.0E-01	I	-0.32	1	1	Yes							1.8E+03	6.3E+05	4.2E+02	3.4E+02			
				9.0E-01	I	7.0E-02	P	0.73	1	1	Yes	Ethyl Acetate	140-88-5					1.8E+04	1.2E+06	1.5E+02	1.4E+02			
				5.0E-03	P	8.0E-03	P	1.32	1	1	Yes	Ethyl Acrylate						1.0E+02	3.0E+03	1.7E+01	1.4E+01			
				1.0E+01	I	1.0E+01	I	1.43	1	1	Yes	Ethyl Chloride (Chloroethane)	75-00-3											
				2.0E-01	I		V	0.89	1	1	Yes	Ethyl Ether	60-29-7					4.0E+03	2.0E+05		2.1E+04			
				3.0E-01	P	3.0E-01	P	1.94	1	1	Yes	Ethyl Methacrylate	97-63-2							6.3E+02	3.9E+03			
1.1E-02	C	2.5E-06	C	1.0E-05	I	1.0E+00	I	4.78	1	0.8	Yes	Ethyl-p-nitrophenyl Phosphonate	2104-64-5	7.1E+00	1.2E+01	2.2E+00	1.5E+00	2.0E-01	1.6E-01		8.9E-02			
				1.0E-01	I			3.15	1	1	Yes	Ethylbenzene	100-41-4					2.0E+03	3.8E+03	2.1E+03	8.1E+02	7.0E+02		
				7.0E-02	P			-0.94	1	1	Yes	Ethylene Cyanohydrin	109-78-4					1.4E+03	1.1E+06		1.4E+03			
				9.0E-02	P		V	-2.04	1	1	No	Ethylene Diamine	107-15-3					1.8E+03			1.8E+03			
				2.0E+00	I	4.0E-01	C	-1.36	1	1	Yes	Ethylene Glycol	107-21-1					4.0E+04	5.7E+07		4.0E+04			
				1.0E-01	I	1.6E+00	I	0.83	1	1	Yes	Ethylene Glycol Monobutyl Ether	111-76-2					2.0E+03	1.4E+05		2.0E+03			
3.1E-01	C	8.8E-05	C	3.0E-02	C	3.0E-02	C	-0.3	1	1	Yes	Ethylene Oxide	75-21-8	2.5E-01	5.4E+01	6.4E-02	5.1E-02			6.3E+01	6.3E+01			
4.5E-02	C	1.3E-05	C	8.0E-05	I			-0.66	1	1	Yes	Ethylene Thiourea	96-45-7	1.7E+00	1.0E+03		1.7E+00	1.6E+00	1.0E+03		1.6E+00			
6.5E+01	C	1.9E-02	C				V	-0.28	1	1	Yes	Ethyleneimine	151-56-4	1.2E-03	2.5E-01	3.0E-04	2.4E-04							
				3.0E+00	I			2.19	1	1	Yes	Ethylphthalyl Ethyl Glycolate	84-72-0					6.0E+04	1.5E+06		5.8E+04			
				2.5E-04	I			3.23	1	0.9	Yes	Fenamiphos	22224-92-6					5.0E+00	3.4E+01		4.4E+00			
				2.5E-02	I			5.7	1	0.8	Yes	Fenpropathrin												

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e RfD _a (mg/kg-day)	k _e ₁ RfC ₁ (mg/m ³) ⁻¹	k _e ₂ RfC ₂ (mg/m ³) ⁻¹	k _e ₃ RfC ₃ (mg/m ³) ⁻¹	k _e ₄ RfC ₄ (mg/m ³) ⁻¹	k _e ₅ RfC ₅ (mg/m ³) ⁻¹	k _e ₆ RfC ₆ (mg/m ³) ⁻¹	k _e ₇ RfC ₇ (mg/m ³) ⁻¹	k _e ₈ RfC ₈ (mg/m ³) ⁻¹	k _e ₉ RfC ₉ (mg/m ³) ⁻¹	k _e ₁₀ RfC ₁₀ (mg/m ³) ⁻¹	Analyte	CAS No.	Ingestion SL TR=1E-06 (µg/L)	Dermal SL TR=1E-06 (µg/L)	Inhalation SL TR=1E-06 (µg/L)	Carcinogenic SL TR=1E-06 (µg/L)	Ingestion SL Child THQ=1 (µg/L)	Dermal SL Child THQ=1 (µg/L)	Inhalation SL Child THQ=1 (µg/L)	Noncarcinogenic SL Child THQ=1 (µg/L)	MCL (µg/L)
4.0E-02	C	1.3E-02	C										Fluoride	16984-48-8					8.0E+02	1.8E+05		8.0E+02	
6.0E-02	I	1.3E-02	C										Fluorine (Soluble Fluoride)	7782-41-4					1.2E+03	2.7E+05		1.2E+03	4.0E+03
8.0E-02	I												Fluridone	59756-60-4					1.6E+03	1.4E+04		1.4E+03	
2.0E-02	I												Flurprimidol	56425-91-3					4.0E+02	2.4E+03		3.4E+02	
7.0E-04	I												Flusilazole	85509-19-9					1.4E+01	5.0E+01		1.1E+01	
6.0E-02	I												Flutolanil	66332-96-5					1.2E+03	4.5E+03		9.5E+02	
1.0E-02	I												Fluvalinate	69409-94-5					2.0E+02			2.0E+02	
3.5E-03	I	1.0E-01	I										Folpet	133-07-3	2.2E+01	2.1E+02		2.0E+01	2.0E+03	2.1E+04		1.8E+03	
1.9E-01	I												Fomesafen	72178-02-0	4.1E-01	9.1E+00		3.9E-01					
		2.0E-03	I										Fonofos	944-22-9					4.0E+01	6.3E+01		2.4E+01	
1.3E-05	I	2.0E-01	I	9.8E-03	A	V							Formaldehyde	50-00-0					4.0E+03	3.2E+05	2.0E+01	2.0E+01	
		9.0E-01	P	3.0E-04	X	V							Formic Acid	64-18-6					1.8E+04	6.4E+06	6.3E-01	6.3E-01	
		3.0E+00	I										Fosetyl-AL	39148-24-8					6.0E+04			6.0E+04	
													Furans										
1.0E-03	X												*Dibenzofuran	132-64-9					2.0E+01	1.3E+01		7.9E+00	
1.0E-03	I												*Furan	110-00-9					2.0E+01	4.8E+02		1.9E+01	
9.0E-01	I	2.0E+00	I	V									*Tetrahydrofuran	109-99-9					1.8E+04	1.7E+06	4.2E+03	3.4E+03	
3.8E+00	H												Furazolidone	67-45-8	2.1E-02	1.0E+01		2.0E-02	6.0E+01	7.1E+03	1.0E+02	3.8E+01	
		3.0E-03	I	5.0E-02	H	V							Furfural	98-01-1									
1.5E+00	C	4.3E-04	C										Furium	531-82-8	5.2E-02	1.9E+00		5.1E-02					
3.0E-02	I	8.6E-06	C										Furmecyclox	60568-05-0	2.6E+00	2.0E+00		1.1E+00					
		4.0E-04	I										Glufosinate, Ammonium	77182-82-2					8.0E+00			8.0E+00	
		8.0E-05	C										Glutaraldehyde	111-30-8									
4.0E-04	I	1.0E-03	H	V									Glycidyl	765-34-4					8.0E+00	1.8E+03	2.1E+00	1.7E+00	
1.0E-01	I												Glyphosate	1071-83-6					2.0E+03			2.0E+03	7.0E+02
1.0E-02	X												Guanidine	113-00-8					2.0E+02	4.2E+05		2.0E+02	
2.0E-02	P												Guanidine Chloride	50-01-1					4.0E+02			4.0E+02	
5.0E-05	I												Haloxypol, Methyl	69806-40-2					1.0E+00	3.1E+00		7.6E-01	
4.5E+00	I	1.3E-03	I	5.0E-04	I								Heptachlor	76-44-8	1.7E-02	2.3E-03	4.3E-03	1.4E-03	1.0E+01	1.5E+00		1.3E+00	4.0E-01
9.1E+00	I	2.6E-03	I	1.3E-05	I								Heptachlor Epoxide	1024-57-3	8.6E-03	7.1E-03	2.2E-03	1.4E-03	2.6E-01	2.4E-01		1.2E-01	2.0E-01
		2.0E-03	I										Hexabromobenzene	87-82-1					4.0E+01			4.0E+01	
		2.0E-04	I										Hexabromodiphenyl ether, 2,2',4,4',5,5'-(BDE-153)	68631-49-2					4.0E+00			4.0E+00	
1.6E+00	I	4.6E-04	I										Hexachlorobenzene	118-74-1	4.9E-02		1.2E-02	9.8E-03	1.6E+01			1.6E+01	1.0E+00
7.8E-02	I	2.2E-05	I	1.0E-03	P								Hexachlorobutadiene	87-68-3	1.0E+00	4.4E-01	2.6E-01	1.4E-01	2.0E+01	9.5E+00		6.5E+00	
6.3E+00	I	1.8E-03	I	8.0E-03	A								Hexachlorocyclohexane, Alpha-	319-84-6	1.2E-02	1.8E-02		7.2E-03	1.6E+02	2.5E+02		9.7E+01	
1.8E+00	I	5.3E-04	I										Hexachlorocyclohexane, Beta-	319-85-7	4.3E-02	6.1E-02		2.5E-02					
1.1E+00	C	3.1E-04	C	3.0E-04	I								Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	7.1E-02	1.0E-01		4.2E-02	6.0E+00	9.3E+00		3.6E+00	2.0E-01
1.8E+00	I	5.1E-04	I										Hexachlorocyclohexane, Technical	608-73-1	4.3E-02	6.1E-02		2.5E-02					
		6.0E-03	I	2.0E-04	I	V							Hexachlorocyclopentadiene	77-47-4					1.2E+02	4.2E+01	4.2E-01	4.1E-01	5.0E+01
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I	V					Hexachloroethane	67-72-1	1.9E+00	1.7E+00	5.1E-01	3.3E-01	1.4E+01	1.4E+01	6.3E+01	6.2E+00	
		3.0E-04	I										Hexachlorophene	70-30-4					6.0E+00			6.0E+00	
1.1E-01	I	3.0E-03	I										Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	7.1E-01	8.6E+01		7.0E-01	6.0E+01	8.0E+03		6.0E+01	
		1.0E-05	I	V									Hexamethylene Diisocyanate, 1,6-	822-06-0							2.1E-02	2.1E-02	
		4.0E-04	P										Hexamethylphosphoramide	680-31-9					8.0E+00	2.0E+03		8.0E+00	
		7.0E-01	I	V									Hexane, N-	110-54-3							1.5E+03	1.5E+03	
		2.0E+00	P										Hexanedioic Acid	124-04-9					4.0E+04	1.1E+07		4.0E+04	
		5.0E-03	I	3.0E-02	I	V							Hexanone, 2-	591-78-6					1.0E+02	2.8E+03	6.3E+01	3.8E+01	
		3.3E-02	I										Hexazinone	51235-04-2					6.6E+02	2.4E+04		6.4E+02	
		2.5E-02	I										Hexythiazox	78587-05-0					5.0E+02	1.4E+02		1.1E+02	
		3.0E-04	I										Hydramethylnon	67485-29-4					6.0E+00	5.1E+02		5.9E+00	
3.0E+00	I	4.9E-03	I										Hydrazine	302-01-2	2.6E-02	1.1E+02	1.1E-03	1.1E-03			6.3E-02	6.3E-02	
3.0E+00	I	4.9E-03	I										Hydrazine Sulfate	10034-93-2	2.6E-02	4.9E+00		2.6E-02					
		2.0E-02	I	V									Hydrogen Chloride	7647-01-0							4.2E+01	4.2E+01	
		4.0E-02	C	1.4E-02	C	V							Hydrogen Fluoride	7664-39-3					8.0E+02	1.8E+05	2.9E+01	2.8E+01	
		2.0E-03	I	V									Hydrogen Sulfide	7783-06-4							4.2E+00	4.2E+00	
6.0E-02	P	4.0E-02	P										Hydroquinone	123-31-9	1.3E+00	1.2E+02		1.3E+00	8.0E+02	7.9E+04		7.9E+02	
		1.3E-02	I										Imazalil	35554-44-0					2.6E+02	6.8E+02		1.9E+02	
		2.5E-01	I										Imazaquin	81335-37-7					5.0E+03	2.6E+05		4.9E+03	
		2.5E-01	I										Imazethapyr	81335-77-5								4.7E+03	
		1.0E-02	A										Iodine	7553-56-2					2.0E+02	4.6E+04		2.0E+02	
		4.0E-02	I										Iprodione	36734-19-7					8.0E+02	9.1E+03		7.4E+02	
		7.0E-01	P										Iron	7439-89-6					1.4E+04	3.2E+06		1.4E+04	
		3.0E-01	I										Isobutyl Alcohol	78-83-1					6.0E+03	3.6E+05		5.9E+03	
9.5E-04	I	2.0E-01	I	2.0E+00	C								Isophorone	78-59-1	8.2E+01	1.6E+03		7.8E+01	4.0E+03	8.6E+04		3.8E+03	

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Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1					
SFO (mg/kg-day) ¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RfD _a (mg/kg-day)	k _e y	RfC ₁ (mg/m ³)	k _e y	muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	Inhalation SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	
				1.5E-02	I			V		5.8	1	0.8	Yes	Isopropalin	33820-53-0					3.0E+02	4.6E+01		4.0E+01	
				2.0E+00	P	2.0E-01	P	V		0.05	1	1	Yes	Isopropanol	67-63-0					4.0E+04	6.5E+06		4.1E+02	
				1.0E-01	I					0.27	1	1	Yes	Isopropyl Methyl Phosphonic Acid	1832-54-8					2.0E+03	3.9E+05		2.0E+03	
				5.0E-02	I					3.94	1	0.9	Yes	Isoxaben	82558-50-7					1.0E+03	2.7E+03		7.3E+02	
						3.0E-01	A	V		8	1	0	No	JP-7	NA							6.3E+02	6.3E+02	
				2.0E-03	I					4.81	1	0.9	Yes	Lactofen	77501-63-4					4.0E+01	6.7E+01		2.5E+01	
				5.0E-01	C	1.5E-01	C			0.025	1	Yes	Lead Compounds		7758-97-6	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02	
				8.5E-03	C	1.2E-05	C			1	0.8	Yes	*Lead Chromate		7446-27-7	9.2E+00	1.7E+03		9.1E+00					
				2.8E-01	C	8.0E-05	C			-0.08	1	1	Yes	*Lead acetate		301-04-2	2.8E-01	2.8E+02		2.8E-01				
				8.5E-03	C	1.2E-05	C			1	1	Yes	*Lead and Compounds		7439-92-1							1.5E+01	1.5E+01	
										1	1	No	*Lead subacetate		1335-32-6	9.2E+00			9.2E+00					
				1.0E-07	I			V		4.15	1	0.9	Yes	*Tetraethyl Lead		78-00-2				2.0E-03	3.8E-03		1.3E-03	
				5.0E-06	P			V		2.56	1	1	Yes	Lewisite		541-25-3				1.0E-01	9.1E-01		9.0E-02	
				2.0E-03	I					3.2	1	0.9	Yes	Linuron		330-55-2				4.0E+01	2.0E+02		3.3E+01	
				2.0E-03	P					1	1	Yes	Lithium		7439-93-2				4.0E+01	9.1E+03		4.0E+01		
				5.0E-04	I					3.25	1	1	Yes	MCPA		94-74-6				1.0E+01	3.0E+01		7.5E+00	
				1.0E-02	I					2.79	1	0.9	Yes	MCPB		94-81-5				2.0E+02	5.5E+02		1.5E+02	
				1.0E-03	I					3.13	1	1	Yes	MCPP		93-65-2				2.0E+01	7.1E+01		1.6E+01	
				2.0E-02	I					2.36	1	1	Yes	Malathion		121-75-5				4.0E+02	1.1E+04		3.9E+02	
				1.0E-01	I	7.0E-04	C			1.62	1	1	Yes	Maleic Anhydride		108-31-6				2.0E+03	3.8E+04		1.9E+03	
				5.0E-01	I					-0.84	1	1	Yes	Maleic Hydrazide		123-33-1				1.0E+04	8.9E+06		1.0E+04	
				1.0E-04	P					-0.6	1	1	Yes	Malononitrile		109-77-3				2.0E+00	9.2E+02		2.0E+00	
				3.0E-02	H					1.33	1	0.9	Yes	Mancozeb		8018-01-7				6.0E+02	4.9E+03		5.4E+02	
				5.0E-03	I					0.62	1	1	Yes	Maneb		12427-38-2				1.0E+02	3.6E+03		9.8E+01	
				1.4E-01	I	5.0E-05	I			1	1			Manganese (Diet)		7439-96-5								
				2.4E-02	S	5.0E-05	I			0.04	1	Yes	Manganese (Non-diet)		7439-96-5				4.8E+02	4.4E+03		4.3E+02		
				9.0E-05	H					1.04	1	1	Yes	Mephosfolan		950-10-7				1.8E+00	2.5E+02		1.8E+00	
				3.0E-02	I					-2.82	1	1	No	Mepiquat Chloride		28307-26-4				6.0E+02			6.0E+02	
				3.0E-04	I	3.0E-04	S			-0.22	0.07	1	Yes	*Mercuric Chloride (and other Mercury salts)		7487-94-7				6.0E+00	9.6E+01		5.7E+00	2.0E+00
						3.0E-04	I	V		0.62	1	1	Yes	*Mercury (elemental)		7439-97-6						6.3E-01	6.3E-01	2.0E+00
				1.0E-04	I					1	1	Yes	*Methyl Mercury		22967-92-6				2.0E+00	4.6E+02		2.0E+00		
				8.0E-05	I					0.71	1	1	Yes	*Phenylmercuric Acetate		62-38-4				1.6E+00	5.7E+02		1.6E+00	
				3.0E-05	I			V		7.67	1	0.3	No	Merphos		150-50-5				6.0E-01			6.0E-01	
				3.0E-05	I					5.7	1	0.9	Yes	Merphos Oxide		78-48-8				6.0E-01	9.9E-02		8.5E-02	
				6.0E-02	I					1.65	1	1	Yes	Metalaxyl		57837-19-1				1.2E+03	6.4E+04		1.2E+03	
				1.0E-04	I	3.0E-02	P	V		0.68	1	1	Yes	Methacrylonitrile		126-98-7				2.0E+00	1.3E+02		6.3E+01	1.9E+00
				5.0E-05	I					-0.8	1	1	Yes	Methamidophos		10265-92-6				1.0E+00	1.0E+03		1.0E+00	
				2.0E+00	I	2.0E+01	I	V		-0.77	1	1	Yes	Methanol		67-56-1				4.0E+04	1.8E+07		4.2E+04	2.0E+04
				1.0E-03	I					2.2	1	1	Yes	Methidathion		950-37-8				2.0E+01	5.8E+02		1.9E+01	
				2.5E-02	I					0.6	1	1	Yes	Methomyl		16752-77-5				5.0E+02	6.8E+04		5.0E+02	
4.9E-02	C	1.4E-05	C							1.47	1	1	Yes	Methoxy-5-nitroaniline, 2-		99-59-2	1.6E+00	5.4E+01		1.5E+00				
				5.0E-03	I					5.08	1	0.8	Yes	Methoxychlor		72-43-5				1.0E+02	5.9E+01		3.7E+01	4.0E+01
				8.0E-03	P	1.0E-03	P	V		0.1	1	1	Yes	Methoxyethanol Acetate, 2-		110-49-6				1.6E+02	3.5E+04		2.1E+00	
				5.0E-03	P	2.0E-02	I	V		-0.77	1	1	Yes	Methoxyethanol, 2-		109-86-4				1.0E+02	6.3E+04		4.2E+01	2.9E+01
				1.0E+00	X			V		0.18	1	1	Yes	Methyl Acetate		79-20-9				2.0E+04	2.9E+06		2.0E+04	
						2.0E-02	P	V		0.8	1	1	Yes	Methyl Acrylate		96-33-3							4.2E+01	4.2E+01
				6.0E-01	I	5.0E+00	I	V		0.29	1	1	Yes	Methyl Ethyl Ketone (2-Butanone)		78-93-3				1.2E+04	1.5E+06		1.0E+04	5.6E+03
				1.0E-03	X	1.0E-03	P	2.0E-05	X	V	-1.05	1	1	Yes	Methyl Hydrazine		60-34-4	5.6E-03	5.6E-03	2.0E+01	1.5E+04		4.2E-02	4.2E-02
						3.0E+00	I	V		1.31	1	1	Yes	Methyl Isobutyl Ketone (4-methyl-2-pentanone)		108-10-1						6.3E+03	6.3E+03	
				1.0E-03	C	V				0.79	1	1	Yes	Methyl Isocyanate		624-83-9						2.1E+00	2.1E+00	
				1.4E+00	I	7.0E-01	I	V		1.38	1	1	Yes	Methyl Methacrylate		80-62-6				2.8E+04	7.7E+05		1.5E+03	1.4E+03
				2.5E-04	I					2.86	1	1	Yes	Methyl Parathion		298-00-0				5.0E+00	4.1E+01		4.5E+00	
				6.0E-02	X					-0.7	1	1	Yes	Methyl Phosphonic Acid		993-13-5				1.2E+03	1.2E+06		1.2E+03	
9.9E-02	C	2.8E-05	C							3.44	1	0.8	Yes	Methyl Styrene (Mixed Isomers)		25013-15-4				1.2E+02	4.3E+01		8.3E+01	2.3E+01
										-0.66	1	1	Yes	Methyl methanesulfonate		66-27-3	7.9E-01	4.8E+02		7.9E-01				
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		0.94	1	1	Yes	Methyl tert-Butyl Ether (MTBE)		1634-04-4	4.3E+01	2.0E+03	2.2E+01	1.4E+01			6.3E+03	6.3E+03
				3.0E-04	X					-2.06	1	1	Yes	Methyl-1,4-benzenediamine dihydrochloride, 2-		615-45-2				6.0E+00	5.9E+04		6.0E+00	
9.0E-03	P			2.0E-02	X					1.87	1	1	Yes	Methyl-5-Nitroaniline, 2-		99-55-8	8.7E+00	1.4E+02		8.2E+00	4.0E+02	7.3E+03		3.8E+02
8.3E+00	C	2.4E-03	C							-0.92	1	1	Yes	Methyl-N-nitro-N-nitrosoguanidine, N-		70-25-7	9.4E-03	1.1E+01		9.4E-03				
1.3E-01	C	3.7E-05	C							1.62	1	1	Yes	Methylaniline Hydrochloride, 2-		636-21-5	6.0E-01	3.9E+03		6.0E-01				
				1.0E-02	A					-1.18	1	1	Yes	Methylarsonic acid		124-58-3				2.0E+02	3.6E+05		2.0E+02	
				2.0E-04	X																			

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Toxicity and Chemical-specific Information										Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e RfD _a (mg/kg-day)	k _e RfC _i (mg/m ³) ⁻¹	k _e v _o muta- gen	LOGP	GIABS	FA	In	EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (µg/L)	Dermal SL TR=1E-06 (µg/L)	Inhalation SL TR=1E-06 (µg/L)	Carcinogenic SL TR=1E-06 (µg/L)	Ingestion SL Child THQ=1 (µg/L)	Dermal SL Child THQ=1 (µg/L)	Inhalation SL Child THQ=1 (µg/L)	Noncarcinogenic SL Child THI=1 (µg/L)	MCL (ug/L)		
1.0E-01 2.2E+01	X C	3.0E-04 C	X							Methylbenzene-1,4-diamine sulfate, 2-Methylcholanthrene, 3-	615-50-9 56-49-5	7.8E-01 1.1E-03			7.8E-01 1.1E-03	6.0E+00			6.0E+00			
2.0E-03 1.0E-01 4.6E-02	I P I	1.0E-08 4.3E-04 1.3E-05	I C	I P C	6.0E-03 2.0E-03	I P	I M M	1.25 3.91 4.37	1 1 1	Yes Yes Yes	Methylene Chloride Methylene-bis(2-chloroaniline), 4,4'-Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	75-09-2 101-14-4 101-61-1	1.3E+01 2.5E-01 1.7E+00	3.5E+02 4.3E-01 6.7E-01	2.0E+02 1.1E+01 4.8E-01	1.2E+02 4.0E+01	3.7E+03 7.5E+01	1.3E+03 2.0E-01	1.1E+02 2.6E+01	5.0E+00		
1.6E+00	C	4.6E-04 C			2.0E-02 6.0E-04	C I		1.59 5.22 3.48	1 1 1	Yes Yes Yes	Methylenebisbenzenamine, 4,4'-Methylenediphenyl Diisocyanate Methylstyrene, Alpha-	101-77-9 101-68-8 98-83-9	4.9E-02	1.7E+00	4.7E-02							
					7.0E-02	H																
					1.5E-01 2.5E-02 2.5E-01	I I I		3.13 1.7 2.2	1 1 1	Yes Yes Yes	Metolachlor Metribuzin Metsulfuron-methyl	51218-45-2 21087-64-9 74223-64-6										
1.8E+01	C	5.1E-03 C			3.0E+00 2.0E-04 2.0E-03	P I I		6.1 6.89 3.21	1 1 1	No No Yes	Mineral oils Mirex Molinate	8012-95-1 2385-85-5 2212-67-1	4.3E-03		1.1E-03	8.8E-04	6.0E+04 4.0E+00 4.0E+01			6.0E+04 4.0E+00 3.0E+01		
					5.0E-03 1.0E-01 2.0E-03	I I P			1 1 1	Yes Yes Yes	Molybdenum Monochloramine Monomethylaniline	7439-98-7 10599-90-3 100-61-8								4.0E+03		
					2.5E-02 3.0E-04 2.0E-03	I X I		2.94 4.04 1.38	1 1 1	Yes Yes Yes	Myclobutanil N,N'-Diphenyl-1,4-benzenediamine Naled	88671-89-0 74-31-7 300-76-5										
1.8E+00	C	0.0E+00 C			3.0E-02 1.0E-01	X I	1.0E-01 P V	2.28 3.36	1 1	No Yes Yes	Naphtha, High Flash Aromatic (HFAN) Naphthylamine, 2-Napropamide	64742-95-6 91-59-8 15299-99-7	4.3E-02	3.6E-01	3.9E-02							
					2.6E-04 2.6E-04 2.6E-04	C C C	1.1E-02 C 1.4E-05 C 1.4E-05 C V	-1.38 -2.12	1 1 1	Yes Yes Yes	Nickel Acetate Nickel Carbonate Nickel Carbonyl	373-02-4 3333-67-3 13463-39-3			2.2E-02	2.2E-02	2.2E+02 2.2E+02 2.2E+02	6.8E+05 1.4E+06	2.9E-02	2.2E+02 2.2E+02 2.9E-02		
					2.6E-04 2.6E-04 2.4E-04	C C I	1.1E-02 C 1.4E-05 C 1.4E-05 C		0.04 0.04 0.04	1 1 0	Yes Yes Yes	Nickel Hydroxide Nickel Oxide Nickel Refinery Dust	12054-48-7 1313-99-1 NA				2.2E+02 2.2E+02 2.2E+02	2.0E+03 2.0E+03 1.0E+04		2.0E+02 2.0E+02 2.2E+02		
1.7E+00	C	4.8E-04 C			2.6E-04 4.8E-04 2.6E-04	I I C	2.0E-02 I 9.0E-05 A 1.1E-02 C 1.4E-05 C 1.4E-05 C	0.04 0.04 1 0	Yes Yes Yes	Nickel Soluble Salts Nickel Subsulphide Nickelocene	7440-02-0 12035-72-2 1271-28-9	4.6E-02	1.7E+00	4.5E-02								
					1.6E+00 1.0E-01	I I			1 1	Yes Yes	Nitrate Nitrate + Nitrite (as N) Nitrite	14797-55-8 NA 14797-65-0										
2.0E-02	P				1.0E-02 4.0E-03 2.0E-03	X P I	5.0E-05 6.0E-03 9.0E-03	1.85 1.39 1.85	1 1 1	Yes Yes Yes	Nitroaniline, 2-Nitroaniline, 4-Nitrobenzene	88-74-4 100-01-6 98-95-3	3.9E+00	1.2E+02	1.4E-01	3.8E+00 1.4E-01						
1.3E+00	C	3.7E-04 C			3.0E+03 7.0E-02	P H		-4.56 -0.47 0.23	1 1 1	No Yes Yes	Nitrocellulose Nitrofurantoin Nitrofurazone	9004-70-0 67-20-9 59-87-0	6.0E-02	1.7E+01	6.0E-02							
1.7E-02	P				1.0E-04 1.0E-01	P I		1.62 -0.89 -0.35	1 1 1	Yes Yes Yes	Nitroglycerin Nitroguanidine Nitromethane	55-63-0 556-88-7 75-52-5	4.6E+00	1.8E+02		4.5E+00	2.0E+00 2.0E+03	8.7E+01 1.8E+06				
					8.8E-06	P	5.0E-03 P V															
2.7E+01 1.2E+02	C C	7.7E-03 3.4E-02	C C		2.7E-03 2.0E-02	H I V		0.93 0.23 -0.03	1 1 1	Yes Yes Yes	Nitropropane, 2-Nitroso-N-ethylurea, N-Nitroso-N-methylurea, N-	79-46-9 759-73-9 684-93-5	9.3E-04 2.1E-04	1.5E-01 4.6E-02	2.1E-03	2.1E-03 9.2E-04 2.1E-04						
5.4E+00 7.0E+00 2.8E+00	I I I	1.6E-03 2.0E-03 8.0E-04	I C C				V	2.63 1.36 -1.28	1 1 1	Yes Yes Yes	Nitroso-di-N-butylamine, N-Nitroso-di-N-propylamine, N-Nitrosodiethanolamine, N-	924-16-3 621-64-7 1116-54-7	1.4E-02 1.1E-02 2.8E-02	7.9E-02 3.5E-01 8.1E+01	3.5E-03	2.7E-03 1.1E-02 2.8E-02						
1.5E+02 5.1E+01 4.9E-03	I I I	4.3E-02 1.4E-02 2.6E-06	I I C		8.0E-06 4.0E-05	P X V	M M	0.48 -0.57 3.13	1 1 1	Yes Yes Yes	Nitrosodiethylamine, N-Nitrosodimethylamine, N-Nitrosodiphenylamine, N-	55-18-5 62-75-9 86-30-6	1.7E-04 4.9E-04 1.6E+01	1.7E-02 2.0E-01 5.2E+01	1.7E-04 1.1E-04 1.2E+01	1.6E-01 7.4E+01 8.3E-02			5.5E-02			
2.2E+01 6.7E+00 9.4E+00	I C C	6.3E-03 1.9E-03 2.7E-03	C C C				V	0.04 -0.44 0.36	1 1 1	Yes Yes Yes	Nitrosomethylethylamine, N-Nitrosomorpholine [N-] Nitrosopiperidine [N-]	10595-95-6 59-89-2 100-75-4	3.5E-03 1.2E-02 8.3E-03	6.4E-01 5.3E+00 1.1E+00	8.9E-04	7.1E-04 1.2E-02 8.2E-03						
2.1E+00 2.2E-01	I P	6.1E-04 9.0E-04	I P					-0.19 2.45 2.3	1 1 1	Yes Yes Yes	Nitrosopyrrolidine, N-Nitrotoluene, m-Nitrotoluene, o-	930-55-2 99-08-1 88-72-2	3.7E-02 3.5E-01	1.0E+01 2.8E+00	3.7E-02 3.1E-01	2.0E+00 1.8E+01	1.4E+01 1.5E+02			1.7E+00 1.6E+01		
1.6E-02	P				4.0E-03 3.0E-04 4.0E-02	P X I	2.0E-02 P V	2.37 5.65 2.3	1 1 1	Yes No Yes	Nitrotoluene, p-Nonane, n-Norflurazon	99-99-0 111-84-2 27314-13-2	4.9E+00	3.4E+01	4.3E+00							
					3.0E-03 5.0E-02	I I		8.71 0.16	1 1	No Yes	Octabromodiphenyl Ether Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	32536-52-0 2691-41-0										

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SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e IUR (ug/m ³) ⁻¹	RfD _a (mg/kg-day)	k _e IUR (ug/m ³) ⁻¹	RfC _i (mg/m ³)	k _e IUR (ug/m ³) ⁻¹	v _o muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	Inhalation SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)		
			2.0E-03	H				-1.01	1	1	Yes	Octamethylpyrophosphoramide	152-16-9					4.0E+01	1.4E+05		4.0E+01			
			5.0E-02	I				3.73	1	0.9	Yes	Oryzalin	19044-88-3					1.0E+03	4.1E+03		8.1E+02			
			5.0E-03	I				4.8	1	0.8	Yes	Oxadiazon	19666-30-9					1.0E+02	9.0E+01		4.7E+01			
			2.5E-02	I				-0.47	1	1	Yes	Oxamyl	23135-22-0					5.0E+02	5.1E+05		5.0E+02	2.0E+02		
			3.0E-03	I				4.73	1	0.8	Yes	Oxyfluorfen	42874-03-3					6.0E+01	6.7E+01		3.2E+01			
			1.3E-02	I				3.2	1	0.9	Yes	Paclobutrazol	76738-62-0					2.6E+02	1.7E+03		2.3E+02			
			4.5E-03	I				-4.5	1	1	No	Paraquat Dichloride	1910-42-5					9.0E+01			9.0E+01			
			6.0E-03	H				3.83	1	0.9	Yes	Parathion	56-38-2					1.2E+02	3.0E+02		8.6E+01			
			5.0E-02	H		V		3.83	1	1	Yes	Pebulate	1114-71-2					1.0E+03	1.3E+03		5.6E+02			
			4.0E-02	I				5.2	1	0.9	Yes	Pendimethalin	40487-42-1					8.0E+02	2.4E+02		1.8E+02			
			2.0E-03	I		V		6.84	1	0.6	No	Pentabromodiphenyl Ether	32534-81-9					4.0E+01			4.0E+01			
			1.0E-04	I				7.66	1	0.6	No	Pentabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-99)	60348-60-9					2.0E+00			2.0E+00			
			8.0E-04	I		V		5.17	1	0.9	Yes	Pentachlorobenzene	608-93-5					1.6E+01	3.9E+00		3.2E+00			
9.0E-02	P					V		3.22	1	1	Yes	Pentachloroethane	76-01-7	8.7E-01	2.5E+00		6.5E-01							
2.6E-01	H		3.0E-03	I		V		4.64	1	0.9	Yes	Pentachloronitrobenzene	82-68-8	3.0E-01	2.0E-01		1.2E-01	6.0E+01	4.4E+01		2.6E+01			
4.0E-01	I	5.1E-06	C	5.0E-03	I			5.12	1	0.9	Yes	Pentachlorophenol	87-86-5	1.9E-01	5.2E-02		4.1E-02	1.0E+02	2.9E+01		2.3E+01	1.0E+00		
4.0E-03	X		2.0E-03	P				2.38	1	1	Yes	Pentaerythritol tetranitrate (PETN)	78-11-5	1.9E+01	4.3E+02		1.9E+01	4.0E+01	9.6E+02		3.9E+01			
					1.0E+00	P	V	3.39	1	1	Yes	Pentane, n-Perchlorates	109-66-0							2.1E+03	2.1E+03			
			7.0E-04	I					1	1	Yes	*Ammonium Perchlorate	7790-98-9					1.4E+01	3.2E+03		1.4E+01			
			7.0E-04	I					1	1	Yes	*Lithium Perchlorate	7791-03-9					1.4E+01	3.2E+03		1.4E+01			
			7.0E-04	I					1	1	Yes	*Perchlorate and Perchlorate Salts	14797-73-0					1.4E+01	3.2E+03		1.4E+01	1.5E+01(F)		
			7.0E-04	I					1	1	Yes	*Potassium Perchlorate	7778-74-7					1.4E+01	1.6E+03		1.4E+01			
			7.0E-04	I					1	1	Yes	*Sodium Perchlorate	7601-89-0					1.4E+01	3.2E+03		1.4E+01			
			2.0E-02	P		V		2.41	1	1	Yes	Perfluorobutane Sulfonate	375-73-5					4.0E+02	8.3E+03		3.8E+02			
			5.0E-02	I				6.5	1	0.6	No	Permethrin	52645-53-1					1.0E+03			1.0E+03			
2.2E-03	C	6.3E-07	C					1.58	1	1	Yes	Phenacetin	62-44-2	3.5E+01	1.1E+03		3.4E+01	5.0E+03	1.9E+04		4.0E+03			
			2.5E-01	I				3.59	1	0.9	Yes	Phenmedipham	13684-63-4											
			3.0E-01	I	2.0E-01	C		1.46	1	1	Yes	Phenol	108-95-2					6.0E+03	1.4E+05		5.8E+03			
			5.0E-04	X				4.15	1	1	Yes	Phenothiazine	92-84-2					1.0E+01	7.6E+00		4.3E+00			
			6.0E-03	I				-0.33	1	1	Yes	Phenylenediamine, m-	108-45-2					1.2E+02	4.8E+04		1.2E+02			
4.7E-02	H							0.15	1	1	Yes	Phenylenediamine, o-	95-54-5	1.7E+00	2.9E+02		1.6E+00							
			1.9E-01	H				-0.3	1	1	Yes	Phenylenediamine, p-	106-50-3					3.8E+03	1.4E+06		3.8E+03			
1.9E-03	H							3.09	1	1	Yes	Phenylphenol, 2-	90-43-7	4.0E+01	1.2E+02		3.0E+01							
			2.0E-04	H				3.56	1	0.9	Yes	Phorate	298-02-2					4.0E+00	1.2E+01		3.0E+00			
					3.0E-04	I	V	-0.71	1	1	Yes	Phosgene	75-44-5											
			2.0E-02	I				2.78	1	1	Yes	Phosmet	732-11-6					4.0E+02	5.3E+03		3.7E+02			
												Phosphates, Inorganic												
			4.9E+01	P					1	1	Yes	*Aluminum metaphosphate	13776-88-0					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	0	Yes	*Ammonium polyphosphate	68333-79-9					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Calcium pyrophosphate	7790-76-3					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Diammonium phosphate	7783-28-0					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Dicalcium phosphate	7757-93-9					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Dimagnesium phosphate	7782-75-4					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Dipotassium phosphate	7758-11-4					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Disodium phosphate	7558-79-4					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Monoaluminum phosphate	13530-50-2					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Monoammonium phosphate	7722-76-1					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Monocalcium phosphate	7758-23-8					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Monomagnesium phosphate	7757-86-0					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Monopotassium phosphate	7778-77-0					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Monosodium phosphate	7558-80-7					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Polyphosphoric acid	8017-16-1					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	0.9	Yes	*Potassium triphosphate	13845-36-8					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Sodium acid pyrophosphate	7758-16-9					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Sodium aluminum phosphate (acidic)	7785-88-8					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	0	Yes	*Sodium aluminum phosphate (anhydrous)	10279-59-1					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	0.8	Yes	*Sodium aluminum phosphate (tetrahydrate)	10305-76-7					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	0.9	Yes	*Sodium hexametaphosphate	10124-56-8					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Sodium polyphosphate	68915-31-1					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Sodium trimetaphosphate	7785-84-4					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Sodium triphosphate	7758-29-4					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Tetrapotassium phosphate	7320-34-5					9.7E+05	2.2E+08		9.7E+05			
			4.9E+01	P					1	1	Yes	*Tetrasodium pyrophosphate	7722-88-5					9.7E+05	2.2E+08		9.7E+05			

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																										
Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1							
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (mg/kg-day)	RfD _a (mg/kg-day)	k _e (mg/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _v (ug/m ³) ⁻¹	o muta-	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	Inhalation SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)			
	4.9E+01	P									1	0.8	Yes	*Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5					9.7E+05	2.2E+08		9.7E+05			
	4.9E+01	P									1	1	Yes	*Tricalcium phosphate	7758-87-4					9.7E+05	2.2E+08		9.7E+05			
	4.9E+01	P									1	1	Yes	*Trimagnesium phosphate	7757-87-1					9.7E+05	2.2E+08		9.7E+05			
	4.9E+01	P									1	1	Yes	*Tripotassium phosphate	7778-53-2					9.7E+05	2.2E+08		9.7E+05			
	4.9E+01	P									1	1	Yes	*Trisodium phosphate	7601-54-9					9.7E+05	2.2E+08		9.7E+05			
	3.0E-04	I	3.0E-04	I	V				-0.27		1	1	Yes	Phosphine	7803-51-2					6.0E+00	1.4E+03	6.3E-01	5.7E-01			
	4.9E+01	P	1.0E-02	I							1	1	Yes	Phosphoric Acid	7664-38-2					9.7E+05	2.2E+08		9.7E+05			
	2.0E-05	I			V				3.08		1	1	Yes	Phosphorus, White	7723-14-0					4.0E-01	9.1E+01		4.0E-01			
														Phthalates												
1.4E-02	I	2.4E-06	C	2.0E-02	I				7.6	1	0.8	No		*Bis(2-ethylhexyl)phthalate	117-81-7	5.6E+00			5.6E+00	4.0E+02			4.0E+02	6.0E+00		
	1.0E+00	I							4.15	1	0.9	Yes		*Butylphthalyl Butylglycolate	85-70-1					2.0E+04	4.1E+04		1.3E+04			
	1.0E-01	I							4.5	1	0.9	Yes		*Dibutyl Phthalate	84-74-2					2.0E+03	1.6E+03		9.0E+02			
	8.0E-01	I							2.42	1	1	Yes		*Diethyl Phthalate	84-66-2					1.6E+04	2.0E+05		1.5E+04			
	1.0E-01	I				V			2.25	1	1	Yes		*Dimethylterephthalate	120-61-6					2.0E+03	2.7E+04		1.9E+03			
	1.0E-02	P							8.1	1	0	No		*Octyl Phthalate, di-N-	117-84-0					2.0E+02			2.0E+02			
	1.0E+00	H							2	1	1	Yes		*Phthalic Acid, P-	100-21-0					2.0E+04	3.3E+05		1.9E+04			
	2.0E+00	I	2.0E-02	C					1.6	1	1	Yes		*Phthalic Anhydride	85-44-9					4.0E+04	1.1E+06		3.9E+04			
	7.0E-02	I							1.9	1	1	Yes		Picloram	1918-02-1					1.4E+03	4.3E+04		1.4E+03	5.0E+02		
	1.0E-04	X							0.93	1	1	Yes		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					2.0E+00	2.1E+02		2.0E+00			
	9.0E-04	X							1.44	1	1	Yes		Picric Acid (2,4,6-Trinitrophenol)	88-89-1					1.8E+01	1.2E+03		1.8E+01			
	1.0E-02	I							4.2	1	0.9	Yes		Pirimiphos, Methyl	29232-93-7					2.0E+02	3.1E+02		1.2E+02			
3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0	No		Polybrominated Biphenyls	59536-65-1	2.6E-03			2.6E-03	1.4E-01			1.4E-01			
														Polychlorinated Biphenyls (PCBs)												
7.0E-02	S	2.0E-05	S	7.0E-05	I			V	5.69	1	0	No		*Aroclor 1016	12674-11-2	1.1E+00		2.8E-01	2.2E-01	1.4E+00			1.4E+00			
2.0E+00	S	5.7E-04	S					V	4.65	1	1	Yes		*Aroclor 1221	11104-28-2	3.9E-02	1.2E-02	9.8E-03	4.7E-03							
2.0E+00	S	5.7E-04	S					V	4.4	1	1	Yes		*Aroclor 1232	11141-16-5	3.9E-02	1.2E-02	9.8E-03	4.7E-03							
2.0E+00	S	5.7E-04	S					V	6.34	1	0.7	No		*Aroclor 1242	53469-21-9	3.9E-02		9.8E-03	7.8E-03							
2.0E+00	S	5.7E-04	S					V	6.2	1	0	No		*Aroclor 1248	12672-29-6	3.9E-02		9.8E-03	7.8E-03							
2.0E+00	S	5.7E-04	S	2.0E-05	I			V	6.5	1	0.5	No		*Aroclor 1254	11097-69-1	3.9E-02		9.8E-03	7.8E-03	4.0E-01			4.0E-01			
2.0E+00	S	5.7E-04	S					V	7.55	1	0	No		*Aroclor 1260	11096-82-5	3.9E-02		9.8E-03	7.8E-03							
	6.0E-04	X			V				6.34	1	0.7	No		*Aroclor 5460	11126-42-4					1.2E+01			1.2E+01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	8.27	1	0	No		*Heptachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 189)	39635-31-9	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.5	1	0	No		*Hexachlorobiphenyl, 2,3',4,4',5,5'-(PCB 167)	52663-72-6	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.6	1	0	No		*Hexachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 152)	69782-90-7	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.6	1	0	No		*Hexachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 156)	38380-08-4	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V	7.41	1	0.1	No		*Hexachlorobiphenyl, 3,3',4,4',5,5'-(PCB 169)	32774-16-6	2.0E-05		4.9E-06	4.0E-06	4.7E-04		2.8E-03	4.0E-04			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	6.98	1	0.4	No		*Pentachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 123)	65510-44-3	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.12	1	0.3	No		*Pentachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 118)	31508-00-6	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	6.79	1	0.5	No		*Pentachlorobiphenyl, 2,3,3',4,4'-(PCB 105)	32598-14-4	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	6.98	1	0.4	No		*Pentachlorobiphenyl, 2,3,4,4',5-(PCB 114)	74472-37-0	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V	6.98	1	0.4	No		*Pentachlorobiphenyl, 3,3',4,4',5-(PCB 126)	57465-28-8	6.0E-06		1.5E-06	1.2E-06	1.4E-04		8.3E-04	1.2E-04			
2.0E+00	I	5.7E-04	I					V	7.1	1	0.7			*Polychlorinated Biphenyls (high risk)	1336-36-3											
4.0E-01	I	1.0E-04	I					V	7.1	1	0.7	No		*Polychlorinated Biphenyls (low risk)	1336-36-3	1.9E-01		5.6E-02	4.4E-02					5.0E-01		
7.0E-02	I	2.0E-05	I					V	7.1	1	0.7			*Polychlorinated Biphenyls (lowest risk)	1336-36-3											
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E		6.63	1	0.6	No		*Tetrachlorobiphenyl, 3,3',4,4'-(PCB 77)	32598-13-3	6.0E-03			6.0E-03	1.4E-01			1.4E-01			
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V	6.34	1	0.7	No		*Tetrachlorobiphenyl, 3,4,4',5-(PCB 81)	70362-50-4	2.0E-03		4.9E-04	4.0E-04	4.7E-02		2.8E-01	4.0E-02			
									10.46	1	0	No		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9											
														Polynuclear Aromatic Hydrocarbons (PAHs)												
	6.0E-02	I			V				3.92	1	1	Yes		*Acenaphthene	83-32-9					1.2E+03	9.6E+02		5.3E+02			
	3.0E-01	I			V				4.45	1	1	Yes		*Anthracene	120-12-7					6.0E+03	2.5E+03		1.8E+03			
7.3E-01	E	1.1E-04	C					V	5.76	1	1	No		*Benz[a]anthracene	56-55-3	3.4.										

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Toxicity and Chemical-specific Information												Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e IUR (ug/m ³) ⁻¹	k _e IUR (ug/m ³) ⁻¹	RfD _a (mg/kg-day)	k _e IUR (ug/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e IUR (ug/m ³) ⁻¹	muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (µg/L)	Dermal SL TR=1E-06 (µg/L)	Inhalation SL TR=1E-06 (µg/L)	Carcinogenic SL TR=1E-06 (µg/L)	Ingestion SL Child THQ=1 (µg/L)	Dermal SL Child THQ=1 (µg/L)	Inhalation SL Child THQ=1 (µg/L)	Noncarcinogenic SL Child THI=1 (µg/L)	MCL (ug/L)	
	4.0E-03	I	V		3.86	1	V	3.3	1	1	Yes	*Methylnaphthalene, 2- *Naphthalene	91-57-6 91-20-3					8.0E+01 4.0E+02	6.5E+01 7.0E+02	6.3E+00 6.3E+00	3.6E+01 6.1E+00		
1.2E+00	C	1.1E-04	C																				
	3.0E-02	I	V		4.75	1	0.9	Yes	4.88	1	1	Yes	*Nitropyrene, 4- *Pyrene	57835-92-4 129-00-0	6.5E-02	2.7E-02		1.9E-02	6.0E+02 4.0E+02	1.5E+02 2.8E+05		1.2E+02 4.0E+02	
1.5E-01	I																						
	6.0E-03	H	V		4.1	1	0.9	Yes	5.58	1	0.8	Yes	Potassium Perfluorobutane Sulfonate	29420-49-3									
	1.5E-02	I			2.99	1	1	Yes	3.51	1	0.9	Yes	Prochloraz	67747-09-5	5.2E-01	1.4E+00		3.8E-01	1.8E+02 1.2E+02 3.0E+02	5.1E+02 3.3E+01 1.6E+03		1.3E+02 2.6E+01 2.5E+02	
	4.0E-03	I							2.18	1	1	Yes	Prometryn	7287-19-6					8.0E+01	2.3E+02		6.0E+01	
	1.3E-02	I			1.52	1	1	Yes	3.07	1	1	Yes	Propachlor	1918-16-7					2.6E+02	4.3E+03		2.5E+02	
	4.0E-03	I			5	1	0.8	Yes	2.93	1	1	Yes	Propanediol, 1,2-	114-26-1					8.0E+01	3.6E+03		7.8E+01	
	5.0E-03	I			3.07	1	1	Yes	5	1	0.8	Yes	Propargite	2312-35-8					1.0E+02	4.4E+02		8.2E+01	
	2.0E-02	I			5	1	0.8	Yes	2.0E-03	I	V	Yes	Propargyl Alcohol	107-19-7					4.0E+02	2.7E+02		1.6E+02	
	2.0E-02	I			2.93	1	1	Yes	2.0E-03	I	V	Yes	Propazine	139-40-2					4.0E+01	1.2E+04		4.0E+01	
	2.0E-02	I			2.6	1	1	Yes	2.0E-02	I	V	Yes	Propazine	139-40-2					4.0E+02	2.4E+03		3.4E+02	
	1.3E-02	I			3.72	1	0.9	Yes	2.6	1	1	Yes	Propham	122-42-9					4.0E+02	2.8E+03		3.5E+02	
					3.72	1	0.9	Yes	1.3E-02	I	V	Yes	Propiconazole	60207-90-1					2.6E+02	1.1E+03		2.1E+02	
	8.0E-03	I	V		0.59	1	1	Yes	1.0E-01	X	3.0E+00	X	Yes	Propionaldehyde	123-38-6						1.7E+01	1.7E+01	
	1.0E-01	X	3.0E+00	X	3.69	1	1	Yes	1.0E-01	X	3.0E+00	X	Yes	Propyl benzene	103-65-1				2.0E+03	1.8E+03	2.1E+03	6.6E+02	
	3.0E+00	C	V		1.77	1	1	Yes	2.0E+01	P			Yes	Propylene	115-07-1				6.3E+03		6.3E+03		
	2.0E+01	P			-0.92	1	1	Yes	7.0E-01	H	2.7E-04	A	Yes	Propylene Glycol	57-55-6				4.0E+05	3.2E+08		4.0E+05	
	7.0E-01	H	2.7E-04	A	1.83	1	1	Yes	7.0E-01	H	2.7E-04	A	Yes	Propylene Glycol Dinitrate	6423-43-4								
					-0.49	1	1	Yes					Yes	Propylene Glycol Monomethyl Ether	107-98-2				1.4E+04	3.9E+06	4.2E+03	3.2E+03	
2.4E-01	I	3.7E-06	I		0.03	1	1	Yes	7.5E-02	I	V		Yes	Propylene Oxide	75-56-9	3.2E-01	4.7E+01	1.5E+00	2.7E-01				
	7.5E-02	I			3.43	1	0.9	Yes	1.0E-03	I	V		Yes	Propylamine	23950-58-5								
	1.0E-03	I			0.65	1	1	Yes					Yes	Pyridine	110-86-1								
3.0E+00	I				4.44	1	0.9	Yes	5.0E-04	I			Yes	Quinalphos	13593-03-8	2.6E-02	2.9E-01		2.4E-02	1.0E+01	1.0E+01		5.1E+00
	9.0E-03	I			2.03	1	1	Yes					Yes	Quinoline	91-22-5								
					4.28	1	0.9	Yes					Yes	Quizalofop-ethyl	76578-14-8					1.8E+02	3.8E+02		1.2E+02
	3.0E-02	A			1	0	Yes		3.0E-02	I			Yes	Refractory Ceramic Fibers	NA								
	3.0E-02	I			6.14	1	0.7	Yes	5.0E-02	H	2.0E-02	C	Yes	Resmethrin	10453-86-8					6.0E+02	7.6E+01		6.7E+01
	5.0E-02	H	2.0E-02	C	4.88	1	0.8	Yes					Yes	Ronnel	299-84-3					1.0E+03	6.8E+02		4.1E+02
2.2E-01	C	6.3E-05	C		4.1	1	0.9	Yes	4.0E-03	I			Yes	Rotenone	83-79-4	1.1E-01	6.0E-01		9.6E-02	8.0E+01	2.6E+02		6.1E+01
	5.0E-03	I			3.45	1	1	Yes	5.0E-03	I			Yes	Safrrole	94-59-7					1.0E+02	2.3E+04		1.0E+02
	5.0E-03	I	2.0E-02	C		1	1	Yes	5.0E-03	I	2.0E-02	C	Yes	Selenious Acid	7783-00-8					1.0E+02	2.3E+04		1.0E+02
	5.0E-03	C	2.0E-02	C		1	1	Yes	9.0E-02	I			Yes	Selenium	7782-49-2					1.0E+02	2.3E+04		1.0E+02
	9.0E-02	I			4.38	1	0.9	Yes					Yes	Selenium Sulfide	7446-34-6					1.0E+02	2.3E+04		1.0E+02
													Yes	Sethoxydim	74051-80-2					1.8E+03	2.4E+03		1.0E+03
1.2E-01	H				1	1	Yes		5.0E-03	I			Yes	Silica (crystalline, respirable)	7631-86-9					1.0E+02	1.5E+03		9.4E+01
	5.0E-03	I			0.04	1	Yes		5.0E-03	I			Yes	Silver	7440-22-4					1.0E+02	1.6E+03		9.4E+01
	1.3E-02	I			2.18	1	1	Yes					Yes	Simazine	122-34-9	6.5E-01	9.3E+00		6.1E-01	1.0E+02	1.6E+03		4.0E+00
5.0E-01	C	1.5E-01	C		0.37	1	1	Yes	4.0E-03	I			Yes	Sodium Acifluorfen	62476-59-9					2.6E+02	2.1E+05		2.6E+02
	2.0E-02	C	2.0E-04	C		1	1	Yes	2.0E-02	C	2.0E-04	C	Yes	Sodium Azide	26628-22-8					8.0E+01	1.8E+04		8.0E+01
2.7E-01	H				0.025	1	Yes		2.0E-02	C	2.0E-04	C	Yes	Sodium Dichromate	10588-01-9	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02
	3.0E-02	I			-1.43	1	1	Yes					Yes	Sodium Diethyldithiocarbamate	148-18-5	2.9E-01	8.5E+02		2.9E-01	6.0E+02	1.9E+06		6.0E+02
	5.0E-02	A	1.3E-02	C		1	1	Yes					Yes	Sodium Fluoride	7681-49-4					1.0E+03	2.3E+05		1.0E+03
	2.0E-05	I			-3.78	1	1	No					Yes	Sodium Fluoroacetate	62-74-8					4.0E-01			4.0E-01
	1.0E-03	H				1	1	Yes					Yes	Sodium Metavanadate	13718-26-8					2.0E+01	4.6E+03		2.0E+01
	8.0E-04	P				1	1	Yes					Yes	Sodium Tungstate	13472-45-2					1.6E+01	3.6E+03		1.6E+01
	8.0E-04	P				1	1	Yes					Yes	Sodium Tungstate Dihydrate	10213-10-2					1.6E+01	3.6E+03		1.6E+01
2.4E-02	H				3.53	1	0.9	Yes	5.0E-01	C	1.5E-01	C	Yes	Stirofos (Tetrachlorovinphos)	961-11-5	3.2E+00	1.9E+01		2.8E+00	6.0E+02	3.8E+03		5.2E+02
5.0E-01	C	1.5E-01	C		2.0E-02	C	2.0E-04	C		0.025	1	Yes	Yes	Strontium Chromate	7789-06-2	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02
	6.0E-01	I				1	1	Yes					Yes	Strontium, Stable	7440-24-6					1.2E+04	2.7E+06		1.2E+04
	3.0E-04	I			1.93	1	1	Yes					Yes	Strychnine	57-24-9					6.0E+00	3.2E+02		5.9E+00
	2.0E-01	I	1.0E+00	I	2.95	1	1	Yes					Yes	Styrene	100-42-5					4.0E+03	1.0E+04	2.1E+03	1.2E+03
	3.0E-03	P			3.1	1	1	Yes					Yes	Styrene-Acrylonitrile (SAN) Trimer	NA					6.0E+01	2.4E+02		4.8E+01
	1.0E-03	P	2.0E-03	X	-0.77	1	1	Yes					Yes	Sulfolane	126-33-0					2.0E+01	1.7E+04		2.0E+01
	8.0E-04	P			3.9	1	0.9	Yes					Yes	Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					1.6E+01	3.5E+01		1.1E+01
						1	1	Yes					Yes	Sulfur Trioxide	7446-11-9							2.1E+00	2.1E+00
2.5E-02	I	7.1E-06	I		1.0E-03	C				1	1	Yes	Yes	Sulfuric Acid	7664-93-9	3.1E+00	2.3E+00		1.3E+00	1.0E+03	8.2E+02		4.5E+02
	5.0E-02	H			4.82	1	0.8	Yes					Yes	Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8					6.0E+02	2.4E+03		4.8E+02
	3.0E-02	H			3.3	1	0.9	Yes					Yes	TCMTB	21564-17-0								
	7.0E-02	I			1.79	1	1	Yes					Yes	Tebuthiuron	34014-18-1					1.4E+03	4.7E+04		1.4E+03
	2.0E-02	H			5.96	1	0.7	No					Yes	Temephos	3383-96-8					4.0E+02			4.0E+02

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Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1					
SFO (mg/kg-day) ¹	k _e y	IUR (ug/m ³) ¹	k _e y	RfD _a (mg/kg-day)	k _e y	RfC _i (mg/m ³) ¹	k _e y	muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (µg/L)	Dermal SL TR=1E-06 (µg/L)	Inhalation SL TR=1E-06 (µg/L)	Carcinogenic SL TR=1E-06 (µg/L)	Ingestion SL Child THQ=1 (µg/L)	Dermal SL Child THQ=1 (µg/L)	Inhalation SL Child THQ=1 (µg/L)	Noncarcinogenic SL Child THI=1 (µg/L)	MCL (ug/L)	
1.3E-02									1.89	1	1	Yes	Terbacil	5902-51-2					2.6E+02	7.0E+03		2.5E+02		
2.5E-05	H								4.48	1	0.9	Yes	Terbufos	13071-79-9					5.0E-01	4.5E-01		2.4E-01		
1.0E-03									3.74	1	0.9	Yes	Terbutryn	886-50-0					2.0E+01	4.1E+01		1.3E+01		
1.0E-04	I								6.77	1	0.6	No	Tetrabromodiphenyl ether, 2,2',4,4'-(BDE-47)	5436-43-1					2.0E+00			2.0E+00		
3.0E-04	I								4.64	1	1	Yes	Tetrachlorobenzene, 1,2,4,5-	95-94-3					6.0E+00	2.4E+00		1.7E+00		
2.6E-02	I	7.4E-06	I	3.0E-02	I				2.93	1	1	Yes	Tetrachloroethane, 1,1,1,2-	630-20-6	3.0E+00	1.1E+01	7.6E-01	5.7E-01	6.0E+02	2.4E+03		4.8E+02		
2.0E-01	I	5.8E-05	C	2.0E-02	I				2.39	1	1	Yes	Tetrachloroethane, 1,1,2,2-	79-34-5	3.9E-01	3.3E+00	9.7E-02	7.6E-02	4.0E+02	3.6E+03		3.6E+02		
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V	3.4	1	1	Yes	Tetrachloroethylene	127-18-4	3.7E+01	6.5E+01	2.2E+01	1.1E+01	1.2E+02	2.3E+02	8.3E+01	4.1E+01	5.0E+00	
									4.45	1	0.9	Yes	Tetrachlorophenol, 2,3,4,6-	58-90-2					6.0E+02	3.9E+02		2.4E+02		
2.0E+01	H								4.54	1	0.9	Yes	Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	3.9E-03	2.0E-03		1.3E-03						
5.0E-04	I								3.99	1	0.9	Yes	Tetraethyl Dithiopyrophosphate	3689-24-5					1.0E+01	2.4E+01		7.1E+00		
									8.0E+01	I	V		Tetrafluoroethane, 1,1,1,2-	811-97-2					4.0E+01	2.5E+03		1.7E+05		
2.0E-03	P								1.64	1	1	Yes	Tetryl (Trinitrophenylmethyl)nitramine	479-45-8								3.9E+01		
7.0E-06	X											Yes	Thallium (I) Nitrate	10102-45-1					1.4E-01	3.2E+01		1.4E-01		
1.0E-05	X											Yes	Thallium (Soluble Salts)	7440-28-0					2.0E-01	4.6E+01		2.0E-01	2.0E+00	
6.0E-06	X								-0.17	1	1	Yes	Thallium Acetate	563-68-8					1.2E-01	1.0E+02		1.2E-01		
2.0E-05	X								-0.86	1	1	Yes	Thallium Carbonate	6533-73-9					4.0E-01	3.7E+03		4.0E-01		
6.0E-06	X											Yes	Thallium Chloride	7791-12-0					1.2E-01	2.7E+01		1.2E-01		
2.0E-05	X											Yes	Thallium Sulfate	7446-18-6					4.0E-01	9.1E+01		4.0E-01		
1.3E-02	I								1.56	1	1	Yes	Thiophenol	79277-27-3					2.6E+02	3.5E+04		2.6E+02		
1.0E-02	I								3.4	1	0.9	Yes	Thiodiglycol	28249-77-6					2.0E+02	7.7E+02		1.6E+02		
7.0E-02	X								-0.63	1	1	Yes	Thiodiglycol	111-48-8					1.4E+03	9.7E+05		1.4E+03		
3.0E-04	H								2.16	1	1	Yes	Thiofanox	39196-18-4					6.0E+00	4.4E+01		5.3E+00		
8.0E-02	I								1.4	1	1	Yes	Thiophanate, Methyl	23564-05-8					1.6E+03	2.1E+05		1.6E+03		
5.0E-03	I								1.73	1	1	Yes	Thiram	137-26-8					1.0E+02	4.0E+03		9.8E+01		
6.0E-01	H											Yes	Tin	7440-31-5					1.2E+04	2.7E+06		1.2E+04		
									1.0E-04	A	V		Titanium Tetrachloride	7550-45-0								2.1E-01		
8.0E-02	I	5.0E+00	I	V					2.73	1	1	Yes	Toluene	108-88-3					1.6E+03	5.3E+03	2.1E+04	1.1E+03	1.0E+03	
1.8E-01	X								0.16	1	1	Yes	Toluene-2,5-diamine	95-70-5	4.3E-01	8.2E+01		4.3E-01	4.0E+00	8.3E+02		4.0E+00		
3.0E-02	P								1.39	1	1	Yes	Toluidine, p-	106-49-6	2.6E+00	6.8E+01		2.5E+00	8.0E+01	2.3E+03		7.7E+01		
									6.1	1	1	No	Total Petroleum Hydrocarbons (Aliphatic High)	NA					6.0E+04			6.0E+04		
									3.9	1	1	Yes	Total Petroleum Hydrocarbons (Aliphatic Low)	NA							1.3E+03	1.3E+03		
									5.65	1	1	No	Total Petroleum Hydrocarbons (Aliphatic Medium)	NA					2.0E+02		2.1E+02	1.0E+02		
									5.16	1	1	No	Total Petroleum Hydrocarbons (Aromatic High)	NA					8.0E+02			8.0E+02		
									2.13	1	1	Yes	Total Petroleum Hydrocarbons (Aromatic Low)	NA					8.0E+01	6.1E+02	6.3E+01	3.3E+01		
									3.58	1	1	Yes	Total Petroleum Hydrocarbons (Aromatic Medium)	NA					8.0E+01	9.0E+01	6.3E+00	5.5E+00		
1.1E+00	I	3.2E-04	I						5.9	1	0.8	No	Toxaphene	8001-35-2	7.1E-02			7.1E-02					3.0E+00	
7.5E-03	I								7.56	1	0.5	No	Tralometrin	66841-25-6					1.5E+02			1.5E+02		
3.0E-04	A								4.1	1	0.9	Yes	Tri-n-butyltin	688-73-3					6.0E+00	9.9E+00		3.7E+00		
8.0E+01	X								0.25	1	1	Yes	Triacetin	102-76-1					1.6E+06	5.3E+08		1.6E+06		
3.0E-02	I								2.77	1	1	Yes	Triadimefon	43121-43-3					6.0E+02	6.9E+03		5.5E+02		
1.3E-02	I								4.6	1	0.9	Yes	Triallate	2303-17-5					2.6E+02	2.2E+02		1.2E+02		
1.0E-02	I								1.1	1	1	Yes	Triasulfuron	82097-50-5					2.0E+02	6.0E+04		2.0E+02		
8.0E-03	I								0.78	1	1	Yes	Tribenuron-methyl	101200-48-0					1.6E+02	5.0E+03		1.6E+02		
5.0E-03	I								4.66	1	0.9	Yes	Tribromobenzene, 1,2,4-	615-54-3					1.0E+02	8.1E+01		4.5E+01		
1.0E-02	P								4	1	0.9	Yes	Tributyl Phosphate	126-73-8	8.7E+00	1.3E+01		5.2E+00	2.0E+02	3.3E+02		1.2E+02		
3.0E-04	P											No	Tributyltin Compounds	NA					6.0E+00			6.0E+00		
3.0E-04	I								4.05	1	1	Yes	Tributyltin Oxide	56-35-9					6.0E+00	9.5E+01		5.7E+00		
3.0E+01	I	3.0E+01	H	V					3.16	1	1	Yes	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					6.0E+05	1.9E+06	6.3E+04	5.5E+04		
7.0E-02	I								1.33	1	1	Yes	Trichloroacetic Acid	76-03-9	1.1E+00	4.6E+01		1.1E+00	4.0E+02	1.8E+04		3.9E+02	6.0E+01	
2.9E-02	H								-0.67	1	1	Yes	Trichloroaniline HCl, 2,4,6-	33663-50-2	2.7E+00	3.7E+03		2.7E+00						
7.0E-03	X								3.52	1	1	Yes	Trichloroaniline, 2,4,6-	634-93-5	1.1E+01	2.0E+01		7.1E+00	6.0E-01	1.2E+00		4.0E-01		
									4.05	1	1	Yes	Trichlorobenzene, 1,2,3-	87-61-6					1.6E+01	1.3E+01		7.0E+00		
2.9E-02	P								4.02	1	1	Yes	Trichlorobenzene, 1,2,4-	120-82-1	2.7E+00	2.0E+00		1.2E+00	2.0E+02	1.6E+02	4.2E+00	4.0E+00	7.0E+01	
									2.49	1	1	Yes	Trichloroethane, 1,1,1-	71-55-6					4.0E+04	2.5E+05	1.0E+04	8.0E+03	2.0E+02	
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V	1.89	1	1	Yes	Trichloroethane, 1,1,2-	79-00-5	1.4E+00	2.0E+01	3.5E-01	2.8E-01	8.0E+01	1.3E+03	4.2E-01	4.1E-01	5.0E+00	
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	2.42	1	1	Yes	Trichloroethylene	79-01-6	1.2E+00	7.4E+00	9.6E-01	4.9E-01	1.0E+01	6.9E+01	4.2E+00	2.8E+00	5.0E+00	
									2.53	1	1	Yes	Trichlorofluoromethane	75-69-4					6.0E+03	3.6E+04		5.2E+03		
									3.72	1	1	Yes												

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Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHIL Hazard Index (HI) = 1							
SFO (mg/kg-day)	k _e y	IUR (ug/m ³ -d)	k _e y	RfD _a (mg/kg-day)	k _e y	RfC _i (mg/m ³)	k _e y	muta- gen	LOGP	GIABS	FA	In	EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	Inhalation SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)		
3.0E-03	X			3.0E-04	P	V			2.78	1	1	Yes		Trichloropropene, 1,2,3-	96-19-5					6.0E+01	2.6E+02	6.3E-01	6.2E-01			
2.0E-02	A								5.11	1	0.8	Yes		Tricresyl Phosphate (TCP)	1330-78-5					4.0E+02	2.6E+02		1.6E+02			
3.0E-03	I								5.18	1	0.8	Yes		Tridiphenyl	58138-08-2					6.0E+01	2.6E+01		1.8E+01			
				7.0E-03	I	V			1.45	1	1	Yes		Triethylamine	121-44-8							1.5E+01	1.5E+01			
2.0E+00	P								-1.75	1	1	Yes		Triethylene Glycol	112-27-6					4.0E+04	1.8E+08		4.0E+04			
				2.0E+01	P	V			1.74	1	1	Yes		Trifluoroethane, 1,1,1-	420-46-2							4.2E+04	4.2E+04			
7.7E-03	I			7.5E-03	I				5.34	1	0.8	Yes		Trifluralin	1582-09-8	1.0E+01	3.4E+00		2.6E+00	1.5E+02	5.5E+01		4.0E+01			
2.0E-02	P			1.0E-02	P				-0.65	1	1	Yes		Trimethyl Phosphate	512-56-1	3.9E+00	2.8E+03		3.9E+00	2.0E+02	1.6E+05		2.0E+02			
				5.0E-03	P	V			3.66	1	1	Yes		Trimethylbenzene, 1,2,3-	576-73-8							1.0E+01	1.0E+01			
				7.0E-03	P	V			3.63	1	1	Yes		Trimethylbenzene, 1,2,4-	95-63-6					2.0E+02	2.8E+02		1.2E+02			
				1.0E-02	X				3.42	1	1	Yes		Trimethylbenzene, 1,3,5-	108-67-8					2.0E+02	9.6E+01		6.5E+01			
				1.0E-02	X				4.08	1	1	Yes		Trimethylpentene, 2,4,4-	25167-70-8					2.0E+02	3.8E+03		1.9E+02			
3.0E-02	I			3.0E-02	I				1.18	1	1	Yes		Trinitrobenzene, 1,3,5-	99-35-4	2.6E+00	1.1E+02		2.5E+00	6.0E+02	4.7E+04		5.9E+02			
				5.0E-04	I				1.6	1	1	Yes		Trinitrotoluene, 2,4,6-	118-96-7					1.0E+01	4.5E+02		9.8E+00			
				2.0E-02	P				2.83	1	1	Yes		Triphenylphosphine Oxide	791-28-6					4.0E+02	3.8E+03		3.6E+02			
				2.0E-02	A				3.65	1	0.9	Yes		Tris(1,3-Dichloro-2-propyl)Phosphate	19674-87-8					4.0E+02	3.2E+03		3.6E+02			
2.3E+00	C	6.6E-04	C	1.0E-02	X				2.59	1	1	Yes		Tris(1-chloro-2-propyl)phosphate	19674-84-5	3.4E-02		8.5E-03	6.8E-03	2.0E+02	3.8E+03		1.9E+02			
									4.29	1	1	No		Tris(2,3-dibromopropyl)phosphate	126-72-7											
2.0E-02	P			7.0E-03	P				1.44	1	1	Yes		Tris(2-chloroethyl)phosphate	115-96-8	3.9E+00	3.0E+02		3.8E+00	1.4E+02	1.2E+04		1.4E+02			
3.2E-03	P			1.0E-01	P				9.49	1	0	No		Tris(2-ethylhexyl)phosphate	78-42-2	2.4E+01			2.4E+01	2.0E+03			2.0E+03			
				8.0E-04	P					1	1	Yes		Tungsten	7440-33-7					1.6E+01	3.6E+03		1.6E+01			
1.0E+00	C	2.9E-04	C	3.0E-03	I	4.0E-05	A			1	1	Yes		Uranium (Soluble Salts)	NA	2.5E-02	6.1E+00		2.5E-02	6.0E+01	1.4E+04		6.0E+01	3.0E+01		
		8.3E-03	P	9.0E-03	I	7.0E-06	P	M	-0.15	1	1	Yes		Urethane	51-79-6					1.8E+02	1.1E+03		1.5E+02			
				5.0E-03	S	1.0E-04	A			0.026	1	Yes		Vanadium and Compounds	7440-62-2					1.0E+02	6.0E+02		8.6E+01			
				1.0E-03	I				3.84	1	1	Yes		Vernolate	1929-77-7					2.0E+01	2.5E+01		1.1E+01			
				2.5E-02	I				3.1	1	0.9	Yes		Vindozolin	50471-44-8					5.0E+02	3.7E+03		4.4E+02			
				1.0E+00	H	2.0E-01	I	V	0.73	1	1	Yes		Vinyl Acetate	108-05-4					2.0E+04	1.4E+06	4.2E+02	4.1E+02			
		3.2E-05	H			3.0E-03	I	V	1.57	1	1	Yes		Vinyl Bromide	593-60-2			1.8E-01	1.8E-01			6.3E+00	6.3E+00			
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	1.62	1	1	Yes		Vinyl Chloride	75-01-4	2.1E-02	2.8E-01	3.4E-01	1.9E-02	6.0E+01	8.9E+02	2.1E+02	4.4E+01	2.0E+00		
				3.0E-04	I				2.7	1	1	Yes		Warfarin	81-81-2					6.0E+00	8.4E+01		5.6E+00			
				2.0E-01	S	1.0E-01	S	V	3.15	1	1	Yes		Xylene, p-	106-42-3					4.0E+03	7.6E+03	2.1E+02	1.9E+02			
				2.0E-01	S	1.0E-01	S	V	3.2	1	1	Yes		Xylene, m-	108-38-3					4.0E+03	7.1E+03		1.9E+02			
				2.0E-01	S	1.0E-01	S	V	3.12	1	1	Yes		Xylene, o-	95-47-6					4.0E+03	8.0E+03	2.1E+02	1.9E+02			
				2.0E-01	I	1.0E-01	I	V	3.16	1	1	Yes		Xylenes	1330-20-7					4.0E+03	7.5E+03	2.1E+02	1.9E+02	1.0E+04		
				3.0E-04	I					1	1	Yes		Zinc Phosphide	1314-84-7					6.0E+00	2.3E+03		6.0E+00			
3.0E-01	I									1	1	Yes		Zinc and Compounds	7440-66-6					6.0E+03	2.3E+06		6.0E+03			
5.0E-02	I								1.3	1	1	Yes		Zineb	12122-67-7					1.0E+03	9.7E+04		9.9E+02			
8.0E-05	X									1	1	Yes		Zirconium	7440-67-7					1.6E+00	3.6E+02		1.6E+00			

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Toxicity and Chemical-specific						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l	muta- gen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)
2.2E-06	I	9.0E-03	I	V		Acephate	30560-19-1		
						Acetaldehyde	75-07-0	1.3E+00	9.4E+00
						Acetochlor	34256-82-1		
		3.1E+01	A	V		Acetone	67-64-1		3.2E+04
		2.0E-03	X			Acetone Cyanohydrin	75-86-5		2.1E+00
		6.0E-02	I	V		Acetonitrile	75-05-8		6.3E+01
				V		Acetophenone	98-86-2		
1.3E-03	C					Acetylaminofluorene, 2-	53-96-3	2.2E-03	
		2.0E-05	I	V		Acrolein	107-02-8		2.1E-02
1.0E-04	I	6.0E-03	I		M	Acrylamide	79-06-1	1.0E-02	6.3E+00
		1.0E-03	I	V		Acrylic Acid	79-10-7		1.0E+00
6.8E-05	I	2.0E-03	I	V		Acrylonitrile	107-13-1	4.1E-02	2.1E+00
		6.0E-03	P			Adiponitrile	111-69-3		6.3E+00
						Alachlor	15972-60-8		
						Aldicarb	116-06-3		
						Aldicarb Sulfone	1646-88-4		
4.9E-03	I			V		Aldicarb sulfoxide	1646-87-3	5.7E-04	
						Aldrin	309-00-2		
		1.0E-04	X	V		Allyl Alcohol	107-18-6		1.0E-01
6.0E-06	C	1.0E-03	I	V		Allyl Chloride	107-05-1	4.7E-01	1.0E+00
		5.0E-03	P			Aluminum	7429-90-5		5.2E+00
						Aluminum Phosphide	20859-73-8		
6.0E-03	C					Ametryn	834-12-8		
						Aminobiphenyl, 4-	92-67-1	4.7E-04	
						Aminophenol, m-	591-27-5		
						Aminophenol, p-	123-30-8		
						Amitraz	33089-61-1		
		1.0E-01	I	V		Ammonia	7664-41-7		1.0E+02
		3.0E-03	X	V		Ammonium Sulfamate	7773-06-0		3.1E+00
						Amyl Alcohol, tert-	75-85-4		
1.6E-06	C	1.0E-03	I			Aniline	62-53-3	1.8E+00	1.0E+00
						Anthraquinone, 9,10-	84-65-1		
						Antimony (metallic)	7440-36-0		
						Antimony Pentoxide	1314-60-9		
						Antimony Tetroxide	1332-81-6		
		2.0E-04	I			Antimony Trioxide	1309-64-4		2.1E-01
4.3E-03	I	1.5E-05	C			Arsenic, inorganic	7440-38-2	6.5E-04	1.6E-02
		5.0E-05	I			Arsine	7784-42-1		5.2E-02
						Asulam	3337-71-1		
						Atrazine	1912-24-9		
2.5E-04	C					Auramine	492-80-8	1.1E-02	
						Avermectin B1	65195-55-3		
		1.0E-02	A			Azinphos-methyl	86-50-0		1.0E+01
3.1E-05	I			V		Azobenzene	103-33-3	9.1E-02	
		7.0E-06	P			Azodicarbonamide	123-77-3		7.3E-03
		5.0E-04	H			Barium	7440-39-3		5.2E-01
1.5E-01	C	2.0E-04	C		M	Barium Chromate	10294-40-3	6.8E-06	2.1E-01
				V		Benfluralin	1861-40-1		
						Benomyl	17804-35-2		
						Bensulfuron-methyl	83055-99-6		
						Bentazon	25057-89-0		
				V		Benzaldehyde	100-52-7		
7.8E-06	I	3.0E-02	I	V		Benzene	71-43-2	3.6E-01	3.1E+01
						Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1		
				V		Benzenethiol	108-98-5		
6.7E-02	I				M	Benidine	92-87-5	1.5E-05	
						Benzoic Acid	65-85-0		
				V		Benzotrithloride	98-07-7		
4.9E-05	C	1.0E-03	P	V		Benzyl Alcohol	100-51-6		1.0E+00
						Benzyl Chloride	100-44-7	5.7E-02	
2.4E-03	I	2.0E-05	I			Beryllium and compounds	7440-41-7	1.2E-03	2.1E-02
						Bifenox	42576-02-3		
						Biphenthrin	82657-04-3		
		4.0E-04	X	V		Biphenyl, 1,1'-	92-52-4		4.2E-01
				V		Bis(2-chloro-1-methylethyl) ether	108-60-1		
						Bis(2-chloroethoxy)methane	111-91-1		
3.3E-04	I			V		Bis(2-chloroethyl)ether	111-44-4	8.5E-03	
6.2E-02	I			V		Bis(chloromethyl)ether	542-88-1	4.5E-05	

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l u t a b i l i t y	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
					Bisphenol A	80-05-7			
2.0E-02	H				Boron And Borates Only	7440-42-8		2.1E+01	
2.0E-02	P				Boron Trichloride	10294-34-5		2.1E+01	
1.3E-02	C				Boron Trifluoride	7637-07-2		1.4E+01	
6.0E-04	X				Bromate	15541-45-4			
6.0E-02	I				Bromo-2-chloroethane, 1-	107-04-0	4.7E-03		
					Bromobenzene	108-86-1		6.3E+01	
4.0E-02	X				Bromochloromethane	74-97-5		4.2E+01	
3.7E-05	C				Bromodichloromethane	75-27-4	7.6E-02		
1.1E-06	I				Bromoform	75-25-2	2.6E+00		
5.0E-03	I				Bromomethane	74-83-9		5.2E+00	
					Bromophos	2104-96-3			
					Bromoxynil	1689-84-5			
3.0E-05	I	2.0E-03	I		Bromoxynil Octanoate	1689-99-2	9.4E-02		
					Butadiene, 1,3-	106-99-0		2.1E+00	
					Butanol, N-	71-36-3			
3.0E+01	P				Butyl Benzyl Phthalate	85-68-7		3.1E+04	
					Butyl alcohol, sec-	78-92-2			
					Butylate	2008-41-5			
5.7E-08	C				Butylated hydroxyanisole	25013-16-5	4.9E+01		
					Butylated hydroxytoluene	128-37-0			
					Butylbenzene, n-	104-51-8			
					Butylbenzene, sec-	135-98-8			
					Butylbenzene, tert-	98-06-6			
					Cacodylic Acid	75-60-5			
1.8E-03	I	1.0E-05	A		Cadmium (Diet)	7440-43-9			
1.8E-03	I	1.0E-05	A		Cadmium (Water)	7440-43-9	1.6E-03	1.0E-02	
1.5E-01	C	2.0E-04	C	M	Calcium Chromate	13765-19-0	6.8E-06	2.1E-01	
2.2E-03	C				Caprolactam	105-60-2		2.3E+00	
4.3E-05	C				Captafol	2425-06-1	6.5E-02		
6.6E-07	C				Captan	133-06-2	4.3E+00		
7.0E-01	I				Carbaryl	63-25-2			
					Carbofuran	1563-66-2			
					Carbon Disulfide	75-15-0		7.3E+02	
6.0E-06	I	1.0E-01	I		Carbon Tetrachloride	56-23-5	4.7E-01	1.0E+02	
		1.0E-01	P		Carbonyl Sulfide	463-58-1		1.0E+02	
					Carbosulfan	55285-14-8			
9.0E-04	I				Carboxin	5234-68-4			
					Ceric oxide	1306-38-3		9.4E-01	
					Chloral Hydrate	302-17-0			
1.0E-04	I	7.0E-04	I		Chloramben	133-90-4			
					Chloranil	118-75-2			
					Chlordane	12789-03-6	2.8E-02	7.3E-01	
4.6E-03	C				Chlordecone (Kepone)	143-50-0	6.1E-04		
					Chlorfenvinphos	470-90-6			
					Chlorimuron, Ethyl-	90982-32-4			
1.5E-04	A				Chlorine	7782-50-5		1.5E-01	
2.0E-04	I				Chlorine Dioxide	10049-04-4		2.1E-01	
					Chlorite (Sodium Salt)	7758-19-2			
5.0E+01	I				Chloro-1,1-difluoroethane, 1-	75-68-3		5.2E+04	
3.0E-04	I	2.0E-02	I		Chloro-1,3-butadiene, 2-	126-99-8	9.4E-03	2.1E+01	
					Chloro-2-methylaniline HCl, 4-	3165-93-3			
7.7E-05	C				Chloro-2-methylaniline, 4-	95-69-2	3.6E-02		
					Chloroacetaldehyde, 2-	107-20-0			
					Chloroacetic Acid	79-11-8			
3.0E-05	I				Chloroacetophenone, 2-	532-27-4		3.1E-02	
					Chloroaniline, p-	106-47-8			
5.0E-02	P				Chlorobenzene	108-90-7		5.2E+01	
3.1E-05	C				Chlorobenzilate	510-15-6	9.1E-02		
					Chlorobenzoic Acid, p-	74-11-3			
3.0E-01	P				Chlorobenzotrifluoride, 4-	98-56-6		3.1E+02	
					Chlorobutane, 1-	109-69-3			
5.0E+01	I				Chlorodifluoromethane	75-45-6		5.2E+04	
					Chloroethanol, 2-	107-07-3			
2.3E-05	I	9.8E-02	A		Chloroform	67-66-3	1.2E-01	1.0E+02	
		9.0E-02	I		Chloromethane	74-87-3		9.4E+01	
6.9E-04	C				Chloromethyl Methyl Ether	107-30-2	4.1E-03		
1.0E-05	X				Chloronitrobenzene, o-	88-73-3		1.0E-02	

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³) y	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
6.0E-04	P			V	Chloronitrobenzene, p- Chlorophenol, 2-	100-00-5 95-57-8		6.3E-01	
4.0E-04	C	V			Chloropicrin	76-06-2		4.2E-01	
8.9E-07	C			V	Chlorothalonil	1897-45-6	3.2E+00		
				V	Chlorotoluene, o-	95-49-8			
6.9E-02	C			V	Chlorotoluene, p- Chlorozotocin Chlorpropham	106-43-4 54749-90-5 101-21-3	4.1E-05		
					Chlorpyrifos	2921-88-2			
					Chlorpyrifos Methyl	5598-13-0			
					Chlorsulfuron	64902-72-3			
					Chlorthal-dimethyl	1861-32-1			
					Chlorthiophos	60238-56-4			
					Chromium(III), Insoluble Salts	16065-83-1			
8.4E-02	S	1.0E-04	I	M	Chromium(VI) Chromium, Total Clofentazine	18540-29-9 7440-47-3 74115-24-5	1.2E-05	1.0E-01	
9.0E-03	P	6.0E-06	P		Cobalt	7440-48-4	3.1E-04	6.3E-03	
6.2E-04	I		V	M	Coke Oven Emissions Copper	8007-45-2 7440-50-8	1.6E-03		
6.0E-01	C				Cresol, m-	108-39-4		6.3E+02	
6.0E-01	C				Cresol, o-	95-48-7		6.3E+02	
6.0E-01	C				Cresol, p-	106-44-5		6.3E+02	
6.0E-01	C			V	Cresol, p-chloro-m- Cresols	59-50-7 1319-77-3		6.3E+02	
				V	Crotonaldehyde, trans-	123-73-9			
4.0E-01	I	V			Cumene	98-82-8		4.2E+02	
6.3E-05	C				Cupferron	135-20-6	4.5E-02		
					Cyanazine	21725-46-2			
					Cyanides				
					~Calcium Cyanide	592-01-8			
					~Copper Cyanide	544-92-3			
8.0E-04	S	V			~Cyanide (CN ⁻)	57-12-5		8.3E-01	
		V			~Cyanogen	460-19-5			
		V			~Cyanogen Bromide	506-68-3			
		V			~Cyanogen Chloride	506-77-4			
8.0E-04	I	V			~Hydrogen Cyanide	74-90-8		8.3E-01	
		V			~Potassium Cyanide	151-50-8			
					~Potassium Silver Cyanide	506-61-6			
					~Silver Cyanide	506-64-9			
					~Sodium Cyanide	143-33-9			
					~Thiocyanates	NA			
		V			~Thiocyanic Acid	463-56-9			
		V			~Zinc Cyanide	557-21-1			
6.0E+00	I	V			Cyclohexane	110-82-7		6.3E+03	
		V			Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3			
7.0E-01	P	V			Cyclohexanone	108-94-1		7.3E+02	
1.0E+00	X	V			Cyclohexene	110-83-8		1.0E+03	
		V			Cyclohexylamine	108-91-8			
		V			Cyfluthrin	68359-37-5			
					Cyhalothrin	68085-85-8			
					Cypermethrin	52315-07-8			
					Cyromazine	66215-27-8			
6.9E-05	C				DDD	72-54-8	4.1E-02		
9.7E-05	C		V		DDE, p,p'-	72-55-9	2.9E-02		
9.7E-05	I				DDT	50-29-3	2.9E-02		
5.1E-06	C				Dalapon	75-99-0	5.5E-01		
					Daminozide	1596-84-5			
					Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5			
					Demeton	8065-48-3			
					Di(2-ethylhexyl)adipate	103-23-1			
					Diallate	2303-16-4			
			V		Diazinon	333-41-5			
6.0E-03	P	2.0E-04	I	M	Dibenzothiophene	132-65-0	1.7E-04	2.1E-01	
			V		Dibromo-3-chloropropane, 1,2-	96-12-8			
			V		Dibromobenzene, 1,3-	108-36-1			
			V		Dibromobenzene, 1,4-	106-37-6			
			V		Dibromochloromethane	124-48-1			

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TOXICITY AND CHEMICAL-SPECIFIC						Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l	muta- gen				
6.0E-04	I	9.0E-03 4.0E-03	I X	V V		Dibromoethane, 1,2- Dibromomethane (Methylene Bromide) Dibutyltin Compounds	106-93-4 74-95-3 NA	4.7E-03	9.4E+00 4.2E+00
4.2E-03	P			V		Dicamba	1918-00-9		
4.2E-03	P			V		Dichloro-2-butene, 1,4- Dichloro-2-butene, cis-1,4-	764-41-0 1476-11-5	6.7E-04 6.7E-04	
4.2E-03	P			V		Dichloro-2-butene, trans-1,4- Dichloroacetic Acid	110-57-6 79-43-6	6.7E-04	
2.0E-01	H		V			Dichlorobenzene, 1,2-	95-50-1		2.1E+02
1.1E-05	C	8.0E-01	I	V		Dichlorobenzene, 1,4- Dichlorobenzidine, 3,3'- Dichlorobenzophenone, 4,4'-	106-46-7 91-94-1 90-98-2	2.6E-01 8.3E-03	8.3E+02
1.6E-06	C	1.0E-01	X	V		Dichlorodifluoromethane	75-71-8		1.0E+02
2.6E-05	I	7.0E-03	P	V		Dichloroethane, 1,1- Dichloroethane, 1,2-	75-34-3 107-06-2	1.8E+00 1.1E-01	7.3E+00
2.0E-01	I		V			Dichloroethylene, 1,1- Dichloroethylene, 1,2-cis- Dichloroethylene, 1,2-trans-	75-35-4 156-59-2 156-60-5		2.1E+02
						Dichlorophenol, 2,4- Dichlorophenoxy Acetic Acid, 2,4- Dichlorophenoxybutyric Acid, 4-(2,4-	120-83-2 94-75-7 94-82-6		
1.0E-05	C	4.0E-03	I	V		Dichloropropane, 1,2- Dichloropropane, 1,3- Dichloropropanol, 2,3-	78-87-5 142-28-9 616-23-9	2.8E-01	4.2E+00
4.0E-06	I	2.0E-02	I	V		Dichloropropene, 1,3- Dichlorvos	542-75-6 62-73-7	7.0E-01 3.4E-02	2.1E+01 5.2E-01
8.3E-05	C	5.0E-04	I			Dicrotophos	141-66-2		
3.0E-04	X		V			Dicyclopentadiene	77-73-6		3.1E-01
4.6E-03	I					Dieldrin	60-57-1	6.1E-04	
3.0E-04	C	5.0E-03	I			Diesel Engine Exhaust	NA	9.4E-03	5.2E+00
2.0E-04	P					Diethanolamine	111-42-2		2.1E-01
1.0E-04	P					Diethylene Glycol Monobutyl Ether	112-34-5		1.0E-01
3.0E-04	P					Diethylene Glycol Monoethyl Ether	111-90-0		3.1E-01
1.0E-01	C			V		Diethylformamide Diethylstilbestrol Difenoquat	617-84-5 56-53-1 43222-48-6	2.8E-05	
						Diflubenzuron	35367-38-5		
4.0E+01	I		V			Difluoroethane, 1,1- Dihydrosafrole	75-37-6 94-58-6	2.2E-01	4.2E+04
1.3E-05	C					Diisopropyl Ether Diisopropyl Methylphosphonate Dimethipin	108-20-3 1445-75-6 55290-64-7		7.3E+02
						Dimethoate Dimethoxybenzidine, 3,3'- Dimethyl methylphosphonate	60-51-5 119-90-4 756-79-6		
1.3E-03	C					Dimethylamino azobenzene [p-] Dimethylaniline HCl, 2,4- Dimethylaniline, 2,4-	60-11-7 21436-96-4 95-68-1	2.2E-03	
						Dimethylaniline, N,N- Dimethylbenzidine, 3,3'- Dimethylformamide	121-69-7 119-93-7 68-12-2		3.1E+01
2.0E-06	X		V			Dimethylhydrazine, 1,1- Dimethylhydrazine, 1,2- Dimethylphenol, 2,4-	57-14-7 540-73-8 105-67-9	1.8E-05	2.1E-03
1.6E-01	C			V		Dimethylphenol, 2,6- Dimethylphenol, 3,4- Dimethylvinylchloride	576-26-1 95-65-8 513-37-1	2.2E-01	
1.3E-05	C			V		Dinitro-o-cresol, 4,6- Dinitro-o-cyclohexyl Phenol, 4,6- Dinitrobenzene, 1,2-	534-52-1 131-89-5 528-29-0		
						Dinitrobenzene, 1,3- Dinitrobenzene, 1,4- Dinitrophenol, 2,4-	99-65-0 100-25-4 51-28-5		
8.9E-05	C					Dinitrotoluene Mixture, 2,4/2,6- Dinitrotoluene, 2,4- Dinitrotoluene, 2,6-	NA 121-14-2 606-20-2	3.2E-02	
						Dinitrotoluene, 2-Amino-4,6- Dinitrotoluene, 4-Amino-2,6-	35572-78-2 19406-51-0		

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
					Dinitrotoluene, Technical grade	25321-14-6			
5.0E-06	I	3.0E-02	I	V	Dinoseb	88-85-7			
					Dioxane, 1,4-Dioxins	123-91-1	5.6E-01	3.1E+01	
1.3E+00	I				~Hexachlorodibenzo-p-dioxin, Mixture	NA	2.2E-06		
3.8E+01	C	4.0E-08	C	V	~TCDD, 2,3,7,8-Diphenamid	1746-01-6 957-51-7	7.4E-08	4.2E-05	
2.2E-04	I				Diphenyl Sulfone	127-63-9			
					Diphenylamine	122-39-4			
					Diphenylhydrazine, 1,2-	122-66-7	1.3E-02		
1.4E-01	C				Diquat	85-00-7			
1.4E-01	C				Direct Black 38	1937-37-7	2.0E-05		
					Direct Blue 6	2602-46-2	2.0E-05		
1.4E-01	C				Direct Brown 95	16071-86-6	2.0E-05		
				V	Disulfoton	298-04-4			
					Dithiane, 1,4-	505-29-3			
				V	Diuron	330-54-1			
					Dodine	2439-10-3			
				V	EPTC	759-94-4			
				V	Endosulfan	115-29-7			
					Endothall	145-73-3			
					Endrin	72-20-8			
1.2E-06	I	1.0E-03	I	V	Epichlorohydrin	106-89-8	2.3E+00	1.0E+00	
		2.0E-02	I	V	Epoxybutane, 1,2-Ethanol, 2-(2-methoxyethoxy)-	106-88-7 111-77-3		2.1E+01	
					Etchphon	16672-87-0			
					Ethion	563-12-2			
6.0E-02	P	V			Ethoxyethanol Acetate, 2-	111-15-9		6.3E+01	
2.0E-01	I	V			Ethoxyethanol, 2-	110-80-5		2.1E+02	
7.0E-02	P	V			Ethyl Acetate	141-78-6		7.3E+01	
8.0E-03	P	V			Ethyl Acrylate	140-88-5		8.3E+00	
1.0E+01	I	V			Ethyl Chloride (Chloroethane)	75-00-3		1.0E+04	
			V		Ethyl Ether	60-29-7			
3.0E-01	P	V			Ethyl Methacrylate	97-63-2		3.1E+02	
2.5E-06	C	1.0E+00	I	V	Ethyl-p-nitrophenyl Phosphonate	2104-64-5			
					Ethylbenzene	100-41-4	1.1E+00	1.0E+03	
					Ethylene Cyanohydrin	109-78-4			
			V		Ethylene Diamine	107-15-3			
4.0E-01	C				Ethylene Glycol	107-21-1		4.2E+02	
1.6E+00	I				Ethylene Glycol Monobutyl Ether	111-76-2		1.7E+03	
8.8E-05	C	3.0E-02	C	V	Ethylene Oxide	75-21-8	3.2E-02	3.1E+01	
1.3E-05	C				Ethylene Thiourea	96-45-7	2.2E-01		
1.9E-02	C			V	Ethyleneimine	151-56-4	1.5E-04		
					Ethylphthalyl Ethyl Glycolate	84-72-0			
					Fenamiphos	22224-92-6			
					Fenpropathrin	39515-41-8			
					Fenvalerate	51630-58-1			
1.3E-02	C				Fluometuron	2164-17-2			
					Fluoride	16984-48-8		1.4E+01	
1.3E-02	C				Fluorine (Soluble Fluoride)	7782-41-4		1.4E+01	
					Fluridone	59756-60-4			
					Flurprimidol	56425-91-3			
					Flusilazole	85509-19-9			
					Flutolanil	66332-96-5			
					Fluvalinate	69409-94-5			
					Folpet	133-07-3			
					Fomesafen	72178-02-0			
					Fonofos	944-22-9			
1.3E-05	I	9.8E-03	A	V	Formaldehyde	50-00-0	2.2E-01	1.0E+01	
		3.0E-04	X	V	Formic Acid	64-18-6		3.1E-01	
					Fosetyl-AL	39148-24-8			
				V	Furans				
				V	~Dibenzofuran	132-64-9			
					~Furan	110-00-9			
2.0E+00	I	V			~Tetrahydrofuran	109-99-9		2.1E+03	
					Furazolidone	67-45-8			
5.0E-02	H	V			Furfural	98-01-1		5.2E+01	
4.3E-04	C				Furium	531-82-8	6.5E-03		

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
8.6E-06	C				Furmecycloz Glufosinate, Ammonium	60568-05-0 77182-82-2	3.3E-01		
8.0E-05	C				Glutaraldehyde	111-30-8		8.3E-02	
1.0E-03	H V				Glycidyl Glyphosate	765-34-4 1071-83-6		1.0E+00	
				V	Guanidine Guanidine Chloride Haloxyp, Methyl	113-00-8 50-01-1 69806-40-2			
1.3E-03	I			V	Heptachlor	76-44-8	2.2E-03		
2.6E-03	I			V	Heptachlor Epoxide	1024-57-3	1.1E-03		
				V	Hexabromobenzene	87-82-1			
4.6E-04	I			V	Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2			
2.2E-05	I			V	Hexachlorobenzene	118-74-1	6.1E-03		
				V	Hexachlorobutadiene	87-68-3	1.3E-01		
1.8E-03	I				Hexachlorocyclohexane, Alpha-	319-84-6	1.6E-03		
5.3E-04	I				Hexachlorocyclohexane, Beta-	319-85-7	5.3E-03		
3.1E-04	C				Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	9.1E-03		
5.1E-04	I				Hexachlorocyclohexane, Technical	608-73-1	5.5E-03		
2.0E-04	I V				Hexachlorocyclopentadiene	77-47-4		2.1E-01	
1.1E-05	C 3.0E-02	I V			Hexachloroethane	67-72-1	2.6E-01	3.1E+01	
					Hexachlorophene	70-30-4			
1.0E-05	I V				Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4			
					Hexamethylene Diisocyanate, 1,6-	822-06-0		1.0E-02	
					Hexamethylphosphoramide	680-31-9			
7.0E-01	I V				Hexane, N-	110-54-3		7.3E+02	
					Hexanedioic Acid	124-04-9			
3.0E-02	I V				Hexanone, 2-	591-78-6		3.1E+01	
					Hexazinone	51235-04-2			
					Hexythiazox	78587-05-0			
4.9E-03	I 3.0E-05	P V			Hydramethylnon	67485-29-4	5.7E-04	3.1E-02	
4.9E-03	I				Hydrazine	302-01-2	5.7E-04		
					Hydrazine Sulfate	10034-93-2			
2.0E-02	I V				Hydrogen Chloride	7647-01-0		2.1E+01	
1.4E-02	C V				Hydrogen Fluoride	7664-39-3		1.5E+01	
2.0E-03	I V				Hydrogen Sulfide	7783-06-4		2.1E+00	
					Hydroquinone	123-31-9			
					Imazalil	35554-44-0			
					Imazaquin	81335-37-7			
					Imazethapyr	81335-77-5			
					Iodine	7553-56-2			
					Iprodione	36734-19-7			
					Iron	7439-89-6			
2.0E+00	C V				Isobutyl Alcohol	78-83-1		2.1E+03	
					Isophorone	78-59-1			
2.0E-01	P V				Isopropalin	33820-53-0		2.1E+02	
					Isopropanol	67-63-0			
					Isopropyl Methyl Phosphonic Acid	1832-54-8			
3.0E-01	A V				Isoxaben	82558-50-7		3.1E+02	
					JP-7	NA			
					Lactofen	77501-63-4			
1.5E-01	C 2.0E-04	C M			Lead Compounds				
1.2E-05	C				Lead Chromate	7758-97-6	6.8E-06	2.1E-01	
					Lead Phosphate	7446-27-7	2.3E-01		
8.0E-05	C				Lead acetate	301-04-2	3.5E-02	1.5E-01	
					Lead and Compounds	7439-92-1			
1.2E-05	C				Lead subacetate	1335-32-6	2.3E-01		
				V	Tetraethyl Lead	78-00-2			
				V	Lewisite	541-25-3			
					Linuron	330-55-2			
					Lithium	7439-93-2			
					MCPA	94-74-6			
					MCPB	94-81-5			
7.0E-04	C				MCP	93-65-2			
					Malathion	121-75-5			
					Maleic Anhydride	108-31-6		7.3E-01	
					Maleic Hydrazide	123-33-1			
					Malononitrile	109-77-3			
					Mancozeb	8018-01-7			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	muta- gen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
5.0E-05	I				Maneb	12427-38-2			
5.0E-05	I				Manganese (Diet)	7439-96-5			
					Manganese (Non-diet)	7439-96-5			5.2E-02
					Mephosfolan	950-10-7			
					Mepiquat Chloride	24307-26-4			
					Mercury Compounds				
3.0E-04	S				~Mercuric Chloride (and other Mercury salts)	7487-94-7			3.1E-01
3.0E-04	I V				~Mercury (elemental)	7439-97-6			3.1E-01
					~Methyl Mercury	22967-92-6			
					~Phenylmercuric Acetate	62-38-4			
	V				Merphos	150-50-5			
					Merphos Oxide	78-48-8			
3.0E-02	P V				Metalaxyl	57837-19-1			
					Methacrylonitrile	126-98-7			3.1E+01
					Methamidophos	10265-92-6			
2.0E+01	I V				Methanol	67-56-1			2.1E+04
					Methidathion	950-37-8			
					Methomyl	16752-77-5			
1.4E-05	C				Methoxy-5-nitroaniline, 2-	99-59-2	2.0E-01		
					Methoxychlor	72-43-5			
1.0E-03	P V				Methoxyethanol Acetate, 2-	110-49-6			1.0E+00
2.0E-02	I V				Methoxyethanol, 2-	109-86-4			2.1E+01
	V				Methyl Acetate	79-20-9			
2.0E-02	P V				Methyl Acrylate	96-33-3			2.1E+01
5.0E+00	I V				Methyl Ethyl Ketone (2-Butanone)	78-93-3			5.2E+03
1.0E-03	X	2.0E-05	X V		Methyl Hydrazine	60-34-4	2.8E-03		2.1E-02
3.0E+00	I V				Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1			3.1E+03
1.0E-03	C V				Methyl Isocyanate	624-83-9			1.0E+00
7.0E-01	I V				Methyl Methacrylate	80-62-6			7.3E+02
					Methyl Parathion	298-00-0			
					Methyl Phosphonic Acid	993-13-5			
4.0E-02	H V				Methyl Styrene (Mixed Isomers)	25013-15-4			4.2E+01
2.8E-05	C				Methyl methanesulfonate	66-27-3	1.0E-01		
2.6E-07	C	3.0E+00	I V		Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.1E+01		3.1E+03
					Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2			
					Methyl-5-Nitroaniline, 2-	99-55-8			
2.4E-03	C				Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	1.2E-03		
3.7E-05	C				Methylaniline Hydrochloride, 2-	636-21-5	7.6E-02		
					Methylarsonic acid	124-58-3			
					Methylbenzene,1,4-diamine monohydrochloride, 2-	74612-12-7			
6.3E-03	C			M	Methylbenzene-1,4-diamine sulfate, 2-	615-50-9			
					Methylcholanthrene, 3-	56-49-5	1.6E-04		
1.0E-08	I	6.0E-01	I V	M	Methylene Chloride	75-09-2	1.0E+02		6.3E+02
4.3E-04	C			M	Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	2.4E-03		
1.3E-05	C				Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	2.2E-01		
4.6E-04	C	2.0E-02	C		Methylenebisbenzenamine, 4,4'-	101-77-9	6.1E-03		2.1E+01
		6.0E-04	I		Methylenediphenyl Diisocyanate	101-68-8			6.3E-01
			V		Methylstyrene, Alpha-	98-83-9			
					Metolachlor	51218-45-2			
					Metribuzin	21087-64-9			
					Metsulfuron-methyl	74223-64-6			
5.1E-03	C			V	Mineral oils	8012-95-1	5.5E-04		
				V	Mirex	2385-85-5			
					Molinate	2212-67-1			
					Molybdenum	7439-98-7			
					Monochloramine	10599-90-3			
					Monomethylaniline	100-61-8			
					Myclobutanil	88671-89-0			
					N,N'-Diphenyl-1,4-benzenediamine	74-31-7			
				V	Naled	300-76-5			
1.0E-01	P V				Naphtha, High Flash Aromatic (HFAN)	64742-95-6			1.0E+02
0.0E+00	C				Naphthylamine, 2-	91-59-8			
					Napropamide	15299-99-7			
2.6E-04	C	1.4E-05	C		Nickel Acetate	373-02-4	1.1E-02		1.5E-02
2.6E-04	C	1.4E-05	C		Nickel Carbonate	3333-67-3	1.1E-02		1.5E-02
2.6E-04	C	1.4E-05	C V		Nickel Carbonyl	13463-39-3	1.1E-02		1.5E-02
2.6E-04	C	1.4E-05	C		Nickel Hydroxide	12054-48-7	1.1E-02		1.5E-02
2.6E-04	C	2.0E-05	C		Nickel Oxide	1313-99-1	1.1E-02		2.1E-02

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
2.4E-04	I	1.4E-05	C		Nickel Refinery Dust	NA	1.2E-02	1.5E-02	
2.6E-04	C	9.0E-05	A		Nickel Soluble Salts	7440-02-0	1.1E-02	9.4E-02	
4.8E-04	I	1.4E-05	C		Nickel Subsulfide	12035-72-2	5.8E-03	1.5E-02	
2.6E-04	C	1.4E-05	C		Nickelocene	1271-28-9	1.1E-02	1.5E-02	
					Nitrate	14797-55-8			
					Nitrate + Nitrite (as N)	NA			
					Nitrite	14797-65-0			
		5.0E-05	X		Nitroaniline, 2-	88-74-4		5.2E-02	
		6.0E-03	P		Nitroaniline, 4-	100-01-6		6.3E+00	
4.0E-05	I	9.0E-03	I	V	Nitrobenzene	98-95-3	7.0E-02	9.4E+00	
					Nitrocellulose	9004-70-0			
					Nitrofurantoin	67-20-9			
3.7E-04	C				Nitrofurazone	59-87-0	7.6E-03		
					Nitroglycerin	55-63-0			
					Nitroguanidine	556-88-7			
8.8E-06	P	5.0E-03	P	V	Nitromethane	75-52-5	3.2E-01	5.2E+00	
2.7E-03	H	2.0E-02	I	V	Nitropropane, 2-	79-46-9	1.0E-03	2.1E+01	
7.7E-03	C			M	Nitroso-N-ethylurea, N-	759-73-9	1.3E-04		
3.4E-02	C			M	Nitroso-N-methylurea, N-	684-93-5	3.0E-05		
1.6E-03	I			V	Nitroso-di-N-butylamine, N-	924-16-3	1.8E-03		
2.0E-03	C				Nitroso-di-N-propylamine, N-	621-64-7	1.4E-03		
8.0E-04	C				Nitrosodiethanolamine, N-	1116-54-7	3.5E-03		
4.3E-02	I			M	Nitrosodiethylamine, N-	55-18-5	2.4E-05		
1.4E-02	I	4.0E-05	X	V	Nitrosodimethylamine, N-	62-75-9	7.2E-05	4.2E-02	
2.6E-06	C				Nitrosodiphenylamine, N-	86-30-6	1.1E+00		
6.3E-03	C			V	Nitrosomethylethylamine, N-	10595-95-6	4.5E-04		
1.9E-03	C				Nitrosomorpholine [N-]	59-89-2	1.5E-03		
2.7E-03	C				Nitrosopiperidine [N-]	100-75-4	1.0E-03		
6.1E-04	I				Nitrosopyrrolidine, N-	930-55-2	4.6E-03		
				V	Nitrotoluene, m-	99-08-1			
					Nitrotoluene, o-	88-72-2			
					Nitrotoluene, p-	99-99-0			
2.0E-02	P			V	Nonane, n-	111-84-2		2.1E+01	
					Norflurazon	27314-13-2			
					Octabromodiphenyl Ether	32536-52-0			
					Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0			
					Octamethylpyrophosphoramide	152-16-9			
					Oryzalin	19044-88-3			
					Oxadiazon	19666-30-9			
					Oxamyl	23135-22-0			
					Oxyfluorfen	42874-03-3			
					Paclobutrazol	76738-62-0			
					Paraquat Dichloride	1910-42-5			
				V	Parathion	56-38-2			
					Pebulate	1114-71-2			
					Pendimethalin	40487-42-1			
				V	Pentabromodiphenyl Ether	32534-81-9			
					Pentabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-99)	60348-60-9			
				V	Pentachlorobenzene	608-93-5			
				V	Pentachloroethane	76-01-7			
5.1E-06	C			V	Pentachloronitrobenzene	82-68-8	5.5E-01		
					Pentachlorophenol	87-86-5			
					Pentaerythritol tetranitrate (PETN)	78-11-5			
1.0E+00	P			V	Pentane, n-	109-66-0		1.0E+03	
					Perchlorates				
					~Ammonium Perchlorate	7790-98-9			
					~Lithium Perchlorate	7791-03-9			
					~Perchlorate and Perchlorate Salts	14797-73-0			
				V	~Potassium Perchlorate	7778-74-7			
					~Sodium Perchlorate	7601-89-0			
					Perfluorobutane Sulfonate	375-73-5			
6.3E-07	C				Permethrin	52645-53-1	4.5E+00		
					Phenacetin	62-44-2			
					Phenmedipham	13684-63-4			
2.0E-01	C				Phenol	108-95-2		2.1E+02	
					Phenothiazine	92-84-2			
					Phenylenediamine, m-	108-45-2			
					Phenylenediamine, o-	95-54-5			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l u t a b i l i t y	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
					Phenylenediamine, p- Phenylphenol, 2-	106-50-3 90-43-7			
3.0E-04	I			V	Phorate Phosgene Phosmet	298-02-2 75-44-5 732-11-6		3.1E-01	
					Phosphates, Inorganic ~Aluminum metaphosphate ~Ammonium polyphosphate	13776-88-0 68333-79-9			
					~Calcium pyrophosphate ~Diammonium phosphate ~Dicalcium phosphate	7790-76-3 7783-28-0 7757-93-9			
					~Dimagnesium phosphate ~Dipotassium phosphate ~Disodium phosphate	7782-75-4 7758-11-4 7558-79-4			
					~Monoaluminum phosphate ~Monoammonium phosphate ~Monocalcium phosphate	13530-50-2 7722-76-1 7758-23-8			
					~Monomagnesium phosphate ~Monopotassium phosphate ~Monosodium phosphate	7757-86-0 7778-77-0 7558-80-7			
					~Polyphosphoric acid ~Potassium triphosphate ~Sodium acid pyrophosphate	8017-16-1 13845-36-8 7758-16-9			
					~Sodium aluminum phosphate (acidic) ~Sodium aluminum phosphate (anhydrous) ~Sodium aluminum phosphate (tetrahydrate)	7785-88-8 10279-59-1 10305-76-7			
					~Sodium hexametaphosphate ~Sodium polyphosphate ~Sodium trimetaphosphate	10124-56-8 68915-31-1 7785-84-4			
					~Sodium triphosphate ~Tetrapotassium phosphate ~Tetrasodium pyrophosphate	7758-29-4 7320-34-5 7722-88-5			
					~Trialuminum sodium tetra decahydrogenooctathio phosphate (dihydrate) ~Tricalcium phosphate ~Trimagnesium phosphate	15136-87-5 7758-87-4 7757-87-1			
3.0E-04	I			V	~Tripotassium phosphate ~Trisodium phosphate Phosphine	7778-53-2 7601-54-9 7803-51-2		3.1E-01	
1.0E-02	I			V	Phosphoric Acid Phosphorus, White Phthalates	7664-38-2 7723-14-0		1.0E+01	
2.4E-06	C				~Bis(2-ethylhexyl)phthalate ~Butylphthalyl Butylglycolate ~Dibutyl Phthalate	117-81-7 85-70-1 84-74-2	1.2E+00		
				V	~Diethyl Phthalate ~Dimethylterephthalate ~Octyl Phthalate, di-N-	84-66-2 120-61-6 117-84-0			
2.0E-02	C				~Phthalic Acid, P- ~Phthalic Anhydride Picloram	100-21-0 85-44-9 1918-02-1		2.1E+01	
8.6E-03	C				Picramic Acid (2-Amino-4,6-dinitrophenol) Picric Acid (2,4,6-Trinitrophenol) Pirimiphos, Methyl	96-91-3 88-89-1 29232-93-7			
2.0E-05	S			V	Polybrominated Biphenyls Polychlorinated Biphenyls (PCBs) ~Aroclor 1016	59536-65-1 12674-11-2	3.3E-04 1.4E-01		
5.7E-04	S			V	~Aroclor 1221	11104-28-2	4.9E-03		
5.7E-04	S			V	~Aroclor 1232	11141-16-5	4.9E-03		
5.7E-04	S			V	~Aroclor 1242	53469-21-9	4.9E-03		
5.7E-04	S			V	~Aroclor 1248	12672-29-6	4.9E-03		
5.7E-04	S			V	~Aroclor 1254	11097-69-1	4.9E-03		
5.7E-04	S			V	~Aroclor 1260	11096-82-5	4.9E-03		
1.1E-03	E	1.3E-03	E	V	~Aroclor 5460	11126-42-4			
1.1E-03	E	1.3E-03	E	V	~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	2.5E-03	1.4E+00	
1.1E-03	E	1.3E-03	E	V	~Hexachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 167)	52663-72-6	2.5E-03	1.4E+00	
1.1E-03	E	1.3E-03	E	V	~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	2.5E-03	1.4E+00	
1.1E-03	E	1.3E-03	E	V	~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 156)	38380-08-4	2.5E-03	1.4E+00	
1.1E+00	E	1.3E-06	E	V	~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	2.5E-06	1.4E-03	

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	o l i g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	2.5E-03	1.4E+00	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	2.5E-03	1.4E+00	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	2.5E-03	1.4E+00	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	2.5E-03	1.4E+00	
3.8E+00	E	4.0E-07	E	V	~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	7.4E-07	4.2E-04	
5.7E-04	I			V	~Polychlorinated Biphenyls (high risk)	1336-36-3	4.9E-03		
1.0E-04	I			V	~Polychlorinated Biphenyls (low risk)	1336-36-3	2.8E-02		
2.0E-05	I			V	~Polychlorinated Biphenyls (lowest risk)	1336-36-3	1.4E-01		
3.8E-03	E	4.0E-04	E		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	7.4E-04	4.2E-01	
1.1E-02	E	1.3E-04	E	V	~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	2.5E-04	1.4E-01	
		6.0E-04	I		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9		6.3E-01	
					Polynuclear Aromatic Hydrocarbons (PAHs)				
				V	~Acenaphthene	83-32-9			
				V	~Anthracene	120-12-7			
1.1E-04	C			V M	~Benz[a]anthracene	56-55-3	9.2E-03		
1.1E-04	C				~Benzo[j]fluoranthene	205-82-3	2.6E-02		
1.1E-03	C			M	~Benzo[a]pyrene	50-32-8	9.2E-04		
1.1E-04	C			M	~Benzo[b]fluoranthene	205-99-2	9.2E-03		
1.1E-04	C			M	~Benzo[k]fluoranthene	207-08-9	9.2E-03		
			V		~Chloronaphthalene, Beta-	91-58-7			
1.1E-05	C			M	~Chrysene	218-01-9	9.2E-02		
1.2E-03	C			M	~Dibenz[a,h]anthracene	53-70-3	8.4E-04		
1.1E-03	C				~Dibenzo(a,e)pyrene	192-65-4	2.6E-03		
7.1E-02	C			M	~Dimethylbenz(a)anthracene, 7,12-	57-97-6	1.4E-05		
				V	~Fluoranthene	206-44-0			
					~Fluorene	86-73-7			
1.1E-04	C			M	~Indeno[1,2,3-cd]pyrene	193-39-5	9.2E-03		
				V	~Methylnaphthalene, 1-	90-12-0			
				V	~Methylnaphthalene, 2-	91-57-6			
3.4E-05	C	3.0E-03	I	V	~Naphthalene	91-20-3	8.3E-02	3.1E+00	
1.1E-04	C			V	~Nitropyrene, 4-	57835-92-4	2.6E-02		
					~Pyrene	129-00-0			
					Potassium Perfluorobutane Sulfonate	29420-49-3			
				V	Prochloraz	67747-09-5			
					Profluralin	26399-36-0			
					Prometon	1610-18-0			
					Prometryn	7287-19-6			
					Propachlor	1918-16-7			
					Propanediol, 1,2-	114-26-1			
				V	Propanil	709-98-8			
					Propargite	2312-35-8			
					Propargyl Alcohol	107-19-7			
					Propazine	139-40-2			
					Propham	122-42-9			
					Propiconazole	60207-90-1			
8.0E-03	I	V			Propionaldehyde	123-38-6		8.3E+00	
1.0E+00	X	V			Propyl benzene	103-65-1		1.0E+03	
3.0E+00	C	V			Propylene	115-07-1		3.1E+03	
					Propylene Glycol	57-55-6			
2.7E-04	A				Propylene Glycol Dinitrate	6423-43-4		2.8E-01	
2.0E+00	I	V			Propylene Glycol Monomethyl Ether	107-98-2		2.1E+03	
3.7E-06	I	3.0E-02	I	V	Propylene Oxide	75-56-9	7.6E-01	3.1E+01	
					Propyzamide	23950-58-5			
				V	Pyridine	110-86-1			
					Quinalphos	13593-03-8			
					Quinoline	91-22-5			
					Quizalofop-ethyl	76578-14-8			
3.0E-02	A				Refractory Ceramic Fibers	NA		3.1E+01	
				V	Resmethrin	10453-86-8			
					Ronnel	299-84-3			
6.3E-05	C			M	Rotenone	83-79-4			
					Safrole	94-59-7	1.6E-02		
					Selenious Acid	7783-00-8			
2.0E-02	C				Selenium	7782-49-2		2.1E+01	
2.0E-02	C				Selenium Sulfide	7446-34-6		2.1E+01	
					Sethoxydim	74051-80-2			
3.0E-03	C				Silica (crystalline, respirable)	7631-86-9		3.1E+00	
					Silver	7440-22-4			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
					Simazine	122-34-9			
1.5E-01	C	2.0E-04	C	M	Sodium Acifluorfen	62476-59-9			
					Sodium Azide	26628-22-8			
					Sodium Dichromate	10588-01-9	6.8E-06		2.1E-01
1.3E-02	C				Sodium Diethyldithiocarbamate	148-18-5			
					Sodium Fluoride	7681-49-4			1.4E+01
					Sodium Fluoroacetate	62-74-8			
					Sodium Metavanadate	13718-26-8			
					Sodium Tungstate	13472-45-2			
					Sodium Tungstate Dihydrate	10213-10-2			
1.5E-01	C	2.0E-04	C	M	Stirofos (Tetrachlorovinphos)	961-11-5			
					Strontium Chromate	7789-06-2	6.8E-06		2.1E-01
					Strontium, Stable	7440-24-6			
1.0E+00	I	V			Strychnine	57-24-9			
					Styrene	100-42-5			1.0E+03
					Styrene-Acrylonitrile (SAN) Trimer	NA			
2.0E-03	X				Sulfolane	126-33-0			2.1E+00
1.0E-03	C	V			Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9			
					Sulfur Trioxide	7446-11-9			1.0E+00
7.1E-06	I				Sulfuric Acid	7664-93-9			1.0E+00
					Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	4.0E-01		
					TCMTB	21564-17-0			
					Tebuthiuron	34014-18-1			
					Temephos	3383-96-8			
					Terbacil	5902-51-2			
				V	Terbufos	13071-79-9			
					Terbutryn	886-50-0			
					Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1			
7.4E-06	I			V	Tetrachlorobenzene, 1,2,4,5-	95-94-3	3.8E-01		
5.8E-05	C			V	Tetrachloroethane, 1,1,1,2-	630-20-6	4.8E-02		
				V	Tetrachloroethane, 1,1,2,2-	79-34-5			
2.6E-07	I	4.0E-02	I	V	Tetrachloroethylene	127-18-4	1.1E+01		4.2E+01
				V	Tetrachlorophenol, 2,3,4,6-	58-90-2			
					Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1			
8.0E+01	I	V			Tetraethyl Dithiopyrophosphate	3689-24-5			
					Tetrafluoroethane, 1,1,1,2-	811-97-2			8.3E+04
					Tetryl (Trinitrophenylmethyl)nitramine	479-45-8			
					Thallium (I) Nitrate	10102-45-1			
				V	Thallium (Soluble Salts)	7440-28-0			
					Thallium Acetate	563-68-8			
				V	Thallium Carbonate	6533-73-9			
					Thallium Chloride	7791-12-0			
					Thallium Sulfate	7446-18-6			
					Thifensulfuron-methyl	79277-27-3			
					Thiobencarb	28249-77-6			
					Thiodiglycol	111 48 8			
					Thiofanox	39196-18-4			
					Thiophanate, Methyl	23564-05-8			
					Thiram	137-26-8			
1.0E-04	A	V			Tin	7440-31-5			
5.0E+00	I	V			Titanium Tetrachloride	7550-45-0			1.0E-01
					Toluene	108-88-3			5.2E+03
				V	Toluene-2,5-diamine	95-70-5			
					Toluidine, p-	106-49-0			
					Total Petroleum Hydrocarbons (Aliphatic High)	NA			
6.0E-01	P	V			Total Petroleum Hydrocarbons (Aliphatic Low)	NA			6.3E+02
1.0E-01	P	V			Total Petroleum Hydrocarbons (Aliphatic Medium)	NA			1.0E+02
					Total Petroleum Hydrocarbons (Aromatic High)	NA			
3.0E-02	P	V			Total Petroleum Hydrocarbons (Aromatic Low)	NA			3.1E+01
3.0E-03	P	V			Total Petroleum Hydrocarbons (Aromatic Medium)	NA			3.1E+00
3.2E-04	I				Toxaphene	8001-35-2	8.8E-03		
				V	Tralothrin	66841-25-6			
					Tri-n-butyltin	688-73-3			
					Triacetin	102-76-1			
				V	Triadimefon	43121-43-3			
					Triallate	2303-17-5			
					Triasulfuron	82097-50-5			
					Tribenuron-methyl	101200-48-0			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
				V	Tribromobenzene, 1,2,4- Tributyl Phosphate	615-54-3 126-73-8			
				3.0E+01 H V	Tributyltin Compounds Tributyltin Oxide Trichloro-1,2,2-trifluoroethane, 1,1,2-	NA 56-35-9 76-13-1			3.1E+04
					Trichloroacetic Acid Trichloroaniline HCl, 2,4,6- Trichloroaniline, 2,4,6-	76-03-9 33663-50-2 634-93-5			
				V 2.0E-03 P V 5.0E+00 I V	Trichlorobenzene, 1,2,3- Trichlorobenzene, 1,2,4- Trichloroethane, 1,1,1-	87-61-6 120-82-1 71-55-6			2.1E+00 5.2E+03
1.6E-05 I 4.1E-06 I		2.0E-04 X V 2.0E-03 I V		V M	Trichloroethane, 1,1,2- Trichloroethylene Trichlorofluoromethane	79-00-5 79-01-6 75-69-4	1.8E-01 4.8E-01		2.1E-01 2.1E+00
3.1E-06 I					Trichlorophenol, 2,4,5- Trichlorophenol, 2,4,6- Trichlorophenoxyacetic Acid, 2,4,5-	95-95-4 88-06-2 93-76-5	9.1E-01		
				V 3.0E-04 I V M	Trichlorophenoxypropionic acid, -2,4,5 Trichloropropane, 1,1,2- Trichloropropane, 1,2,3-	93-72-1 598-77-6 96-18-4			3.1E-01
				3.0E-04 P V	Trichloropropene, 1,2,3- Tricresyl Phosphate (TCP) Tridiphenyl	96-19-5 1330-78-5 58138-08-2			3.1E-01
				7.0E-03 I V 2.0E+01 P V	Triethylamine Triethylene Glycol Trifluoroethane, 1,1,1-	121-44-8 112-27-6 420-46-2			7.3E+00 2.1E+04
				V 5.0E-03 P V	Trifluralin Trimethyl Phosphate Trimethylbenzene, 1,2,3-	1582-09-8 512-56-1 526-73-8			5.2E+00
				7.0E-03 P V V V	Trimethylbenzene, 1,2,4- Trimethylbenzene, 1,3,5- Trimethylpentene, 2,4,4-	95-63-6 108-67-8 25167-70-8			7.3E+00
					Trinitrobenzene, 1,3,5- Trinitrotoluene, 2,4,6- Triphenylphosphine Oxide	99-35-4 118-96-7 791-28-6			
6.6E-04 C				V	Tris(1,3-Dichloro-2-propyl) Phosphate Tris(1-chloro-2-propyl)phosphate Tris(2,3-dibromopropyl)phosphate	13674-87-8 13674-84-5 126-72-7	4.3E-03		
					Tris(2-chloroethyl)phosphate Tris(2-ethylhexyl)phosphate Tungsten	115-96-8 78-42-2 7440-33-7			
4.0E-05 A 2.9E-04 C 8.3E-03 P				A C P	Uranium (Soluble Salts) Urethane Vanadium Pentoxide	NA 51-79-6 1314-62-1			4.2E-02 3.5E-03 3.4E-04
				1.0E-04 A V	Vanadium and Compounds Vernolate Vinclozolin	7440-62-2 1929-77-7 50471-44-8			1.0E-01
2.0E-01 I V 3.2E-05 H 4.4E-06 I				I V I V I V M	Vinyl Acetate Vinyl Bromide Vinyl Chloride	108-05-4 593-60-2 75-01-4	8.8E-02 1.7E-01		2.1E+02 3.1E+00 1.0E+02
				1.0E-01 S V 1.0E-01 S V	Warfarin Xylene, p- Xylene, m-	81-81-2 106-42-3 108-38-3			1.0E+02 1.0E+02
				1.0E-01 S V 1.0E-01 I V	Xylene, o- Xylenes Zinc Phosphide	95-47-6 1330-20-7 1314-84-7			1.0E+02 1.0E+02
					Zinc and Compounds Zineb Zirconium	7440-66-6 12122-67-7 7440-67-7			

Key: I = IRIS; P = PPRTV; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																											
Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHLD Hazard Index (HI) = 1				Protection of Groundwater				
SFO (mg/kg-day)	k _e y	IUR (ug/m ³)	k _e y	RfD _a (mg/kg-day)	k _e y	RfC _i (mg/m ³)	k _e y	muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)		
8.7E-03	I	2.2E-06	I	4.0E-03	I	9.0E-03	I	V	-0.85	1	1	Yes	Acephate	30560-19-1	9.0E+00	1.2E+04	2.6E+00	8.9E+00	8.0E+01	1.1E+05	1.9E+01	8.0E+01		2.0E-03			
				2.0E-02	I	3.1E+01	A	V	-0.34	1	1	Yes	Acetaldehyde	75-07-0										5.2E-04			
									3.03	1	0.9	Yes	Acetochlor	34256-82-1				2.6E+00	4.0E+02	2.9E+03		3.5E+02		2.8E-01			
				9.0E-01	I	2.0E-03	X		-0.24	1	1	Yes	Acetone	67-64-1					1.8E+04	4.4E+06	6.4E+04	1.4E+04		2.9E+00			
						6.0E-02	I	V	-0.03	1	1	Yes	Acetone Cyanohydrin	75-86-5													
									-0.34	1	1	Yes	Acetonitrile	75-05-8							1.3E+02	1.3E+02		2.6E-02			
3.8E+00	C	1.3E-03	C	1.0E-01	I			V	1.58	1	1	Yes	Acetophenone	98-86-2					2.0E+03	4.6E+04		1.9E+03		5.8E-01			
				5.0E-04	I	2.0E-05	I	V	3.12	1	1	Yes	Acetylaminofluorene, 2-	53-96-3	2.1E-02	6.7E-02		1.6E-02						7.2E-05			
									-0.01	1	1	Yes	Acrolein	107-02-8					1.0E+01	1.7E+03	4.2E-02	4.2E-02		8.4E-06			
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I	M	-0.67	1	1	Yes	Acrylamide	79-06-1	5.0E-02	2.3E+01		5.0E-02	4.0E+01	2.1E+04		4.0E+01		1.1E-05			
				5.0E-01	I	1.0E-03	I	V	0.35	1	1	Yes	Acrylic Acid	79-10-7					1.0E+04	1.1E+06	2.1E+00	2.1E+00		4.2E-04			
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V	0.25	1	1	Yes	Acrylonitrile	107-13-1	1.4E-01	1.4E+01	8.3E-02	5.2E-02	8.0E+02	8.9E+04	4.2E+00	4.1E+00		1.1E-05			
5.6E-02	C			1.0E-02	I	6.0E-03	P		-0.32	1	1	Yes	Adiponitrile	111-69-3	1.4E+00	4.4E+00		1.1E+00	2.0E+02	6.9E+02		1.6E+02	2.0E+00	8.7E-04	1.7E-03		
				1.0E-03	I				3.52	1	0.9	Yes	Alachlor	15972-60-8					2.0E+01	1.4E+03		2.0E+01	3.0E+00	4.9E-03	7.5E-04		
				1.0E-03	I				1.13	1	1	Yes	Aldicarb	116-06-3					2.0E+01	2.4E+04		2.0E+01	4.0E+00	4.4E-03	4.4E-04		
				1.0E-03	I				-0.57	1	1	Yes	Aldicarb Sulfone	1646-88-4					2.0E+01				4.0E+00	4.4E-03	4.4E-04		
				1.0E-03	I				-0.78	1	1	Yes	Aldicarb sulfoxide	1646-87-3									4.0E+00	8.8E-04			
1.7E+01	I	4.9E-03	I	3.0E-05	I			V	6.5	1	1	No	Aldrin	309-00-2	4.6E-03		1.1E-03	9.2E-04	6.0E-01				1.5E-04				
				5.0E-03	I	1.0E-04	X	V	0.17	1	1	Yes	Allyl Alcohol	107-18-6					1.0E+02	1.3E+04	2.1E-01	2.1E-01		4.2E-05			
2.1E-02	C	6.0E-06	C			1.0E-03	I	V	1.93	1	1	Yes	Allyl Chloride	107-05-1	3.7E+00	3.5E+01	9.4E-01	7.3E-01	4.0E+02	9.1E+04	2.1E+00	2.1E+00		2.3E-04			
				1.0E+00	P	5.0E-03	P		1	1	1	Yes	Aluminum	7429-90-5					2.0E+04	4.6E+06		2.0E+04		3.0E+04			
				4.0E-04	I					1	1	Yes	Aluminum Phosphide	20859-73-8					8.0E+00	1.8E+03		8.0E+00					
2.1E+01	C	6.0E-03	C	9.0E-03	I				2.98	1	1	Yes	Ametryn	834-12-8					1.8E+02	9.8E+02		1.5E+02		1.6E-01			
									2.86	1	1	Yes	Aminobiphenyl, 4-	92-67-1	3.7E-03	1.5E-02		3.0E-03						1.5E-05			
				8.0E-02	P				0.21	1	1	Yes	Aminophenol, m-	591-27-5					1.6E+03	2.8E+05		1.6E+03		6.1E-01			
				2.0E-02	P				0.04	1	1	Yes	Aminophenol, p-	123-30-8					4.0E+02	9.1E+04		4.0E+02		1.5E-01			
				2.5E-03	I				5.5	1	0.9	Yes	Amtraz	33089-61-1					5.0E+01	9.8E+00		8.2E+00		4.2E+00			
				1.0E-01	I	V			0.23	1	1	Yes	Ammonia	7664-41-7					4.0E+03	9.1E+05							
				2.0E-01	I					1	1	Yes	Ammonium Sulfamate	7773-06-0													
						3.0E-03	X	V	0.89	1	1	Yes	Amyl Alcohol, tert-	75-85-4							6.3E+00	6.3E+00		1.3E-03			
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I		0.9	1	1	Yes	Aniline	62-53-3	1.4E+01	6.9E+02		1.3E+01	1.4E+02	7.7E+03		1.4E+02		4.6E-03			
4.0E-02	P			2.0E-03	X				3.39	1	0.9	Yes	Anthraquinone, 9,10-	84-65-1	1.9E+00	5.1E+00		1.4E+00	4.0E+01	1.1E+02		3.0E+01		1.4E-02			
				4.0E-04	I				0.15	1	1	Yes	Antimony (metallid)	7440-36-0					8.0E+00	2.7E+02		7.8E+00	6.0E+00	3.5E-01	2.7E-01		
				5.0E-04	H				0.15	1	1	Yes	Antimony Pentoxide	1314-60-9					1.0E+01	3.4E+02		9.7E+00					
				4.0E-04	H				0.15	1	1	Yes	Antimony Tetroxide	1332-81-6					8.0E+00	2.7E+02		7.8E+00					
						2.0E-04	I		0.15	1	1	Yes	Antimony Trioxide	1309-64-4													
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	1	Yes	Arsenic, inorganic	7440-38-2	5.2E-02	9.7E+00		5.2E-02	6.0E+00	1.4E+03		6.0E+00	1.0E+01	1.5E-03	2.9E-01		
				3.5E-06	C	5.0E-05	I			1	1	Yes	Arsine	7784-42-1					7.0E-02	1.6E+01		7.0E-02					
				5.0E-02	I				-0.27	1	1	Yes	Asulam	3337-771-1					1.0E+03	8.0E+05		1.0E+03		2.6E-01			
2.3E-01	C			3.5E-02	I				2.61	1	1	Yes	Atrazine	1912-24-9	3.4E-01	2.8E+00		3.0E-01	7.0E+02	6.2E+03		6.3E+02	3.0E+00	2.0E-04	2.0E-03		
8.8E-01	C	2.5E-04	C						2.98	1	0.9	Yes	Auramine	892-80-8	8.9E-02	2.7E-01		6.7E-02						6.1E-04			
				4.0E-04	I				4.48	1	1	No	Avermectin B1	85195-55-3					8.0E+00			8.0E+00		1.4E-01			
				3.0E-03	A	1.0E-02	A		2.75	1	1	Yes	Azinphos-methyl	86-50-0					6.0E+01	8.3E+02		5.6E+01		1.7E-02			
1.1E-01	I	3.1E-05	I					V	3.82	1	1	Yes	Azobenzene	103-33-3	7.1E-01	7.3E-01	1.8E-01	1.2E-01						9.3E-04			
				1.0E+00	P	7.0E-06	P		-1.7	1	1	Yes	Azodicarbonamide	123-77-3					2.0E+04	6.8E+07		2.0E+04		6.8E+00			
5.0E-01	C	1.5E-01	C	2.0E-01	I	5.0E-04	H		0.07	1	1	Yes	Barium	7440-39-3					4.0E+03	6.4E+04		3.8E+03	2.0E+03	1.6E+02	8.2E+01		
				2.0E-02	C	2.0E-04	C	M	0.025	1	1	Yes	Barium Chromate	10294-40-3	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02					
				3.0E-01	I			V	5.29	1	0.8	Yes	Benfluralin	1861-40-1					6.0E+03	2.4E+03		1.7E+03		5.6E+01			
				5.0E-02	I				2.12	1	1	Yes	Benomyl	17804-35-2					1.0E+03	3.0E+04		9.7E+02		8.5E-01			
				2.0E-01	I				2.18	1	1	Yes	Bensulfuron-methyl	83055-99-6					4.0E+03	2.4E+05		3.9E+03		1.0E+00			
				3.0E-02	I				2.34	1	1	Yes	Bentazon	25057-89-0					6.0E+02	9.4E+03		5.7E+02		1.2E-01			
5.5E-02	I	7.8E-06	I	1.0E-01	X	4.0E-03	I	3.0E-02	I	V	1.48	1	Yes	Benzaldehyde	100-52-7					2.0E+03	4.9E+04		1.9E+03		4.3E-01		
				1.0E-01	X	3.0E-04	X		2.13	1	1	Yes	Benzene	71-43-2	1.4E+00	9.8E+00	7.2E-01	4.6E-01	8.0E+01	6.1E+02	6.3E+01	3.3E+01	5.0E+00	2.3E-04	2.6E-03		
									-3.727	1	1	No	Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	7.8E-01		7.8E-01		6.0E+00			6.0E+00		2.2E-04			
2.3E+02	I	6.7E-02	I	1.0E-03	P			V	2.52	1	1	Yes	Benzenethiol	108-98-5					2.0E+01	1.0E+02		1.7E+01		1.1E-02			
				3.0E-03	I			M	1.34	1	1	Yes	Benzdine	92-87-5	1.1E-04	5.0E-03		1.1E-04	6.0E+01	3.0E+03		5.9E+01		2.8E-07			
				4.0E+00	I				1.87	1	1	Yes	Benzoic Acid	65-85-0					8.0E+04	1.2E+06		7.5E+04		1.8E+01			
1.3E+01	I			1.0E-01	P			V	3.9	1	1	Yes	Benzotrichloride	98-07-7	6.0E-03	6.0E-03		3.0E-03	2.0E+03	8.9E+04		2.0E+03		6.6E-06			
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V	1.1	1	1	Yes	Benzyl Alcohol	100-51-6					4.0E+01	3.2E+02	2.1E+00	2.0E+00		4.8E-01			
									2.3	1	1	Yes	Benzyl Chloride	100-44-7	4.6E-01	3.4E+00	1.1E-01	8.9E-02						9.8E-05			
				2.4E-03	I	2.0E-03	I	2.0E-05	I		0.007	1	Yes	Beryllium and compounds	7440-41-7					4.0E+01	6.4E+01		2.5E+01	4.0E+00	2.0E+01	3.2E+00	
				9.0E-03	P				4.48	1	0.9	Yes	Bifenox	42576-02-3					1.8E+02	2.3E+02		1.0E+02		7.6E-01			
				1.5E-02																							

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Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				Protection of Groundwater				
SFO (mg/kg-day) ¹	k _e (ug/m ³ -day) ¹	IUR (ug/m ³ -day) ¹	k _e (mg/kg-day)	RfD _c (mg/kg-day)	k _e (mg/m ³ -day)	RfC _c (mg/m ³ -day)	k _e (mg/m ³ -day)	o ₁ muta-	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)		
6.2E-02	I	3.7E-05	C	2.0E-02	I	4.0E-02	X	V	1.41	1	1	Yes	Bromochloromethane	74-97-5	1.3E+00	1.9E+01	1.5E-01	1.3E-01	4.0E+02	6.5E+03	8.3E+01	8.3E+01	8.0E+01(F)	2.1E-02			
7.9E-03	I	1.1E-06	I	2.0E-02	I		V	V	2.4	1	1	Yes	Bromodichloromethane	75-27-4	9.9E+00	1.4E+02	5.1E+00	3.3E+00	4.0E+02	6.2E+03	3.8E+02	3.8E+02	8.0E+01(F)	3.7E-05	2.2E-02		
													Bromoform	75-25-2					4.0E+02	1.0E+03	1.0E+01	7.5E+00		1.9E-03			
													Bromomethane	74-83-9					4.0E+02	1.0E+03	1.0E+01	7.5E+00		1.9E-03			
													Bromophos	2104-96-3					1.0E+02	5.5E+01		3.5E+01		1.5E-01			
													Bromoxynil	1689-84-5					4.0E+02	1.8E+03		3.3E+02		2.8E-01			
3.4E+00	C	3.0E-05	I	2.0E-02	I		V	V	5.4	1	0.8	Yes	Bromoxynil Octanoate	1689-99-2	2.3E-02	1.6E-01	1.9E-01	1.8E-02	4.0E+02	2.1E+02		1.4E+02		1.2E+00			
													Butadiene, 1,3-	106-99-0					4.0E+04	3.0E+06	6.3E+04	2.4E+04		9.9E-06			
													Butanol, n-	71-36-3					2.0E+03	1.0E+05		2.0E+03		4.1E-01			
1.9E-03	P			2.0E-01	I			P	4.73	1	0.9	Yes	Butyl Benzyl Phthalate	85-68-7	4.1E+01	2.7E+01		1.6E+01	4.0E+03	2.9E+03		1.7E+03		2.4E-01			
				2.0E+00	P	3.0E+01	P	V	0.61	1	1	Yes	Butyl alcohol, sec-	78-92-2					4.0E+04	3.0E+06		2.4E+04		5.0E+00			
				5.0E-02	I		V	V	4.15	1	1	Yes	Butylate	2008-41-5					1.0E+03	8.5E+02		4.6E+02		4.5E-01			
2.0E-04	C	5.7E-08	C						3.5	1	0.8	Yes	Butylated hydroxyanisole	25013-16-5	3.9E+02	2.5E+02		1.5E+02	6.0E+03	1.2E+03		1.0E+03		2.9E-01			
3.6E-03	P			3.0E-01	P				5.1	1	1	Yes	Butylated hydroxytoluene	128-37-0	2.2E+01	4.0E+00		3.4E+00	1.0E+03	1.2E+03		1.0E+03		1.0E-01			
				5.0E-02	P		V	V	4.38	1	1	No	Butylbenzene, n-	104-51-8					1.0E+03	1.2E+03		1.0E+03		3.2E+00			
				1.0E-01	X		V	V	4.57	1	1	No	Butylbenzene, sec-	135-98-8					2.0E+03	1.1E+03		2.0E+03		5.9E+00			
				1.0E-01	X		V	V	4.11	1	1	Yes	Butylbenzene, tert-	98-06-6					2.0E+03	1.1E+03		2.0E+03		1.6E+00			
				2.0E-02	A				0.36	1	1	Yes	Cacodylic Acid	75-60-5					4.0E+02	6.7E+04		4.0E+02		1.2E-01			
	1.8E-03	I		1.0E-03	I	1.0E-05	A			0.025	1	Yes	Cadmium (Diet)	7440-43-9					1.0E+01	1.1E+02		9.2E+00	5.0E+00	6.9E-01	3.8E-01		
	1.8E-03	I		5.0E-04	I	1.0E-05	A			0.05	1	Yes	Cadmium (Water)	7440-43-9					4.0E+02	2.3E+03		3.4E+02					
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M		0.025	1	Yes	Calcium Chromate	13765-19-0	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02					
				5.0E-01	I	2.2E-03	C		-0.19	1	1	Yes	Caprolactam	105-60-2					1.0E+04	9.0E+05		9.9E+03		2.5E+00			
1.5E-01	C	4.3E-05	C	2.0E-03	I				3.8	1	0.9	Yes	Captafol	2425-06-1	5.2E-01	1.8E+00		4.0E-01	4.0E+01	1.5E+02		3.2E+01		7.1E-04			
2.3E-03	C	6.6E-07	C	1.3E-01	I				2.8	1	1	Yes	Captan	133-06-2	3.4E+01	3.6E+02		3.1E+01	2.6E+03	3.0E+04		2.4E+03		2.2E-02			
				1.0E-01	I				2.36	1	1	Yes	Carbaryl	63-25-2					2.0E+03	2.4E+04		1.8E+03		1.7E+00			
				5.0E-03	I				2.32	1	1	Yes	Carbofuran	1563-66-2					1.0E+02	1.4E+03		9.4E+01	4.0E+01	3.7E-02	1.6E-02		
				1.0E-01	I	7.0E-01	I	V	1.94	1	1	Yes	Carbon Disulfide	75-15-0					2.0E+03	2.0E+04	1.5E+03	8.1E+02		2.4E-01			
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V	2.83	1	1	Yes	Carbon Tetrachloride	56-23-5	1.1E+00	4.3E+00	9.4E-01	4.6E-01	8.0E+01	3.4E+02	2.1E+02	4.9E+01	5.0E+00	1.8E-04	1.9E-03		
						1.0E-01	P	V	-1.33	1	1	Yes	Carbonyl Sulfide	463-58-1					2.1E+02	2.1E+02		2.1E+02		5.1E-01			
				1.0E-02	I				5.57	1	0.8	Yes	Carbosulfan	55285-14-8					2.0E+02	6.9E+01		5.1E+01		1.2E+00			
				1.0E-01	I				2.14	1	1	Yes	Carboxin	5234-68-4					2.0E+03	4.1E+04		1.9E+03		1.0E+00			
						9.0E-04	I			1	1	Yes	Ceric oxide	1306-38-3					2.0E+03	1.5E+05		2.0E+03		4.0E-01			
				1.5E-02	I		V		0.99	1	1	Yes	Chloral Hydrate	802-17-0					3.0E+02	7.4E+03		2.9E+02		7.0E-02			
4.0E-01	H			1.5E-04	I				1.9	1	1	Yes	Chloramben	133-90-4	1.9E-01	3.5E+00		1.8E-01	3.0E+02	7.4E+03		2.9E+02		1.5E-04			
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	V	2.22	1	1	Yes	Chloranil	118-75-2	2.2E-01		5.6E-02	4.5E-02	1.0E+01		1.5E+00	1.3E+00	2.0E+00	3.0E-03	1.4E-01		
									6.26	1	0.7	No	Chlordane	12789-03-6					1.0E+01			1.3E+00		3.0E-03	1.4E-01		
1.0E+01	I	4.6E-03	C	3.0E-04	I				5.41	1	0.8	Yes	Chlordecone (Kepone)	143-50-0	7.8E-03	6.5E-03		3.5E-03	6.0E+00	5.4E+00		2.9E+00		1.2E-04			
				7.0E-04	A				3.81	1	0.9	Yes	Chlorfenvinphos	470-90-6					1.4E+01	5.6E+01		1.1E+01		3.1E-02			
				2.0E-02	I				2.5	1	1	Yes	Chlorimuron, Ethyl-	90982-32-4					4.0E+02	1.5E+04		3.9E+02		1.3E-01			
				1.0E-01	I	1.5E-04	A	V	0.85	1	1	Yes	Chlorine	7782-50-5					2.0E+03	4.6E+05	3.0E-01	3.0E-01		1.4E-04			
				3.0E-02	I	2.0E-04	I	V	1	1	1	Yes	Chlorine Dioxide	10049-04-4					6.0E+02	1.4E+05	4.2E-01	4.2E-01					
				3.0E-02	I				1	1	1	Yes	Chlorite (Sodium Salt)	7758-19-2					6.0E+02	1.4E+05		6.0E+02	1.0E+03				
4.6E-01	H	3.0E-04	I	2.0E-02	H	2.0E-02	I	V	2.05	1	1	Yes	Chloro-1,1-difluoroethane, 1-	75-68-3	1.7E-01	5.1E+02	1.9E-02	1.9E-02	4.0E+02	1.8E+03	1.0E+05	1.0E+05		5.2E+01			
									2.53	1	1	Yes	Chloro-1,3-butadiene, 2-	126-99-8					4.0E+02	1.8E+03	4.2E+01	3.7E+01		9.9E-06			
									2.27	1	1	Yes	Chloro-2-methylaniline HCl, 4-	3165-93-3	1.7E-01				4.0E+02	1.5E+04		3.9E+02		1.5E-04			
1.0E-01	P	7.7E-05	C	3.0E-03	X				2.27	1	1	Yes	Chloro-2-methylaniline, 4-	95-69-2	7.8E-01	6.6E+00		7.0E-01	6.0E+01	5.6E+02		5.4E+01		4.0E-04			
2.7E-01	X							V	0.09	1	1	Yes	Chloroacetaldehyde, 2-	107-20-0	2.9E-01	4.6E+01		2.9E-01					6.0E+01	5.8E-05			
									0.22	1	1	Yes	Chloroacetic Acid	79-11-8										1.2E-02			
						3.0E-05	I		1.93	1	1	Yes	Chloroacetophenone, 2-	532-27-4	3.9E-0												

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Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				Protection of Groundwater		
SFO (mg/kg-day) ¹	k _e IUR (ug/m ³ -day) ¹	k _e y	RfD _a (mg/kg-day)	k _e y	RfC ₁ (mg/m ³) ¹	k _e y	o	muta-	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)		
			9.0E-02	P	2.0E-01	I	V		-0.32	1	1	Yes	Ethoxyethanol, 2-	110-80-5					1.8E+03	6.3E+05	4.2E+02	3.4E+02		6.8E-02			
			9.0E-01	I	7.0E-02	P	V		0.73	1	1	Yes	Ethyl Acetate	141-78-6					1.8E+04	1.2E+06	1.5E+02	1.4E+02		3.1E-02			
			5.0E-03	P	8.0E-03	P	V		1.32	1	1	Yes	Ethyl Acrylate	140-88-5					1.0E+02	3.0E+03	1.7E+01	1.4E+01		3.2E-03			
					1.0E+01	I	V		1.43	1	1	Yes	Ethyl Chloride (Chloroethane)	75-00-3							2.1E+04	2.1E+04		5.9E+00			
			2.0E-01	I		V			0.89	1	1	Yes	Ethyl Ether	60-29-7					4.0E+03	2.0E+05		3.9E+03		8.8E-01			
					3.0E-01	P	V		1.94	1	1	Yes	Ethyl Methacrylate	97-63-2							6.3E+02	6.3E+02		1.5E-01			
1.1E-02	C	2.5E-06	C	1.0E-05	I				4.78	1	0.8	Yes	Ethyl-p-nitrophenyl Phosphonate	2104-64-5	7.1E+00	1.2E+01	2.2E+00	1.5E+00	2.0E-01	1.6E-01		8.9E-02	7.0E+02	2.8E-03			
			1.0E-01	I	1.0E+00	I	V		3.15	1	1	Yes	Ethylbenzene	100-41-4					2.0E+03	3.8E+03	2.1E+03	8.1E+02		1.7E-03	7.9E-01		
			7.0E-02	P					-0.94	1	1	Yes	Ethylene Cyanohydrin	109-78-4					1.4E+03	1.1E+06		1.4E+03		2.8E-01			
			9.0E-02	P		V			-2.04	1	1	No	Ethylene Diamine	107-15-3					1.8E+03			1.8E+03		4.2E-01			
			2.0E+00	I	4.0E-01	C			-1.36	1	1	Yes	Ethylene Glycol	107-21-1					4.0E+04	5.7E+07		4.0E+04		8.1E+00			
			1.0E-01	I	1.6E+00	I			0.83	1	1	Yes	Ethylene Glycol Monobutyl Ether	111-76-2					2.0E+03	1.4E+05		2.0E+03		4.1E-01			
3.1E-01	C	8.8E-05	C		3.0E-02	C	V		-0.3	1	1	Yes	Ethylene Oxide	75-21-8	2.5E-01	5.4E+01	6.4E-02	5.1E-02			6.3E+01	6.3E+01		1.1E-05			
4.5E-02	C	1.3E-05	C	8.0E-05	I				-0.66	1	1	Yes	Ethylene Thiourea	96-45-7	1.7E+00	1.0E+03		1.7E+00	1.6E+00	1.0E+03		1.6E+00		3.6E-04			
6.5E+01	C	1.9E-02	C					V	-0.28	1	1	Yes	Ethyleneimine	151-56-4	1.2E-03	2.5E-01	3.0E-04	2.4E-04						5.2E-08			
			3.0E+00	I					2.19	1	1	Yes	Ethylphthalyl Ethyl Glycolate	84-72-0					6.0E+04	1.5E+06		5.8E+04		1.3E+02			
			2.5E-04	I					3.23	1	0.9	Yes	Fenamiphos	22224-92-6					5.0E+00	3.4E+01		4.4E+00		4.4E-03			
			2.5E-02	I					5.7	1	0.8	Yes	Fenpropathrin	39515-41-8					5.0E+02	7.3E+01		6.4E+01		2.9E+00			
			2.5E-02	I					6.2	1	0.7	No	Fenvalerate	51630-58-1					5.0E+02			5.0E+02		3.2E-02			
			1.3E-02	I					2.42	1	1	Yes	Fluometuron	2164-17-2					2.6E+02	3.4E+03		2.4E+02		1.9E-01			
			4.0E-02	C	1.3E-02	C				1	1	Yes	Fluoride	16984-48-8					8.0E+02	1.8E+05		8.0E+02		1.2E+02			
			6.0E-02	I	1.3E-02	C				1	1	Yes	Fluorine (Soluble Fluoride)	7782-41-4					1.2E+03	2.7E+05		1.2E+03	4.0E+03	1.8E+02	6.0E+02		
			8.0E-02	I					3.16	1	0.9	Yes	Fluridone	59756-60-4					1.6E+03	1.4E+04		1.4E+03		1.6E+02			
			2.0E-02	I					3.34	1	0.9	Yes	Flurprimidol	56425-91-3					4.0E+02	2.4E+03		3.4E+02		1.6E+00			
			7.0E-04	I					3.7	1	0.9	Yes	Flusilazole	85509-19-9					1.4E+01	5.0E+01		1.1E+01		1.8E+00			
			6.0E-02	I					3.7	1	0.9	Yes	Flutolanil	66332-96-5					1.2E+03	4.5E+03		9.5E+02		5.0E+00			
			1.0E-02	I					6.81	1	0.6	No	Fluvalinate	69409-94-5					2.0E+02			2.0E+02		2.9E+02			
3.5E-03	I		1.0E-01	I					2.85	1	1	Yes	Folpet	133-07-3	2.2E+01	2.1E+02		2.0E+01	2.0E+03	2.1E+04		1.8E+03		4.7E-03			
1.9E-01	I		2.0E-03	I					2.9	1	1	Yes	Fomesafen	72178-02-0	4.1E-01	9.1E+00		3.9E-01						1.3E-03			
			2.0E-03	I					3.94	1	0.9	Yes	Fonofos	944-22-9					4.0E+01	6.3E+01		2.4E+01		4.7E-02			
	1.3E-05	I	2.0E-01	I	9.8E-03	A	V		0.35	1	1	Yes	Formaldehyde	50-00-0			4.3E-01	4.3E-01	4.0E+03	3.2E+05	2.0E+01	2.0E+01		8.7E-05			
			9.0E-01	P	3.0E-04	X	V		-0.54	1	1	Yes	Formic Acid	64-18-6					1.8E+04	6.4E+06	6.3E-01	6.3E-01		1.3E-04			
			3.0E+00	I					-2.4	1	1	No	Posetyl-AL	39148-24-8					6.0E+04			6.0E+04		7.9E+02			
			1.0E-03	X		V			4.12	1	1	Yes	Furans						2.0E+01	1.3E+01		7.9E+00		1.5E-01			
			1.0E-03	I		V			1.34	1	1	Yes	*Dibenzofuran	132-64-9					2.0E+01	4.8E+02		1.9E+01		7.3E-03			
			9.0E-01	I	2.0E+00	I	V		0.46	1	1	Yes	*Tetrahydrofuran	109-99-9					1.8E+04	1.7E+06	4.2E+03	3.4E+03		7.5E-01			
3.8E+00	H		3.0E-03	I	5.0E-02	H	V		-0.04	1	1	Yes	Furazolidone	67-45-8	2.1E-02	1.0E+01		2.0E-02	6.0E+01	7.1E+03	1.0E+02	3.8E+01		3.9E-05			
									0.41	1	1	Yes	Furfural	98-01-1										8.1E-03			
1.5E+00	C	4.3E-04	C						1.8	1	1	Yes	Furium	531-82-8	5.7E-02	1.9E+00		5.1E-02						6.9E-05			
3.0E-02	I	8.6E-06	C						4.38	1	0.9	Yes	Furmecyclo	60568-05-0	2.6E+00	2.0E+00		1.1E+00						1.2E-03			
			4.0E-04	I					-4.81	1	1	No	Glufosinate, Ammonium	77182-82-2					8.0E+00			8.0E+00		1.8E-03			
					8.0E-05	C			-0.33	1	1	Yes	Glutaraldehyde	111-30-8					8.0E+00	1.8E+03	2.1E+00	1.7E+00		3.3E-04			
			4.0E-04	I	1.0E-03	H	V		-0.12	1	1	Yes	Glycidyl	765-34-4					2.0E+03			2.0E+03	7.0E+02	8.8E+00	3.1E+00		
			1.0E-01	I					-3.4	1	1	No	Glyphosate	1071-83-6													
			1.0E-02	X		V			-1.63	1	1	Yes	Guanidine	143-00-8					2.0E+02	4.2E+05		2.0E+02		4.5E-02			
			2.0E-02	P					-3.56	1	1	No	Guanidine Chloride	50-01-1					4.0E+02			4.0E+02					
			5.0E-05	I					4.07	1	0.9	Yes	Haloxypol, Methyl	69806-40-2					1.0E+00	3.1E+00		7.6E-01		8.4E-03			
4.5E+00	I	1.3E-03	I	5.0E-04	I	V			6.1	1	0.8	Yes	Heptachlor	76-44-8	1.7E-02	2.3E-03	4.3E-03	1.4E-03	1.0E+01	1.5E+00		1.3E+00	4.0E-01	1.2E-04	3.3E-02		
9.1E+00	I	2.6E-03	I	1.3E-05	I	V			4.98	1	0.8	Yes	Heptachlor Epoxide	1024-57-3	8.6E-03	7.1E-03	2.2E-03	1.4E-03	2.6E-01	2.4E-01		1.2E-01	2.0E-01	2.8E-05	4.1E-03		
			2.0E-03	I	V				6.07	1	0.7	No	Hexabromobenzene	87-82-1					4.0E+01			4.0E+01		2.3E-01			
			2.0E-04	I						1	0	No															

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Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				Protection of Groundwater			
SFO (mg/kg-day) ¹	k _e IUR (ug/m ³) ¹	k _e RfD _a (mg/kg-day)	k _e RfC ₁ (mg/m ³)	k _e RfC ₂ (mg/m ³)	k _e RfC ₃ (mg/m ³)	k _e RfC ₄ (mg/m ³)	k _e RfC ₅ (mg/m ³)	k _e RfC ₆ (mg/m ³)	k _e RfC ₇ (mg/m ³)	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)	
6.0E-02	P	4.0E-02	P	1.3E-02	I	1.86	1	1	Yes	0.59	1	1	Yes	Hydroquinone	123-31-9	1.3E+00	1.2E+02		1.3E+00	8.0E+02	7.9E+04		7.9E+02			8.8E-04	
		1.3E-02	I	3.82	1	0.9	Yes			3.82	1	0.9	Yes	Imazalil	35554-44-0					2.6E+02	6.8E+02		1.9E+02			3.2E+00	
		2.5E-01	I	1.49	1	1	Yes			1.86	1	1	Yes	Imazaquin	81335-37-7					5.0E+03	2.6E+05		4.9E+03			2.5E+01	
		2.5E-01	I	1.49	1	1	Yes			1.49	1	1	Yes	Imazethapyr	81335-77-5					5.0E+03	7.2E+04		4.7E+03			4.1E+00	
		1.0E-02	A	2.49	1	1	Yes			2.49	1	1	Yes	Iodine	7553-56-2					2.0E+02	4.6E+04		2.0E+02			1.2E+01	
		4.0E-02	I	3	1	0.9	Yes			3	1	0.9	Yes	Iprodione	36734-19-7					8.0E+02	9.1E+03		7.4E+02			2.3E-01	
		7.0E-01	P	3.0E-01	I	2.0E+00	C	V	0.76	1	1	1	Yes	Iron	7439-89-6					1.4E+04	3.2E+06		1.4E+04			3.5E+02	
9.5E-04	I	2.0E-01	I	2.0E+00	C	V	1.7	1	1	Yes				Isobutyl Alcohol	78-83-1	8.2E+01	1.6E+03		7.8E+01	6.0E+03	3.6E+05		5.9E+03			1.2E+00	
		1.5E-02	I	0.05	1	1	Yes			1.7	1	1	Yes	Isophorone	78-59-1					4.0E+03	8.6E+04		3.8E+03			2.6E-02	
		2.0E+00	P	2.0E-01	P	V	0.05	1	1	Yes				Isopropalin	33820-53-0					3.0E+02	4.6E+01	4.2E+02	4.0E+01			9.2E-01	
		1.0E-01	I	0.27	1	1	Yes			0.05	1	1	Yes	Isopropanol	67-63-0					4.0E+04	6.5E+06		4.1E+02			8.4E-02	
		5.0E-02	I	3.94	1	0.9	Yes			0.27	1	1	Yes	Isopropyl Methyl Phosphonic Acid	1832-54-8					2.0E+03	3.9E+05		2.0E+03			4.3E-01	
		3.0E-01	A	V	8	1	0	No		3.94	1	0.9	Yes	Isosabenerin	82558-50-7					1.0E+03	2.7E+03		7.3E+02			2.0E+00	
		2.0E-03	I	4.81	1	0.9	Yes			8	1	0	No	JP-7	NA					6.3E+02							
		2.0E-03	I	4.81	1	0.9	Yes			4.81	1	0.9	Yes	Lactofen	77501-63-4					4.0E+01	6.7E+01		2.5E+01			1.2E+00	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M	0.025	1	1	Yes		Lead Compounds	7758-97-6	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02				
8.5E-03	C	1.2E-05	C							1	0.8	Yes		*Lead Chromate	7446-27-7	9.2E+00	1.7E+03		9.1E+00								
2.8E-01	C	8.0E-05	C							-0.08	1	1	Yes	*Lead acetate	301-04-2	2.8E-01	2.8E+02		2.8E-01								
8.5E-03	C	1.2E-05	C							-4	1	1	No	*Lead and Compounds	7439-92-1								1.5E+01	1.5E+01			1.4E+01
		1.0E-07	I		V					4.15	1	0.9	Yes	*Lead subacetate	1335-32-6	9.2E+00			9.2E+00								
		5.0E-06	P		V					2.56	1	1	Yes	Tetraethyl Lead	78-00-2					2.0E-03	3.8E-03		1.3E-03			4.7E-06	
		2.0E-03	I							3.2	1	0.9	Yes	Lewisite	541-25-3					1.0E-01	9.1E-01		9.0E-02			3.8E-05	
		2.0E-03	I							3.2	1	0.9	Yes	Linuron	330-55-2					4.0E+01	2.0E+02		3.3E+01			2.9E-02	
		2.0E-03	P							1	1	1	Yes	Lithium	7439-93-2					4.0E+01	9.1E+03		4.0E+01			1.2E+01	
		5.0E-04	I							3.25	1	1	Yes	MCPA	94-74-6					1.0E+01	3.0E+01		7.5E+00			2.0E-03	
		1.0E-02	I							2.79	1	0.9	Yes	MCPB	94-81-5					2.0E+02	5.5E+02		1.5E+02			5.8E-02	
		1.0E-03	I							3.13	1	1	Yes	MCPP	95-67-3					2.0E+01	7.1E+01		1.6E+01			4.7E-03	
		2.0E-02	I							2.36	1	1	Yes	Malathion	121-75-5					4.0E+02	1.1E+04		3.9E+02			1.0E-01	
		1.0E-01	I	7.0E-04	C					1.62	1	1	Yes	Maleic Anhydride	108-31-6					2.0E+03	3.8E+04		1.9E+03			3.9E-01	
		5.0E-01	I	-0.84	1	1	Yes			-0.84	1	1	Yes	Maleic Hydrazide	123-33-1					1.0E+04	8.9E+06		1.0E+04			2.1E+00	
		1.0E-04	P	-0.6	1	1	Yes			-0.6	1	1	Yes	Malononitrile	109-77-3					2.0E+00	9.2E+02		2.0E+00			4.1E-04	
		3.0E-02	H	1.33	1	0.9	Yes			1.33	1	0.9	Yes	Mancozeb	8018-01-7					6.0E+02	4.9E+03		5.4E+02			7.6E-01	
		5.0E-03	I	0.62	1	1	Yes			0.62	1	1	Yes	Maneb	12427-38-2					1.0E+02	3.6E+03		9.8E+01			1.4E-01	
		1.4E-01	I	5.0E-05	I					0.04	1	1	Yes	Manganese (Diet)	7439-96-5					4.8E+02	4.4E+03		4.3E+02			2.8E+01	
		2.4E-02	S	5.0E-05	I					0.04	1	1	Yes	Manganese (Non-diet)	7439-96-5					4.8E+02	4.4E+03		4.3E+02			2.8E+01	
		9.0E-05	H							1.04	1	1	Yes	Mephosfolan	950-10-7					1.8E+00	2.5E+02		1.8E+00			2.6E-03	
		3.0E-02	I	-2.82	1	1	No			-2.82	1	1	No	Mepiquat Chloride	24307-26-4					6.0E+02			6.0E+02			2.0E-01	
3.0E-04	I	3.0E-04	S							-0.22	0.07	1	Yes	Mercury Compounds	7487-94-7					6.0E+00	9.6E+01		5.7E+00	2.0E+00			
		1.0E-04	I	3.0E-04	I	V				0.62	1	1	Yes	*Mercuric Chloride (and other Mercury salts)	7439-97-6					2.0E+00	4.6E+02		2.0E+00			3.3E-02	1.0E-01
		1.0E-04	I							1	1	1	Yes	*Mercury (elemental)	7439-97-6					2.0E+00	4.6E+02		2.0E+00				
		8.0E-05	I							0.71	1	1	Yes	*Methyl Mercury	72967-92-6					1.6E+00	5.7E+02		1.6E+00			5.0E-04	
		3.0E-05	I		V					7.67	1	0.3	No	Phenylmercuric Acetate	62-38-4					6.0E-01	9.9E-02		8.5E-02			5.9E-02	
		3.0E-05	I							5.7	1	0.9	Yes	Merphos	150-50-5					6.0E-01	9.9E-02		8.5E-02			4.2E-04	
		6.0E-02	I	1.65	1	1	Yes			1.65	1	1	Yes	Merphos Oxide	78-48-8					1.2E+03	6.4E+04		1.2E+03			3.3E-01	
		1.0E-04	I	3.0E-02	P	V				0.68	1	1	Yes	Metalaxyl	57837-19-1					2.0E+00	1.3E+02	6.3E+01	1.9E+00			4.4E-04	
		5.0E-05	I	-0.8	1	1	Yes			-0.8	1	1	Yes	Methacrylonitrile	126-98-7					1.0E+00	1.0E+03		1.0E+00			2.1E-04	
		2.0E+00	I	2.0E+01	I	V				-0.77	1	1	Yes	Methamidophos	10265-92-6					4.0E+04	1.8E+07	4.2E+04	2.0E+04			4.1E+00	
		1.0E-03	I	2.2	1	1	Yes			2.2	1	1	Yes	Methanol	67-56-1					2.0E+01	5.8E+02		1.9E+01	</			

14797-65-0					
88-74-4	3.9E+00	1.2E+02			3.8
100-01-6					1.4
88-95-3			1.4E-01		
9004-70-0					
67-20-8					
59-87-0	6.0E-02	1.7E+01			6.0
55-63-0	4.6E+00	1.8E+02			4.5
556-88-7					
75-52-5			6.4E-01		6.4
79-46-9			2.1E-03		2.1
758-73-9	9.3E-04	1.5E-01			9.2
684-93-5	2.1E-04	4.6E-02			2.1
929-16-3	1.4E-02	7.9E-02	3.5E-03		2.7

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Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				Protection of Groundwater									
SFO (mg/kg-day) ¹	k _e IUR (ug/m ³ -d) ¹	k _e RfD _a (mg/kg-day)	k _e RfC ₁ (mg/m ³)	k _e RfC ₂ (mg/m ³)	k _e RfC ₃ (mg/m ³)	k _e RfC ₄ (mg/m ³)	k _e RfC ₅ (mg/m ³)	k _e RfC ₆ (mg/m ³)	k _e RfC ₇ (mg/m ³)	k _e RfC ₈ (mg/m ³)	k _e RfC ₉ (mg/m ³)	k _e RfC ₁₀ (mg/m ³)	k _e RfC ₁₁ (mg/m ³)	k _e RfC ₁₂ (mg/m ³)	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)		
9.0E-02	P																				Pentachloroethane	76-01-7	8.7E-01	2.5E+00		6.5E-01	6.0E+01	4.4E+01		2.6E+01		3.1E-04	
2.6E-01	H																				Pentachloronitrobenzene	82-68-8	3.0E-01	2.0E-01		1.2E-01	1.0E+02	2.9E+01		2.3E+01		1.5E-03	
4.0E-01	I	5.1E-06	C																		Pentachlorophenol	87-86-5	1.9E-01	5.2E-02		4.1E-02	1.0E+02	2.9E+01		2.3E+01	1.0E+00	4.2E-04	1.0E-02
4.0E-03	X																				Pentaerythritol tetranitrate (PETN)	78-11-5	1.9E+01	4.3E+02		1.9E+01	4.0E+01	9.6E+02		3.9E+01		2.8E-02	
																					Pentane, n-Perchlorates	109-66-0						2.1E+03	2.1E+03		1.0E+01		
																					~Ammonium Perchlorate	7790-98-9					1.4E+01	3.2E+03		1.4E+01			
																					~Lithium Perchlorate	7791-03-9					1.4E+01	3.2E+03		1.4E+01			
																					~Perchlorate and Perchlorate Salts	14797-73-0					1.4E+01	3.2E+03		1.4E+01	1.5E+01(F)		
																					~Potassium Perchlorate	7778-74-7					1.4E+01	1.6E+03		1.4E+01			
																					~Sodium Perchlorate	7601-89-0					1.4E+01	3.2E+03		1.4E+01			
																					Perfluorobutane Sulfonate	375-73-5					4.0E+02	8.3E+03		3.8E+02			2.1E-01
																					Permethrin	52645-53-1					1.0E+03			1.0E+03			2.4E+02
2.2E-03	C	6.3E-07	C																		Phenacetin	62-44-2	3.5E+01	1.1E+03		3.4E+01	5.0E+03	1.9E+04		4.0E+03			9.7E-03
																					Phenmedipham	13684-63-4					5.0E+03			4.0E+03			2.1E+01
																					Phenol	108-95-2					6.0E+03	1.4E+05		5.8E+03			3.3E+00
																					Phenothiazine	92-84-2					1.0E+01	7.6E+00		4.3E+00			1.0E-02
																					Phenylenediamine, m-	108-45-2					1.2E+02	4.8E+04		1.2E+02			3.2E-02
4.7E-02	H																				Phenylenediamine, o-	95-54-5	1.7E+00	2.9E+02		1.6E+00	3.8E+03	1.4E+06		3.8E+03			4.4E-04
1.9E-03	H																				Phenylenediamine, p-	106-50-3										1.0E+00	
																					Phenylphenol, 2-	90-43-7	4.0E+01	1.2E+02		3.0E+01						4.1E-01	
																					Phorate	298-02-2					4.0E+00	1.2E+01		3.0E+00			3.4E-03
																					Phosgene	75-44-5											
																					Phosmet	732-11-6					4.0E+02	5.3E+03		3.7E+02			8.2E-02
																					Phosphates, Inorganic												
																					~Aluminum metaphosphate	13776-88-0					9.7E+05	2.2E+08		9.7E+05			
																					~Ammonium polyphosphate	68333-79-9					9.7E+05	2.2E+08		9.7E+05			
																					~Calcium pyrophosphate	7790-76-3					9.7E+05	2.2E+08		9.7E+05			
																					~Diammonium phosphate	7783-28-0					9.7E+05	2.2E+08		9.7E+05			
																					~Dicalcium phosphate	7757-93-9					9.7E+05	2.2E+08		9.7E+05			
																					~Dimagnesium phosphate	7782-75-4					9.7E+05	2.2E+08		9.7E+05			
																					~Dipotassium phosphate	7758-11-4					9.7E+05	2.2E+08		9.7E+05			
																					~Disodium phosphate	7558-79-4					9.7E+05	2.2E+08		9.7E+05			
																					~Monoaluminum phosphate	13530-50-2					9.7E+05	2.2E+08		9.7E+05			
																					~Monoammonium phosphate	7772-76-1					9.7E+05	2.2E+08		9.7E+05			
																					~Monocalcium phosphate	7754-23-8					9.7E+05	2.2E+08		9.7E+05			
																					~Monomagnesium phosphate	7757-86-0					9.7E+05	2.2E+08		9.7E+05			
																					~Monopotassium phosphate	7778-77-0					9.7E+05	2.2E+08		9.7E+05			
																					~Monosodium phosphate	7558-80-7					9.7E+05	2.2E+08		9.7E+05			
																					~Polyphosphoric acid	8017-16-1					9.7E+05	2.2E+08		9.7E+05			
																					~Potassium tripolyphosphate	13845-36-8					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium acid pyrophosphate	7758-16-9					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium aluminum phosphate (addic)	7785-88-8					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium aluminum phosphate (anhydrous)	10279-59-1					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium aluminum phosphate (tetrahydrate)	10305-76-7					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium hexametaphosphate	40124-56-8					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium polyphosphate	68915-31-1					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium trimetaphosphate	7785-84-4					9.7E+05	2.2E+08		9.7E+05			
																					~Sodium tripolyphosphate	7758-29-4					9.7E+05	2.2E+08		9.7E+05			
																					~Tetrapotassium phosphate	7320-34-5			</								

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Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				Protection of Groundwater			
SFO (mg/kg-day) ¹	k _e (ug/m ³) ¹	IUR (ug/m ³) ¹	k _e (mg/kg-day)	RfD _c (mg/kg-day)	k _e (mg/m ³) ¹	RfC _c (mg/m ³) ¹	k _e (ug/m ³) ¹	muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)	
2.0E+00	S	5.7E-04	S					V	4.65	1	1	Yes	*Aroclor 1221	11104-28-2	3.9E-02	1.2E-02	9.8E-03	4.7E-03							8.0E-05	
2.0E+00	S	5.7E-04	S					V	4.4	1	1	Yes	*Aroclor 1232	11141-16-5	3.9E-02	1.2E-02	9.8E-03	4.7E-03							8.0E-05	
2.0E+00	S	5.7E-04	S					V	6.34	1	0.7	No	*Aroclor 1242	53469-21-9	3.9E-02		9.8E-03	7.8E-03							1.2E-03	
2.0E+00	S	5.7E-04	S					V	6.2	1	0	No	*Aroclor 1248	12672-29-6	3.9E-02		9.8E-03	7.8E-03							1.2E-03	
2.0E+00	S	5.7E-04	S	2.0E-05	I			V	6.5	1	0.5	No	*Aroclor 1254	11097-69-1	3.9E-02		9.8E-03	7.8E-03	4.0E-01			4.0E-01			2.1E-03	
2.0E+00	S	5.7E-04	S					V	7.55	1	0	No	*Aroclor 1260	11096-82-5	3.9E-02		9.8E-03	7.8E-03							5.5E-03	
				6.0E-04	X			V	6.34	1	0.7	No	*Aroclor 5460	11126-42-4					1.2E+01			1.2E+01			2.0E+00	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	8.27	1	0	No	*Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	96635-31-9	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			2.8E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.5	1	0	No	*Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			1.7E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.6	1	0	No	*Hexachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 157)	69782-90-7	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			1.7E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.6	1	0	No	*Hexachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 156)	38380-08-4	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			1.7E-03	
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V	7.41	1	0.1	No	*Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	2.0E-05		4.9E-06	4.0E-06	4.7E-04		2.8E-03	4.0E-04			1.7E-06	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	6.98	1	0.4	No	*Pentachlorobiphenyl, 2',3,4,4',5,5'- (PCB 123)	65510-44-3	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			1.0E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	7.12	1	0.3	No	*Pentachlorobiphenyl, 2,3',4,4',5,5'- (PCB 118)	31508-00-6	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			1.0E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	6.79	1	0.5	No	*Pentachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 105)	32598-14-4	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			1.0E-03	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	6.98	1	0.4	No	*Pentachlorobiphenyl, 2,3,4,4',5,5'- (PCB 114)	74472-37-0	2.0E-02		4.9E-03	4.0E-03	4.7E-01		2.8E+00	4.0E-01			1.0E-03	
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V	6.98	1	0.4	No	*Pentachlorobiphenyl, 3,3',4,4',5,5'- (PCB 126)	57465-28-8	6.0E-06		1.5E-06	1.2E-06	1.4E-04		8.3E-04	1.2E-04			3.0E-07	
2.0E+00	I	5.7E-04	I					V	7.1	1	0.7	No	*Polychlorinated Biphenyls (high risk)	1336-36-3												
4.0E-01	I	1.0E-04	I					V	7.1	1	0.7	No	*Polychlorinated Biphenyls (low risk)	1336-36-3	1.9E-01		5.6E-02	4.4E-02					5.0E-01	6.8E-03	7.8E-02	
7.0E-02	I	2.0E-05	I					V	7.1	1	0.7	No	*Polychlorinated Biphenyls (lowest risk)	1336-36-3												
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E		6.63	1	0.6	No	*Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	6.0E-03			6.0E-03	1.4E-01			1.4E-01			9.4E-04	
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V	6.34	1	0.7	No	*Tetrachlorobiphenyl, 3,4,4',5,5'- (PCB 81)	70362-50-4	2.0E-03		4.9E-04	4.0E-04	4.7E-02		2.8E-01	4.0E-02			6.2E-05	
				6.0E-04	I				10.46	1	0	No	Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9												
													Polynuclear Aromatic Hydrocarbons (PAHs)													
				6.0E-02	I			V	3.92	1	1	Yes	*Acenaphthene	83-32-9					1.2E+03	9.6E+02		5.3E+02			5.5E+00	
				3.0E-01	I			V	4.45	1	1	Yes	*Anthracene	120-12-7					6.0E+03	2.5E+03		1.8E+03			5.8E+01	
7.3E-01	E	1.1E-04	C					V	5.76	1	1	No	*Benz[a]anthracene	56-55-3	3.4E-02		1.8E-02	1.2E-02							4.3E-03	
1.2E+00	C	1.1E-04	C						6.11	1	0.9	No	*Benzo[b]fluoranthene	205-82-3	6.5E-02			6.5E-02					2.0E-01	7.8E-02		
7.3E+00	I	1.1E-03	C						6.13	1	1	No	*Benzo[a]pyrene	50-32-8	3.4E-03			3.4E-03							4.0E-03	
7.3E-01	E	1.1E-04	C						5.78	1	1	No	*Benzo[b]fluoranthene	205-99-2	3.4E-02			3.4E-02							4.1E-02	
7.3E-02	E	1.1E-04	C						6.11	1	0.9	No	*Benzo[k]fluoranthene	207-08-9	3.4E-01			3.4E-01							4.0E-01	
				8.0E-02	I			V	3.9	1	1	Yes	*Chloronaphthalene, beta	91-58-7					1.6E+03	1.4E+03		7.5E+02			3.9E+00	
7.3E-03	E	1.1E-05	C						5.81	1	1	No	*Chrysene	218-01-9	3.4E+00			3.4E+00							1.2E+00	
7.3E+00	E	1.2E-03	C						6.75	1	0.6	No	*Dibenz[a,h]anthracene	53-70-3	3.4E-03			3.4E-03							1.3E-02	
1.2E+01	C	1.1E-03	C						7.71	1	0.3	No	*Dibenzo[a,e]pyrene	192-65-4	6.5E-03			6.5E-03							8.4E-02	
2.5E+02	C	7.1E-02	C						5.8	1	0.9	No	*Dimethylbenz[a]anthracene, 7,12	57-97-6	1.0E-04			1.0E-04							9.9E-05	
				4.0E-02	I				5.16	1	1	No	*Fluoranthene	206-44-0					8.0E+02			8.0E+02			8.9E+01	
				4.0E-02	I			V	4.18	1	1	Yes	*Fluorene	86-73-7					8.0E+02	4.6E+02		2.9E+02			5.5E+00	
7.3E-01	E	1.1E-04	C						6.7	1	0.6	No	*Indeno[1,2,3-cd]pyrene	193-39-5	3.4E-02			3.4E-02							1.3E-01	
2.9E-02	P		7.0E-02	A				V	3.87	1	1	Yes	*Methylnaphthalene, 1-	90-12-0	2.7E+00	2.0E+00		1.1E+00	1.4E+03	1.1E+03		6.2E+02			6.0E-03	
			4.0E-03	I				V	3.86	1	1	Yes	*Methylnaphthalene, 2-	91-37-6					8.0E+01	6.5E+01		3.6E+01			1.9E-01	
			2.0E-02	I	3.0E-03	I	V		3.3	1	1	Yes	*Naphthalene	91-20-3			1.7E-01	1.7E-01	4.0E+02	7.0E+02	6.3E+00	6.1E+00			5.4E-04	
1.2E+00	C	1.1E-04	C						4.75	1	0.9	Yes	*Nitropyrene, 4-	57835-92-4	6.5E-02	2.7E-02		1.9E-02							3.3E-03	
			3.0E-02	I				V	4.88	1	1	Yes	*Pyrene	129-00-0					6.0E+02	1.5E+02		1.2E+02			1.3E+01	
			2.0E-02	P					-0.33	1	1	Yes	Potassium Perfluorobutane Sulfonate	29420-49-3					4.0E+02	2.8E+05		4.0E+02				
1.5E-01	I		9.0E-03	H					4.1	1	0.9	Yes	Prochloraz	67747-09-5	5.2E-01	1.4E+00		3.8E-01	1.8E+02	5.1E+02		1.3E+02			1.9E-03	
			6.0E-03	I				V	5.58	1	0.8</															

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																											
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				Protection of Groundwater			
SFO (mg/kg-day) ¹	k _e IUR (ug/m ³ -day) ¹	k _e RfD _a (mg/kg-day) ¹	k _e RfC _d (mg/m ³) ¹	k _e RfC _i (mg/m ³) ¹	k _e RfC _s (mg/m ³) ¹	k _e RfC _h (mg/m ³) ¹	k _e RfC _l (mg/m ³) ¹	k _e RfC _o (mg/m ³) ¹	k _e RfC _p (mg/m ³) ¹	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)	
		5.0E-03	I	2.0E-02	C						1	1	Yes	Selenium	7782-49-2					1.0E+02	2.3E+04		1.0E+02	5.0E+01	5.2E-01	2.6E-01	
		5.0E-03	C	2.0E-02	C						1	1	Yes	Selenium Sulfide	7446-34-6					1.0E+02	2.3E+04		1.0E+02				
		9.0E-02	I							4.38	1	0.9	Yes	Sethoxydim	74051-80-2					1.8E+03	2.4E+03		1.0E+03		9.3E+00		
				3.0E-03	C								1	Yes	Silica (crystalline, respirable)	7631-86-9											
1.2E-01	H		5.0E-03	I						2.18	1	1	Yes	Silver	7440-22-4					1.0E+02	1.5E+03		9.4E+01	4.0E+00	8.0E-01	3.0E-04	2.0E-03
			5.0E-03	I									1	Yes	Simazine	122-34-9	6.5E-01	9.3E+00		6.1E-01							
			1.3E-02	I						0.37	1	1	Yes	Sodium Acifluorfen	62476-59-9					2.6E+02	2.1E+05		2.6E+02		2.1E+00		
			4.0E-03	I							1	1	Yes	Sodium Azide	26628-22-8					8.0E+01	1.8E+04		8.0E+01				
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M		0.025	1	1	Yes	Sodium Dichromate	10588-01-9	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02				
2.7E-01	H		3.0E-02	I						-1.43	1	1	Yes	Sodium Diethyldithiocarbamate	148-18-5	2.9E-01	8.5E+02		2.9E-01	6.0E+02	1.9E+06		6.0E+02				
			5.0E-02	A	1.3E-02	C					1	1	Yes	Sodium Fluoride	7681-49-4					1.0E+03	2.3E+05		1.0E+03				
			2.0E-05	I						-3.78	1	1	No	Sodium Fluoroacetate	62-74-8					4.0E-01			4.0E-01		8.1E-05		
			1.0E-03	H							1	1	Yes	Sodium Metavanadate	13718-26-8					2.0E+01	4.6E+03		2.0E+01				
			8.0E-04	P							1	1	Yes	Sodium Tungstate	13472-45-2					1.6E+01	3.6E+03		1.6E+01				
			8.0E-04	P							1	1	Yes	Sodium Tungstate Dihydrate	10213-10-2					1.6E+01	3.6E+03		1.6E+01				
2.4E-02	H		3.0E-02	I						3.53	1	0.9	Yes	Stirofos (Tetrachlorovinphos)	961-11-5	3.2E+00	1.9E+01		2.8E+00	6.0E+02	3.8E+03		5.2E+02		8.2E-03		
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M		0.025	1	1	Yes	Strontium Chromate	7789-06-2	5.0E-02	2.3E-01		4.1E-02	4.0E+02	2.3E+03		3.4E+02		4.2E+02		
			6.0E-01	I							1	1	Yes	Strontium, Stable	7440-24-6					1.2E+04	2.7E+06		1.2E+04				
			3.0E-04	I						1.93	1	1	Yes	Strychnine	57-24-9					6.0E+00	3.2E+02		5.9E+00		6.5E-02	1.1E-01	
			2.0E-01	I	1.0E+00	I	V			2.95	1	1	Yes	Styrene	100-42-5					4.0E+03	1.0E+04	2.1E+03	1.2E+03	1.0E+02	1.3E+00		
			3.0E-03	P						3.1	1	1	Yes	Styrene-Acrylonitrile (SAN) Trimer	NA					6.0E+01	2.4E+02		4.8E+01				
			1.0E-03	P	2.0E-03	X				-0.77	1	1	Yes	Sulfolane	126-33-0					2.0E+01	1.7E+04		2.0E+01		4.4E-03		
			8.0E-04	P						3.9	1	0.9	Yes	Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					1.6E+01	3.5E+01		1.1E+01		6.5E-02		
					1.0E-03	C	V				1	1	Yes	Sulfur Trioxide	7446-11-9							2.1E+00	2.1E+00				
					1.0E-03	C					1	1	Yes	Sulfuric Acid	7664-93-9												
2.5E-02	I	7.1E-06	I	5.0E-02	H					4.82	1	0.8	Yes	Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl	140-57-8	3.1E+00	2.3E+00		1.3E+00	1.0E+03	8.2E+02		4.5E+02		1.5E-02		
			3.0E-02	H						3.3	1	0.9	Yes	TCMTB	21564-17-0					6.0E+02	2.4E+03		4.8E+02		3.3E+00		
			7.0E-02	I						1.79	1	1	Yes	Tebuthiuron	34014-18-1					1.4E+03	4.7E+04		1.4E+03		3.9E-01		
			2.0E-02	H						5.96	1	0.7	No	Temephos	3383-96-8					4.0E+02			4.0E+02		7.6E-01		
			1.3E-02	I						1.89	1	1	Yes	Terbacil	5902-51-2					2.6E+02	7.0E+03		2.5E+02		7.5E-02		
			2.5E-05	H			V			4.48	1	0.9	Yes	Terbufos	13071-79-9					5.0E-01	4.5E-01		2.4E-01		5.2E-04		
			1.0E-03	I						3.74	1	0.9	Yes	Terbutryn	886-50-0					2.0E+01	4.1E+01		1.3E+01		1.9E-02		
			1.0E-04	I						6.77	1	0.6	No	Tetrabromodiphenylether, 2,2',4,4'-(BDE-47)	6436-33-7					2.0E+00			2.0E+00		5.4E-02		
			3.0E-04	I			V			4.64	1	1	Yes	Tetrachlorobenzene, 1,2,4,5-	95-94-1					6.0E+00	2.4E+00		1.7E+00		7.9E-03		
2.6E-02	I	7.4E-06	I	3.0E-02	I		V			2.93	1	1	Yes	Tetrachloroethane, 1,1,1,2-	630-20-6	3.0E+00	1.1E+01	7.6E-01	5.7E-01	6.0E+02	2.4E+03		4.8E+02		2.2E-04		
2.0E-01	I	5.8E-05	C	2.0E-02	I		V			2.39	1	1	Yes	Tetrachloroethane, 1,1,1,2-	79-34-5	3.9E-01	3.3E+00	9.7E-02	7.6E-02	4.0E+02	3.6E+03		3.6E+02		3.0E-05		
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		3.4	1	1	Yes	Tetrachloroethylene	127-18-4	3.7E+01	6.5E+01	2.2E+01	1.1E+01	1.2E+02	2.3E+02	8.3E+01	4.1E+01	5.0E+00	5.1E-03	2.3E-03	
			3.0E-02	I						4.45	1	0.9	Yes	Tetrachlorophenol, 2,3,4,6-	58-90-2					6.0E+02	3.9E+02		2.4E+02		1.5E+00		
2.0E+01	H						V			4.54	1	0.9	Yes	Tetrachlorotoluene, p- alpha, alpha-	5216-25-1	3.9E-03	2.0E-03		1.3E-03						4.5E-06		
			5.0E-04	I						3.99	1	0.9	Yes	Tetraethyl Dithiopyrophosphate	3689-24-5					1.0E+01	2.4E+01		7.1E+00		5.2E-03		
					8.0E+01	I	V			1.68	1	1	Yes	Tetrafluoroethane, 1,1,1,2-	811-97-2							1.7E+05	1.7E+05		9.3E+01		
			2.0E-03	P						1.64	1	1	Yes	Tetryl (Trinitrophenylmethyl nitramine)	479-45-8					4.0E+01	2.5E+03		3.9E+01		3.7E-01		
			7.0E-06	X							1	1	Yes	Thallium (I) Nitrate	10102-45-1					1.4E-01	3.2E+01		1.4E-01				
			1.0E-05	X							1	1	Yes	Thallium (Soluble Salts)	7440-28-0					2.0E-01	4.6E+01		2.0E-01	2.0E+00	1.4E-02	1.4E-01	
			6.0E-06	X			V			-0.17	1	1	Yes	Thallium Acetate	563-68-8					1.2E-01	1.0E+02		1.2E-01				
			2.0E-05	X			V			-0.86	1	1	Yes	Thallium Carbonate	6533-73-9					4.0E-01	3.7E+03		4.0E-01				
			6.0E-06	X							1	1	Yes	Thallium Chloride	7791-12-0					1.2E-01	2.7E+01		1.2E-01				
			2.0E-05	X							1	0.9	Yes	Thallium Sulfate	7446-18-6					4.0E-01	9.1E+01		4.0E-01				
			1.3E-02	I						1.56	1	1	Yes	Thifensulfuron-methyl	79277-27-3					2.6E							

Key: I = IRIS; P = PPRVT; A = ATSDR; C = Cal EPA; X = APPENDIX PPRVT SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																										
Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer CHILD Hazard Index (HI) = 1				Protection of Groundwater			
SFO (mg/kg-day) ¹	k _e v	IUR (ug/m ³ -day) ¹	k _e v	RfD _c (mg/kg-day)	k _e v	RfC _c (mg/m ³)	k _e v	muta- gen	LOGP	GIABS	FA	In EPD?	Analyte	CAS No.	Ingestion SL TR=1E-06 (ug/L)	Dermal SL TR=1E-06 (ug/L)	Inhalation SL TR=1E-06 (ug/L)	Carcinogenic SL TR=1E-06 (ug/L)	Ingestion SL Child THQ=1 (ug/L)	Dermal SL Child THQ=1 (ug/L)	SL Child THQ=1 (ug/L)	Noncarcinogenic SL Child THI=1 (ug/L)	MCL (ug/L)	Risk-based SSL (mg/kg)	MCL-based SSL (mg/kg)	
				3.0E-04	P						1	0	No	Tributyltin Compounds	NA					6.0E+00						
				3.0E-04	I				4.05	1	1	Yes	Tributyltin Oxide	56-35-9						6.0E+00	9.5E+01		5.7E+00		2.9E+02	
				3.0E+01	I	3.0E+01	H	V	3.16	1	1	Yes	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1					6.0E+05	1.9E+06	6.3E+04	5.5E+04		1.4E+02		
7.0E-02	I			2.0E-02	I				1.33	1	1	Yes	Trichloroacetic Acid	76-03-9	1.1E+00	4.6E+01		1.1E+00	4.0E+02	1.8E+04		3.9E+02	6.0E+01	2.2E-04	1.2E-02	
2.9E-02	H								-0.67	1	1	Yes	Trichloroaniline HCl, 2,4,6-	33663-50-2	2.7E+00	3.7E+03		2.7E+00						7.4E-03		
7.0E-03	X			3.0E-05	X				3.52	1	1	Yes	Trichloroaniline, 2,4,6-	634-93-5	1.1E+01	2.0E+01		7.1E+00	6.0E-01	1.2E+00		4.0E-01		3.6E-03		
				8.0E-04	X		V		4.05	1	1	Yes	Trichlorobenzene, 1,2,3-	87-61-6					1.6E+01	1.3E+01		7.0E+00		2.1E-02		
2.9E-02	P			1.0E-02	I	2.0E-03	P	V	4.02	1	1	Yes	Trichlorobenzene, 1,2,4-	120-82-1	2.7E+00	2.0E+00		1.2E+00	2.0E+02	1.6E+02	4.2E+00	4.0E+00	7.0E+01	3.4E-03	2.0E-01	
				2.0E+00	I	5.0E+00	I	V	2.49	1	1	Yes	Trichloroethane, 1,1,1-	71-55-6					4.0E+04	2.5E+05	1.0E+04	8.0E+03	2.0E+02	2.8E+00	7.0E-02	
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V	1.89	1	1	Yes	Trichloroethane, 1,1,2-	79-00-5	1.4E+00	2.0E+01	3.5E-01	2.8E-01	8.0E+01	1.3E+03	4.2E-01	4.1E-01	5.0E+00	8.9E-05	1.6E-03	
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	2.42	1	1	Yes	Trichloroethylene	79-01-6	1.2E+00	7.4E+00	9.6E-01	4.9E-01	1.0E+01	6.9E+01	4.2E+00	2.8E+00	5.0E+00	1.8E-04	1.8E-03	
				3.0E-01	I		V		2.53	1	1	Yes	Trichlorofluoromethane	75-69-4					6.0E+03	3.6E+04		5.2E+03		3.3E+00		
				1.0E-01	I				3.72	1	1	Yes	Trichlorophenol, 2,4,5-	95-95-4					2.0E+03	2.9E+03		1.2E+03		4.4E+00		
1.1E-02	I	3.1E-06	I	1.0E-03	P				3.69	1	1	Yes	Trichlorophenol, 2,4,6-	88-06-2	7.1E+00	9.8E+00		4.1E+00	2.0E+01	3.0E+01		1.2E+01		1.5E-02		
				1.0E-02	I				3.31	1	0.9	Yes	Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					2.0E+02	8.7E+02		1.6E+02		6.8E-02		
				8.0E-03	I				3.8	1	0.9	Yes	Trichlorophenoxypropionic acid, -2,4,5	93-72-1					1.6E+02	3.6E+02		1.1E+02	5.0E+01	6.1E-02	2.8E-02	
				5.0E-03	I		V		2.43	1	1	Yes	Trichloropropane, 1,1,2-	598-77-6					1.0E+02	7.5E+02		8.8E+01		3.5E-02		
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	2.27	1	1	Yes	Trichloropropane, 1,2,3-	96-18-4	8.4E-04	7.3E-03		7.5E-04	8.0E+01	7.7E+02	6.3E-01	6.2E-01		3.2E-07		
				3.0E-03	X	3.0E-04	P	V	2.78	1	1	Yes	Trichloropropene, 1,2,3-	96-19-5					6.0E+01	2.6E+02	6.3E-01	6.2E-01		3.1E-04		
				2.0E-02	A				5.11	1	0.8	Yes	Tricresyl Phosphate (TCP)	1330-78-5					4.0E+02	2.6E+02		1.6E+02		1.5E+01		
				3.0E-03	I				5.18	1	0.8	Yes	Tridiphenyl	58138-08-2					6.0E+01	2.6E+01		1.8E+01		1.3E-01		
				2.0E+00	P	7.0E-03	I	V	1.45	1	1	Yes	Triethylamine	121-44-8					4.0E+04	1.8E+08		1.5E+01		4.4E-03		
				2.0E+01	P	V			-1.75	1	1	Yes	Triethylene Glycol	112-27-6							4.2E+04	4.0E+04		8.8E+00		
				2.0E+01	P	V			1.74	1	1	Yes	Trifluoroethane, 1,1,1-	420-46-2							4.2E+04	4.2E+04		1.3E+02		
7.7E-03	I			7.5E-03	I		V		5.34	1	0.8	Yes	Trifluralin	1582-09-8	1.0E+01	3.4E+00		2.6E+00	1.5E+02	5.5E+01		4.0E+01		8.4E-02		
2.0E-02	P			1.0E-02	P				-0.65	1	1	Yes	Trimethyl Phosphate	512-56-1	3.9E+00	2.8E+03		3.9E+00	2.0E+02	1.6E+05		2.0E+02		8.6E-04		
				5.0E-03	P	V			3.66	1	1	Yes	Trimethylbenzene, 1,2,3-	526-73-8							1.0E+01	1.0E+01		1.5E-02		
				7.0E-03	P	V			3.63	1	1	Yes	Trimethylbenzene, 1,2,4-	95-63-6					2.0E+02	2.8E+02		1.2E+02		1.7E-01		
				1.0E-02	X		V		3.42	1	1	Yes	Trimethylbenzene, 1,3,5-	108-67-8					2.0E+02	9.6E+01		6.5E+01		2.2E-01		
				1.0E-02	X		V		4.08	1	1	Yes	Trimethylpentene, 2,4,4-	25167-70-8					2.0E+02	9.6E+01		6.5E+01		2.2E-01		
				3.0E-02	I				1.18	1	1	Yes	Trinitrobenzene, 1,3,5-	99-35-4					6.0E+02	4.7E+04		5.9E+02		2.1E+00		
				5.0E-04	I				1.6	1	1	Yes	Trinitrotoluene, 2,4,6-	118-96-7	2.6E+00	1.1E+02		2.5E+00	1.0E+01	4.5E+02		9.8E+00		1.5E-02		
				2.0E-02	P				2.83	1	1	Yes	Triphenylphosphine Oxide	791-28-6					4.0E+02	3.8E+03		3.6E+02		1.5E+00		
				2.0E-02	A				3.65	1	0.9	Yes	Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8					4.0E+02	3.2E+03		3.6E+02		8.0E+00		
2.3E+00	C	6.6E-04	C	1.0E-02	X				2.59	1	1	Yes	Tris(1-chloro-2-propyl)phosphate	13674-84-5	3.4E-02		8.5E-03	6.8E-03	2.0E+02	3.8E+03		1.9E+02		6.5E-01	1.3E-04	
				1.0E-02	X				4.29	1	1	No	Tris(2,3-dibromopropyl)phosphate	126-72-7												
2.0E-02	P			7.0E-03	P				1.44	1	1	Yes	Tris(2-chloroethyl)phosphate	115-96-8	3.9E+00	3.0E+02		3.8E+00	1.4E+02	1.2E+04		1.4E+02		3.8E-03		
3.2E-03	P			1.0E-01	P				9.49	1	0	No	Tris(2-ethylhexyl)phosphate	78-42-2	2.4E+01			2.4E+01	2.0E+03			2.0E+03		1.2E+02		
				8.0E-04	P				1	1	1	Yes	Tungsten	7440-33-7					1.6E+01	3.6E+03		1.6E+01		2.4E+00		
1.0E+00	C	2.9E-04	C	3.0E-03	I	4.0E-05	A		1	1	1	Yes	Uranium (Soluble Salts)	NA	2.5E-02	6.1E+00		2.5E-02	6.0E+01	1.4E+04		6.0E+01	3.0E+01	2.7E+01	1.4E+01	
				8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026	1	Yes	Urethane	51-79-6								5.6E-06		
				5.0E-03	S	1.0E-04	A		0.026	1	1	Yes	Vanadium and Compounds	7440-62-2					1.0E+02	6.0E+02		8.6E+01		8.6E+01		
				1.0E-03	I		V		3.84	1	1	Yes	Vernolate	1929-77-7					2.0E+01	2.5E+01		1.1E+01		8.9E-03		
				2.5E-02	I				3.1	1	0.9	Yes	Vindozolin	50471-44-8					5.0E+02	3.7E+03		4.4E+02		3.4E-01		
				1.0E+00	H	2.0E-01	I	V	0.73	1	1	Yes	Vinyl Acetate	108-05-4					2.0E+04	1.4E+06	4.2E+02	4.1E+02		8.7E-02		
7.2E-01	I	3.2E-05	H	3.0E-03	I	1.0E-01	I	V	1.57	1	1	Yes	Vinyl Bromide	593-60-2			1.8E-01	1.8E-01			6.3E+00	6.3E+00		5.1E-05		
				3.0E-03	I	1.0E-01	I	V	1.62	1	1	Yes	Vinyl Chloride	75-01-4	2.1E-02	2.8E-01	3.4E-01	1.9E-02	6.0E+01	8.9E+02	2.1E+02	4.4E+01	2.0E+00	6.5E-06	6.9E-04	
				3.0E-04	I				2.7	1	1	Yes	Warfarin	81-81-2					6.0E+00	8.4E+01		5.6E+00		5.9E-03		
				2.0E-01	S	1.0E-01	S	V	3.15	1	1	Yes	Xylene, p-	106-42-3					4.0E+03	7.6E+03	2.1E+02	1.9E+02		1.9E-01		
				2.0E-01	S	1.0E-01	S	V	3.2	1	1	Yes	Xylene, m-	108-38-3					4.0E+03	7.1E+03	2.1E+02	1.9E+02		1.9E-01		
				2.0E-01	S	1.0E-01	S	V	3.12	1	1	Yes	Xylene, o-	95-47-6					4.0E+03	8.0E+03	2.1E+02	1.9E+02		1.9E-01		
				2.0E-01	I	1.0E-01	I	V	3.16	1	1	Yes														

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Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³)	k _e y	o ₁ y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)			
8.7E-03	I			4.0E-03	I					1	0.1		1.4E+09		Acephate	30560-19-1	3.8E+02	8.9E+02		2.6E+02	4.7E+03	1.1E+04			3.3E+03		
		2.2E-06	I			9.0E-03	I	V		1		1.1E+05	1.4E+09	8.7E+03	Acetaldehyde	75-07-0				4.9E+01					3.4E+02		
				2.0E-02	I					1	0.1		1.4E+09		Acetochlor	34256-82-1					2.3E+04	5.5E+04			1.6E+04		
				9.0E-01	I	3.1E+01	A	V		1		1.1E+05	1.4E+09	1.4E+04	Acetone	67-64-1					1.1E+06		1.8E+06	6.7E+05			
						2.0E-03	X			1	0.1		1.4E+09		Acetone Cyanohydrin	75-86-5							1.2E+07	1.2E+07			
						6.0E-02	I	V		1		1.3E+05	1.4E+09	1.3E+04	Acetonitrile	75-05-8							3.4E+03	3.4E+03			
3.8E+00	C	1.3E-03	C			2.0E-05	I	V		1	0.1		1.4E+09		Acetophenone	98-86-2	8.6E-01	2.0E+00	1.3E+04	6.0E-01	5.8E+02		6.1E-01	6.0E-01			
				5.0E-04	I	2.0E-05	I	V		1		2.3E+04	1.4E+09	6.9E+03	Acetylaminofluorene, 2-Acrolein	53-96-3											
5.0E-01	I	1.0E-04	I			6.0E-03	I		M	1	0.1		1.4E+09		Acrylamide	79-06-1	6.5E+00	1.5E+01	1.7E+05	4.6E+00	2.3E+03	5.5E+03	3.6E+07	1.6E+03			
				5.0E-01	I	1.0E-03	I	V		1		1.1E+05	1.4E+09	9.5E+04	Acrylic Acid	79-10-7					5.8E+05		4.2E+02	4.2E+02			
5.4E-01	I	6.8E-05	I			4.0E-02	A	2.0E-03	I	V	1		1.1E+04	1.4E+09	7.7E+03	Acrylonitrile	107-13-1	6.1E+00		1.4E+00	1.1E+00	4.7E+04		6.7E+01	6.7E+01		
						6.0E-03	P			1	0.1		1.4E+09		Adiponitrile	111-69-3							3.6E+07	3.6E+07			
5.6E-02	C			1.0E-02	I					1	0.1		1.4E+09		Alachlor	15972-60-8	5.8E+01	1.4E+02		4.1E+01	1.2E+04	2.8E+04		8.2E+03			
				1.0E-03	I					1	0.1		1.4E+09		Aldicarb	116-06-3					1.2E+03	2.8E+03		8.2E+02			
				1.0E-03	I					1	0.1		1.4E+09		Aldicarb Sulfone	1646-88-4					1.2E+03	2.8E+03		8.2E+02			
1.7E+01	I	4.9E-03	I			3.0E-05	I		V	1			1.4E+09	1.7E+06	Aldicarb sulfoxide	1646-87-3	1.9E-01		4.3E+00	1.8E-01	3.5E+01			3.5E+01			
										1			1.4E+09		Aldrin	309-00-2											
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	1.4E+09	1.6E+03	Allyl Alcohol	107-18-6	1.6E+02		3.2E+00	3.2E+00	5.8E+03		1.5E+01	1.5E+01			
				1.0E+00	P	5.0E-03	P			1			1.4E+09		Allyl Chloride	107-05-1					1.2E+06		6.9E+00	6.9E+00			
										1			1.4E+09		Aluminum	7429-90-5							3.0E+07	1.1E+06			
				4.0E-04	I					1			1.4E+09		Aluminum Phosphide	20859-73-8					4.7E+02			4.7E+02			
2.1E+01	C	6.0E-03	C			9.0E-03	I			1	0.1		1.4E+09		Ametryn	834-12-8	1.6E-01	3.7E-01	2.8E+03	1.1E-01	1.1E+04	2.5E+04		7.4E+03			
										1			1.4E+09		Aminobiphenyl, 4-	92-67-1											
				8.0E-02	P					1	0.1		1.4E+09		Aminophenol, m-	591-27-5					9.3E+04	2.2E+05		6.6E+04			
				2.0E-02	P					1	0.1		1.4E+09		Aminophenol, p-	123-30-8					2.3E+04	5.5E+04		1.6E+04			
				2.5E-03	I					1	0.1		1.4E+09		Amtraz	33089-61-1					2.9E+03	6.9E+03		2.1E+03			
						1.0E-01	I	V		1			1.4E+09		Ammonia	7664-41-7											
				2.0E-01	I					1			1.4E+09		Ammonium Sulfamate	7773-06-0					2.3E+05			2.3E+05			
						3.0E-03	X	V		1		1.4E+04	1.4E+09	2.6E+04	Amyl Alcohol, tert-	75-85-4							3.4E+02	3.4E+02			
5.7E-03	I	1.6E-06	C			7.0E-03	P	1.0E-03	I	1	0.1		1.4E+09		Aniline	62-53-3	5.7E+02	1.4E+03	1.0E+07	4.0E+02	8.2E+03	1.9E+04	6.0E+06	5.7E+03			
4.0E-02	P			2.0E-03	X					1	0.1		1.4E+09		Anthraquinone, 9,10-	84-65-1	8.2E-01	1.9E+02		5.7E+01	2.3E+03	5.5E+03		1.6E+03			
				4.0E-04	I					0.15			1.4E+09		Antimony (metallic)	7440-36-0					4.7E+02			4.7E+02			
				5.0E-04	H					0.15			1.4E+09		Antimony Pentoxide	1314-60-9					5.8E+02			5.8E+02			
				4.0E-04	H					0.15			1.4E+09		Antimony Tetroxide	1332-81-6					4.7E+02			4.7E+02			
						2.0E-04	I			0.15			1.4E+09		Antimony Trioxide	1309-64-4							1.2E+06	1.2E+06			
1.5E+00	I	4.3E-03	I			3.0E-04	I	1.5E-05	C	1	0.03		1.4E+09		Arsenic, Inorganic	7440-38-2	3.6E+00	1.7E+01	3.9E+03	3.0E+00	5.8E+02	2.8E+03	8.9E+04	4.8E+02			
				3.5E-06	C	5.0E-05	I			1			1.4E+09		Arsine	7784-42-1					4.1E+00		3.0E+05	4.1E+00			
				5.0E-02	I					1	0.1		1.4E+09		Asulam	3337-71-1					5.8E+04	1.4E+05		4.1E+04			
2.3E-01	C			3.5E-02	I					1	0.1		1.4E+09		Atrazine	1912-24-9	1.4E+01	3.4E+01		1.0E+01	4.1E+04	9.7E+04		2.9E+04			
8.8E-01	C	2.5E-04	C			4.0E-04	I			1	0.1		1.4E+09		Auramine	492-80-8	3.7E+00	8.8E+00	6.7E+04	2.6E+00	4.7E+02	1.1E+03		3.3E+02			
										1	0.1		1.4E+09		Avermectin B1	65195-55-3											
1.1E-01	I	3.1E-05	I			3.0E-03	A	1.0E-02	A	1	0.1		1.4E+09		Azinphos-methyl	86-50-0	3.0E+01		2.1E+02	2.6E+01	3.5E+03	8.3E+03	6.0E+07	2.5E+03			
						1.0E+00	P	7.0E-06	P	1	0.1		1.4E+09		Azobenzene	103-33-3					1.2E+06	2.8E+06	4.2E+04	4.0E+04			
						2.0E-01	I	5.0E-04	H		0.07		1.4E+09		Azodicarbonamide	123-77-3											
5.0E-01	C	1.5E-01	C			2.0E-02	C	2.0E-04	C	M	0.025		1.4E+09		Barium	7440-39-3	6.5E+00		1.1E+02	6.2E+00	2.3E+05		3.0E+06	2.2E+05			
				3.0E-01	I				V	1			1.4E+09	3.1E+05	Barium Chromate	10294-40-3					2.3E+04		1.2E+06	2.3E+04			
										1			1.4E+09		Benfluralin	1861-40-1					3.5E+05			3.5E+05			
				5.0E-02	I					1	0.1		1.4E+09		Benomyl	17804-35-2					5.8E+04	1.4E+05		4.1E+04			
				2.0E-01	I					1	0.1		1.4E+09		Bensulfuron-methyl	83055-99-6					2.3E+05	5.5E+05		1.6E+05			
				3.0E-02	I					1	0.1		1.4E+09		Bentazon	25057-89-0					3.5E+04	8.3E+04		2.5E+04			
				1.0E-01	I				V	1		1.2E+03	1.4E+09	2.3E+04	Benzaldehyde	100-52-7					1.2E+05			1.2E+05			
5.5E-02	I	7.8E-06	I			4.0E-03	I	3.0E-02	I	V	1	1.8E+03	1.4E+09	3.5E+03	Benzene	71-43-2	5.9E+01		5.6E+00	5.1E+00	4.7E+03		4.6E+02	4.2E+02			

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information													Contaminant			Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1				
SFO (mg/kg-day) ¹	k _e (y)	IUR (ug/m ³) ¹	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³)	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)	
				3.0E-03	P				1	0.1		1.4E+09		Bis(2-chloroethoxy)methane	111-91-1					3.5E+03	8.3E+03		2.5E+03	
1.1E+00	I	3.3E-04	I					V	1		5.1E+03	1.4E+09	4.3E+04	Bis(2-chloroethyl)ether	111-44-4	3.0E+00		1.6E+00	1.0E+00					
2.2E+02	I	6.2E-02	I					V	1		4.2E+03	1.4E+09	1.9E+03	Bis(chloromethyl)ether	542-88-1	1.5E-02		3.7E-04	3.6E-04					
				5.0E-02	I					0.1		1.4E+09		Bisphenol A	80-05-7					5.8E+04	1.4E+05		4.1E+04	
				2.0E-01	I	2.0E-02	H		1			1.4E+09		Boron And Borates Only	7440-42-8					2.3E+05		1.2E+08	2.3E+05	
				2.0E+00	P	2.0E-02	P	V	1			1.4E+09		Boron Trichloride	10294-34-5					2.3E+06		1.2E+08	2.3E+06	
				4.0E-02	C	1.3E-02	C	V	1			1.4E+09		Boron Trifluoride	7637-07-2					4.7E+04		7.7E+07	4.7E+04	
7.0E-01	I			4.0E-03	I				1			1.4E+09		Bromate	15541-45-4	4.7E+00			4.7E+00	4.7E+03			4.7E+03	
2.0E+00	X	6.0E-04	X					V	1		2.4E+03	1.4E+09	5.9E+03	Bromo-2-chloroethane, 1-	107-04-0	1.6E+00		1.2E-01	1.1E-01					
				8.0E-03	I	6.0E-02	I	V	1		6.8E+02	1.4E+09	8.4E+03	Bromobenzene	108-86-1					9.3E+03		2.2E+03	1.8E+03	
				4.0E-02	X	V			1		4.0E+03	1.4E+09	3.6E+03	Bromochloromethane	74-97-5							6.3E+02	6.3E+02	
6.2E-02	I	3.7E-05	C	2.0E-02	I			V	1		9.3E+02	1.4E+09	4.0E+03	Bromodichloromethane	75-27-4	5.3E+01		1.3E+00	1.3E+00	2.3E+04			2.3E+04	
7.9E-03	I	1.1E-06	I	2.0E-02	I			V	1		9.2E+02	1.4E+09	9.7E+03	Bromoform	75-25-2	4.1E+02		1.1E+02	8.6E+01	2.3E+04			2.3E+04	
				1.4E-03	I	5.0E-03	I	V	1		3.6E+03	1.4E+09	1.4E+03	Bromomethane	74-83-9					1.6E+03		3.1E+01	3.0E+01	
				5.0E-03	H			V	1			1.4E+09	1.2E+05	Bromophos	2104-96-3					5.8E+03			5.8E+03	
				2.0E-02	I				1	0.1		1.4E+09		Bromoxynil	1689-84-5					2.3E+04	5.5E+04		1.6E+04	
3.4E+00	C	3.0E-05	I			2.0E-03	I	V	1		6.7E+02	1.4E+09	8.7E+02	Bromoxynil Octanoate	1689-99-2					2.3E+04			2.3E+04	
				1.0E-01	I			V	1		7.6E+03	1.4E+09	3.0E+04	Butadiene, 1,3- Butanol, N-	106-99-0 71-36-3	9.6E-01		3.5E-01	2.6E-01			7.6E+00	7.6E+00	
1.9E-03	P			2.0E-01	I				1	0.1		1.4E+09		Butyl Benzyl Phthalate	85-68-7	1.7E+03	4.1E+03		1.2E+03	2.3E+05	5.5E+05		1.6E+05	
				2.0E+00	P	3.0E+01	P	V	1		2.1E+04	1.4E+09	2.9E+04	Butyl alcohol, sec-	78-92-2					2.3E+06			1.5E+06	
				5.0E-02	I			V	1		1.4E+09	8.6E+04		Butylate	2008-41-5					5.8E+04		3.8E+06	5.8E+04	
2.0E-04	C	5.7E-08	C						1	0.1		1.4E+09		Butylated hydroxyanisole	25013-16-5	1.6E+04	3.9E+04	2.9E+08	1.1E+04	3.5E+05		8.3E+05	2.5E+05	
3.6E-03	P			3.0E-01	P				1	0.1		1.4E+09		Butylated hydroxytoluene	128-37-0	9.1E+02	2.1E+03		6.4E+02	5.8E+04			5.8E+04	
				5.0E-02	P			V	1		1.1E+02	1.4E+09	8.1E+03	Butylbenzene, n-	104-51-8									
				1.0E-01	X			V	1		1.5E+02	1.4E+09	7.4E+03	Butylbenzene, sec-	135-98-8					1.2E+05			1.2E+05	
				1.0E-01	X			V	1		1.8E+02	1.4E+09	7.4E+03	Butylbenzene, tert-	98-06-6					1.2E+05			1.2E+05	
				2.0E-02	A				1	0.1		1.4E+09		Cacodylic Acid	75-60-5					2.3E+04	5.5E+04		1.6E+04	
1.8E-03	I	1.0E-03	I	1.0E-05	A				0.025	0.001		1.4E+09		Cadmium (Diet)	7440-43-9			9.3E+03	9.3E+03	1.2E+03	6.9E+03	6.0E+04	9.8E+02	
1.8E-03	I	5.0E-04	I	1.0E-05	A				0.05	0.001		1.4E+09		Cadmium (Water)	7440-43-9									
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C	M	0.025			1.4E+09		Calcium Chromate	13765-19-0	6.5E+00		1.1E+02	6.2E+00	2.3E+04		1.2E+06	2.3E+04	
				5.0E-01	I	2.2E-03	C		1	0.1		1.4E+09		Caprolactam	105-60-2					5.8E+05	1.4E+06	1.3E+07	4.0E+05	
1.5E-01	C	4.3E-05	C	2.0E-03	I				1	0.1		1.4E+09		Captafol	2425-06-1	2.2E+01	5.2E+01	3.9E+05	1.5E+01	2.3E+03	5.5E+03		1.6E+03	
2.3E-03	C	6.6E-07	C	1.3E-01	I				1	0.1		1.4E+09		Captan	133-06-2	1.4E+03	3.4E+03	2.5E+07	1.0E+03	1.5E+05	3.6E+05		1.1E+05	
				1.0E-01	I				1	0.1		1.4E+09		Carbaryl	63-25-2					1.2E+05	2.8E+05		8.2E+04	
				5.0E-03	I				1	0.1		1.4E+09		Carbofuran	1563-66-2					5.8E+03	1.4E+04		4.1E+03	
				1.0E-01	I	7.0E-01	I	V	1		7.4E+02	1.4E+09	1.2E+03	Carbon Disulfide	75-15-0					1.2E+05		3.6E+03	3.5E+03	
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V	1		4.6E+02	1.4E+09	1.5E+03	Carbon Tetrachloride	56-23-5	4.7E+01		3.1E+00	2.9E+00	4.7E+03		6.5E+02	5.7E+02	
						1.0E-01	P	V	1		5.9E+03	1.4E+09	6.5E+02	Carbonyl Sulfide	463-58-1							2.8E+02	2.8E+02	
				1.0E-02	I				1	0.1		1.4E+09		Carbosulfan	55285-14-8					1.2E+04	2.8E+04		8.2E+03	
				1.0E-01	I				1	0.1		1.4E+09		Carboxin	5234-68-4					1.2E+05	2.8E+05		8.2E+04	
						9.0E-04	I		1			1.4E+09		Ceric oxide	1306-38-3							5.4E+06	5.4E+06	
				1.0E-01	I			V	1			1.4E+09	1.5E+05	Chloral Hydrate	302-17-0					1.2E+05			1.2E+05	
				1.5E-02	I				1	0.1		1.4E+09		Chloramben	133-90-4					1.8E+04	4.1E+04		1.2E+04	
4.0E-01	H								1	0.1		1.4E+09		Chloranil	118-75-2	8.1E+00	1.9E+01		5.7E+00					
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	V	1	0.04		1.4E+09	9.0E+05	Chlordane	12789-03-6	9.3E+00	5.5E+01	1.1E+02	7.5E+00	5.8E+02	3.4E+03	2.8E+03	4.2E+02	
1.0E+01	I	4.6E-03	C	3.0E-04	I				1	0.1		1.4E+09		Chlordecone (Kepone)	143-50-0	3.3E-01	7.7E-01	3.6E+03	2.3E-01	3.5E+02	8.3E+02		2.5E+02	
				7.0E-04	A				1	0.1		1.4E+09		Chlorfenvinphos	470-90-6					8.2E+02	1.9E+03		5.7E+02	
				2.0E-02	I				1	0.1		1.4E+09		Chlorimuron, Ethyl-	90982-32-4					2.3E+04	5.5E+04		1.6E+04	
				1.0E-01	I	1.5E-04	A	V	1		2.8E+03	1.4E+09	1.2E+03	Chlorine	7782-50-5					1.2E+05		7.8E-01	7.8E-01	
				3.0E-02	I	2.0E-04	I	V	1			1.4E+09		Chlorine Dioxide	10049-04-4					3.5E+04		1.2E+06	3.4E+04	
				3.0E-02	I				1			1.4E+09		Chlorite (Sodium Salt)	7758-19-2					3.5E+04			3.5E+04	
				5.0E+01	I	V			1		1.2E+03	1.4E+09	1.0E+03	Chloro-1,1-difluoroethane, 1-	75-68-3							2.3E+05	2.3E+05	

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Toxicity and Chemical-specific Information													Contaminant			Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³) ⁻¹	k _e y	o _i y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)		
		2.0E-02	P			5.0E+01	I	V		1		1.7E+03	1.4E+09	9.4E+02	Chlorodifluoromethane	75-45-6							2.3E+04		2.1E+05	2.1E+05
								V				1.1E+05	1.4E+09	7.8E+04	Chloroethanol, 2-	107-07-3										
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	1.4E+09	2.6E+03	Chloroform	67-66-3	1.1E+02		1.4E+00	1.4E+00		1.2E+04		1.1E+03	1.0E+03	
						9.0E-02	I	V		1		1.3E+03	1.4E+09	1.2E+03	Chloromethane	74-87-3									4.6E+02	4.6E+02
2.4E+00	C	6.9E-04	C					V		1		9.3E+03	1.4E+09	5.3E+03	Chloromethyl Methyl Ether	107-30-2	1.4E+00		9.5E-02	8.9E-02						
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		1.4E+09		Chloronitrobenzene, o-	88-73-3	1.1E+01	2.6E+01		7.7E+00		3.5E+03	8.3E+03	6.0E+04	2.4E+03	
6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		1.4E+09		Chloronitrobenzene, p-	100-00-5	5.2E+02	1.2E+03		3.6E+02		1.2E+03	2.8E+03	3.6E+06	8.2E+02	
				5.0E-03	I			V		1		2.2E+04	1.4E+09	1.2E+05	Chlorophenol, 2-	95-57-8						5.8E+03			5.8E+03	
						4.0E-04	C	V		1		6.2E+02	1.4E+09	4.7E+03	Chloropicrin	76-06-2								8.2E+00	8.2E+00	
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		1.4E+09		Chlorothalonil	1897-45-6	1.1E+03	2.5E+03	1.9E+07	7.4E+02		1.8E+04	4.1E+04		1.2E+04	
				2.0E-02	I			V		1		9.1E+02	1.4E+09	8.1E+03	Chlorotoluene, o-	95-49-8						2.3E+04			2.3E+04	
				2.0E-02	X			V		1		2.5E+02	1.4E+09	7.3E+03	Chlorotoluene, p-	106-43-4						2.3E+04			2.3E+04	
2.4E+02	C	6.9E-02	C							1	0.1		1.4E+09		Chlorozotocin	54749-90-5	1.4E-02	3.2E-02	2.4E+02	9.6E-03						
				2.0E-01	I					1	0.1		1.4E+09		Chlorpropham	101-21-3						2.3E+05	5.5E+05			1.6E+05
				1.0E-03	A					1	0.1		1.4E+09		Chlorpyrifos	2921-88-2						1.2E+03	2.8E+03			8.2E+02
				1.0E-02	H					1	0.1		1.4E+09		Chlorpyrifos Methyl	5598-13-0						1.2E+04	2.8E+04			8.2E+03
				5.0E-02	I					1	0.1		1.4E+09		Chlorsulfuron	64902-72-3						5.8E+04	1.4E+05			4.1E+04
				1.0E-02	I					1	0.1		1.4E+09		Chlorthal-dimethyl	1861-32-1						1.2E+04	2.8E+04			8.2E+03
				8.0E-04	H					1	0.1		1.4E+09		Chlorthiophos	60238-56-4						9.3E+02	2.2E+03			6.6E+02
				1.5E+00	I					0.013			1.4E+09		Chromium(III), Insoluble Salts	16065-83-1						1.8E+06				1.8E+06
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I	M		0.025			1.4E+09		Chromium(VI)	18540-29-9	6.5E+00		2.0E+02	6.3E+00		3.5E+03		6.0E+05	3.5E+03	
										0.013			1.4E+09		Chromium, Total	7440 47 3										
				1.3E-02	I					1	0.1		1.4E+09		Clofentazine	74115-24-5						1.5E+04	3.6E+04			1.1E+04
		9.0E-03	P	3.0E-04	P	6.0E-06	P			1			1.4E+09		Cobalt	7440-48-4			1.9E+03	1.9E+03		3.5E+02		3.6E+04	3.5E+02	
		6.2E-04	I					V	M	1					Coke Oven Emissions	8007-45-2										
				4.0E-02	H					1			1.4E+09		Copper	7440-50-8						4.7E+04			4.7E+04	
				5.0E-02	I	6.0E-01	C			1	0.1		1.4E+09		Cresol, o-	108-39-4						5.8E+04	1.4E+05	3.6E+09		4.1E+04
				5.0E-02	I	6.0E-01	C			1	0.1		1.4E+09		Cresol, o-	95-48-7						5.8E+04	1.4E+05	3.6E+09		4.1E+04
				1.0E-01	A	6.0E-01	C			1	0.1		1.4E+09		Cresol, p-	106-34-5						1.2E+05	2.8E+05	3.6E+09		8.2E+04
				1.0E-01	A	6.0E-01	C			1	0.1		1.4E+09		Cresol, p-chloro-m-	59-50-7						1.2E+05	2.8E+05			8.2E+04
1.9E+00	H			1.0E-03	P			V		1		1.7E+04	1.4E+09	1.9E+04	Cresols	4319-77-3	1.7E+00			1.7E+00		1.2E+05	2.8E+05	3.6E+09		8.2E+04
				1.0E-03	I	4.0E-01	I	V		1		2.7E+02	1.4E+09	6.2E+03	Crotonaldehyde, trans-	123-73-9						1.2E+03				1.2E+03
				1.0E-01	I					1					Cumene	98-82-8						1.2E+05		1.1E+04	9.9E+03	
2.2E-01	C	6.3E-05	C							1	0.1		1.4E+09		Cupferron	135-20-6	1.5E+01	3.5E+01	2.6E+05	1.0E+01						
8.4E-01	H			2.0E-03	H					1	0.1		1.4E+09		Cyanazine	21725-46-2	3.9E+00	9.2E+00		2.7E+00		2.3E+03	5.5E+03			1.6E+03
															Cyanides											
				1.0E-03	I					1			1.4E+09		~Calcium Cyanide	592-01-8						1.2E+03				1.2E+03
				5.0E-03	I					1			1.4E+09		~Copper Cyanide	544-92-3						5.8E+03				5.8E+03
				6.0E-04	I	8.0E-04	S	V		1		9.7E+05	1.4E+09	3.5E+03	~Cyanide (CN ⁻)	57-12-5						7.0E+02		1.2E+01		1.2E+01
				1.0E-03	I			V		1			1.4E+09		~Cyanogen	460-19-5						1.2E+03				1.2E+03
				9.0E-02	I			V		1			1.4E+09		~Cyanogen Bromide	506-68-3						1.1E+05				1.1E+05
				5.0E-02	I			V		1			1.4E+09		~Cyanogen Chloride	506-77-4						5.8E+04				5.8E+04
				6.0E-04	I	8.0E-04	I	V		1		1.0E+07	1.4E+09	5.2E+04	~Hydrogen Cyanide	74-90-8						7.0E+02		1.8E+02		1.5E+02
				2.0E-03	I					1			1.4E+09		~Potassium Cyanide	151-50-8						2.3E+03				2.3E+03
				5.0E-03	I					0.04			1.4E+09		~Potassium Silver Cyanide	506-61-6						5.8E+03				5.8E+03
				1.0E-01	I					0.04			1.4E+09		~Silver Cyanide	506-64-9						1.2E+05				1.2E+05
				1.0E-03	I					1			1.4E+09		~Sodium Cyanide	143-33-9						1.2E+03				1.2E+03
				2.0E-04	P					1			1.4E+09		~Thiocyanates	NA						2.3E+02				2.3E+02
				2.0E-04	X			V		1			1.4E+09		~Thiocyanic Acid	463-56-9						2.3E+02				2.3E+02
				5.0E-02	I					1			1.4E+09		~Zinc Cyanide	557-21-1						5.8E+04				5.8E+04
						6.0E+00	I	V		1		1.2E+02	1.4E+09	1.0E+03	Cyclohexane	110-82-7								2.7E+04	2.7E+04	
2.3E-02	H			5.0E+00	I	7.0E-01	P	V		1	0.1		1.4E+09		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	1.4E+02	3.4E+02		1.0E+02		5.8E+06		1.3E+05	1.3E+05	

Regional Screening Level (RSL) Composite Worker Soil Table (TR=1E-06, HQ=1) November 2015

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																											
Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³) ⁻¹	k _e y	o _i y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)			
1.2E-03 6.1E-02	I H			4.0E-05 6.0E-01	I I					1 1	0.1 0.1	1.4E+09 1.4E+09			Demeton Di(2-ethylhexyl)adipate Diallate	8065-48-3 103-23-1 2303-16-4	2.7E+03 5.4E+01	6.4E+03 1.3E+02		1.9E+03 3.8E+01	4.7E+01 7.0E+05	1.1E+02 1.7E+06		3.3E+01 4.9E+05			
				7.0E-04 1.0E-02 2.0E-04	A X P				V V V	1 1 1	0.1 1 1	1.4E+09 1.4E+09 9.8E+02	1.4E+09 5.2E+05 1.4E+09	3.2E+04	Diazinon Dibenzothiophene Dibromo-3-chloropropane, 1,2-	333-41-5 132-65-0 96-12-8	4.1E+00		6.5E-02	6.4E-02		8.2E+02 1.2E+04 2.3E+02	1.9E+03		5.7E+02 1.2E+04 2.5E+01		
8.0E-01 8.4E-02	P I	6.0E-03 I		2.0E-04 4.0E-04 1.0E-02 2.0E-02	I X I I				V V V V	1 1 1 1		1.6E+02 1.4E+09 1.4E+09 8.0E+02	1.4E+09 1.9E+04 2.2E+04 8.0E+03		Dibromobenzene, 1,3- Dibromobenzene, 1,4- Dibromochloromethane	108-36-1 106-37-6 124-48-1	3.9E+01			3.9E+01		4.7E+02 1.2E+04 2.3E+04			4.7E+02 1.2E+04 2.3E+04		
2.0E+00	I	6.0E-04	I	9.0E-03 3.0E-04	I P	9.0E-03 4.0E-03	I X	V V		1 1		1.3E+03 2.8E+03	1.4E+09 1.4E+09	8.6E+03 5.6E+03	Dibromomethane, 1,2- Dibromomethane (Methylene Bromide) Dibutyltin Compounds	106-93-4 74-95-3 NA	1.6E+00		1.8E-01	1.6E-01		1.1E+04 3.5E+02		3.4E+02 8.3E+02	9.9E+01 2.5E+02		
				3.0E-02	I					1	0.1	1.4E+09			Dicamba	1918-00-9					3.5E+04	8.3E+04		2.5E+04			
		4.2E-03 4.2E-03	P P						V V	1 1		5.5E+02 5.2E+02	1.4E+09 1.4E+09	3.2E+03 1.1E+04	Dichloro-2-butene, 1,4- Dichloro-2-butene, cis-1,4-	764-41-0 1476-11-5			9.4E-03 3.2E-02	9.4E-03 3.2E-02							
5.0E-02	I			4.0E-03 9.0E-02	I I	2.0E-01	H	V		1	0.1	7.6E+02 1.4E+09	1.4E+09 1.4E+09	1.1E+04	Dichloro-2-butene, trans-1,4- Dichloroacetic Acid Dichlorobenzene, 1,2-	110-57-6 79-43-6 95-50-1	6.5E+01	1.5E+02	3.2E-02	4.6E+01	4.7E+03 1.1E+05	1.1E+04	1.0E+04	3.3E+03 9.3E+03			
5.4E-03 4.5E-01	C I	1.1E-05 3.4E-04	C C	7.0E-02 9.0E-03	A X	8.0E-01	I	V		1	0.1	1.4E+09 1.4E+09	1.0E+04 1.4E+09		Dichlorobenzene, 1,4- Dichlorobenzidine, 3,3'- Dichlorobenzophenone, 4,4'-	106-46-7 91-94-1 90-98-2	6.1E+02 7.3E+00	1.2E+01 4.9E+04	1.1E+01 5.1E+00		8.2E+04		3.7E+04	2.5E+04			
				2.0E-01 2.0E-01 2.0E-01	I X I	1.0E-01	X V V			1 1 1		8.5E+02 1.7E+03 3.0E+03	1.4E+09 1.4E+09 1.4E+09	8.4E+02 2.1E+03 4.6E+03	Dichlorodifluoromethane Dichloroethane, 1,1- Dichloroethane, 1,2	75-71-8 75-34-3 107-06-2	5.7E+02 3.6E+01		1.6E+01 2.2E+00	1.6E+01 2.0E+00		2.3E+05 2.3E+05 7.0E+03		3.7E+02 2.3E+05 1.4E+02	3.7E+02 2.3E+05 1.4E+02		
				5.0E-02 2.0E-03 2.0E-02	I I I	2.0E-01	I V V			1 1 1		1.2E+03 2.4E+03 1.9E+03	1.4E+09 1.4E+09 1.4E+09	1.2E+03 2.5E+03 1.8E+03	Dichloroethylene, 1,1- Dichloroethylene, 1,2-cis- Dichloroethylene, 1,2-trans	75-35-4 156-59-2 156-60-5					5.8E+04 2.3E+03 2.3E+04		1.0E+03	1.0E+03 2.3E+03 2.3E+04			
				3.0E-03 1.0E-02 8.0E-03	I I I					1 1 1	0.1 0.05 0.1	1.4E+09 1.4E+09 1.4E+09			Dichlorophenol, 2,4- Dichlorophenoxy Acetic Acid, 2,4- Dichlorophenoxybutyric Acid, 4-(2,4-	120-83-2 94-75-7 94-82-6					3.5E+03 1.2E+04 9.3E+03	8.3E+03 5.5E+04 2.2E+04		2.5E+03 9.6E+03 6.6E+03			
3.6E-02	C	1.0E-05	C	9.0E-02 2.0E-02 3.0E-03	A P I	4.0E-03	I	V		1		1.4E+03 1.5E+03 1.4E+09	1.4E+09 1.4E+09 1.4E+09	3.8E+03 6.8E+03	Dichloropropane, 1,2- Dichloropropane, 1,3- Dichloropropanol, 2,3-	78-87-5 142-28-9 616-23-9	9.1E+01		4.6E+00	4.4E+00		1.1E+05 2.3E+04 3.5E+03		6.6E+01 2.3E+04 8.3E+03	6.6E+01 2.3E+04 2.5E+03		
1.0E-01 2.9E-01	I I	4.0E-06 8.3E-05	I C	3.0E-02 5.0E-04 1.0E-04	I I I	2.0E-02	I	V		1		1.6E+03 1.4E+09 1.4E+09	1.4E+09 1.4E+09 1.4E+09	3.6E+03	Dichloropropane, 1,3- Dichlorvos Dicrotophos	542-75-6 62-73-7 141-66-2	3.3E+01 1.1E+01	1.1E+01 2.7E+01	8.2E+00 2.0E+05		3.5E+04 5.8E+02 1.2E+02		3.1E+02 1.4E+03 2.8E+02	3.1E+02 4.1E+02 8.2E+01			
1.6E+01	I	4.6E-03 3.0E-04	I C	8.0E-02 5.0E-05 5.0E-03	P I I	3.0E-04	X V I			1 1 1	0.1 0.1	2.6E+02 1.4E+09	1.4E+09 1.4E+09	4.1E+03	Dicyclopentadiene Dieldrin Diesel Engine Exhaust	77-73-6 60-57-1 NA	2.0E-01	4.8E-01	3.6E+03	1.4E-01		9.3E+04 5.8E+01	1.4E+02	5.4E+00	5.4E+00 4.1E+01		
				2.0E-03 3.0E-02 6.0E-02	P P P	2.0E-04	P	P		1 1 1	0.1 0.1 0.1	1.4E+09 1.4E+09 1.4E+09			Diethanolamine Diethylene Glycol Monobutyl Ether Diethylene Glycol Monoethyl Ether	111-42-2 112-34-5 111-90-0					2.3E+03 3.5E+04 7.0E+04	5.5E+03 8.3E+04 1.7E+05	1.2E+06 6.0E+05 1.8E+06	1.6E+03 2.4E+04 4.8E+04			
3.5E+02	C	1.0E-01	C	1.0E-03 8.0E-02	P I				V	1		1.1E+05 1.4E+09 1.4E+09	1.4E+09 1.4E+09 1.4E+09	1.4E+05	Diethylformamide Diethylstilbestrol Difenoquat	617-84-5 56-53-1 43222-48-6	9.3E-03	2.2E-02	1.7E+02	6.6E-03		1.2E+03		1.2E+03			
4.4E-02	C	1.3E-05	C	2.0E-02 4.0E+01	I I				V	1		1.4E+03 1.4E+09	1.4E+09 1.2E+03	1.2E+03	Diflubenzuron Difluoroethane, 1,1- Dihydroafrrole	35367-38-5 75-37-6 94-58-6	7.4E+01		1.2E+02	4.5E+01		2.3E+04 2.3E+04	5.5E+04	2.0E+05	1.6E+04 2.0E+05		
				7.0E-01	P				V	1		2.3E+03 5.3E+02	1.4E+09 1.4E+09	3.1E+03 3.8E+04	Diisopropyl Ether Diisopropyl Methylphosphonate Dimethipin	108-20-3 1445-75-6 55290-64-7						9.4E+03		9.4E+03 9.3E+04 1.6E+04			
1.6E+00 1.7E-03	P P			2.0E-04 6.0E-02	I P					1 1	0.1 0.1	1.4E+09 1.4E+09			Dimethoate Dimethoxybenzidine, 3,3'- Dimethyl methylphosphonate	60-51-5 119-90-4 756-79-6	2.0E+00 1.9E+03	4.8E+00 4.5E+03		1.4E+00 1.4E+03		2.3E+02 7.0E+04	5.5E+02 1.7E+05		1.6E+02 4.9E+04		
4.6E+00 5.8E-01 2.0E-01	C H P	1.3E-03	C	2.0E-03	X					1	0.1	1.4E+09 1.4E+09 1.4E+09			Dimethylamino azobenzene [p-] Dimethylaniline HCl, 2,4- Dimethylaniline, 2,4-	60-11-7 21436-96-4 95-68-1	7.1E-01 5.6E+00 1.6E+01	1.7E+00 1.3E+01 3.9E+01	1.3E+04 4.0E+00 1.1E+01		5.0E-01 4.0E+00 1.1E+01		2.3E+03 2.3E+03		1.6E+03		
1.1E+01	P			2.0E-03 1.0E-01	I X				V	1	0.1	8.3E+02 1.4E+09	1.4E+09 1.4E+09	3.1E+04 1.3E+05	Dimethylaniline, N,N- Dimethylbenzidine, 3,3'- Dimethylformamide	121-69-7 119-93-7 68-12-2	3.0E-01	7.0E-01		2.1E-01		2.3E+03 1.2E+05		1.7E+04	2.3E+03 1.5E+04		
5.5E+02	C	1.6E-01	C	1.0E-04 2.0E-02	X I	2.0E-06	X	V		1		1.7E+05 1.9E+05	1.4E+09 1.4E+09	2.8E+04 1.7E+05	Dimethylhydrazine, 1,1- Dimethylhydrazine, 1,2- Dimethylphenol, 2,4-	57-14-7 540-73-8 105-67-9	5.9E-03		1.3E-02	4.1E-03		1.2E+02 2.3E+04		2.4E-01	2.4E-01 1.6E+04		
				6.0E-04 1.0E-03	I I					1 1	0.1 0.1	1.4E+09 1.4E+09			Dimethylphenol, 2,6- Dimethylphenol, 3,4-	576-26-1 95-65-8					7.0E+02 1.2E+03	1.7E+03 2.8E+03		4.9E+02 8.2E+02			

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																										
Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³) ⁻¹	k _e y	o ₁ y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)		
4.5E-02	C	1.3E-05	C					V		1		1.3E+03	1.4E+09	9.5E+02	Dimethylvinylchloride	513-37-1	7.3E+01		9.0E-01	8.9E-01						
				8.0E-05	X					1	0.1		1.4E+09		Dinitro-o-cresol, 4,6-	534-52-1					9.3E+01	2.2E+02		6.6E+01		
				2.0E-03	I					1	0.1		1.4E+09		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5					2.3E+03	5.5E+03		1.6E+03		
				1.0E-04	P					1	0.1		1.4E+09		Dinitrobenzene, 1,2-	528-29-0					1.2E+02	2.8E+02		8.2E+01		
				1.0E-04	I					1	0.1		1.4E+09		Dinitrobenzene, 1,3-	99-65-0					1.2E+02	2.8E+02		8.2E+01		
				1.0E-04	P					1	0.1		1.4E+09		Dinitrobenzene, 1,4-	100-25-4					1.2E+02	2.8E+02		8.2E+01		
				2.0E-03	I					1	0.1		1.4E+09		Dinitrophenol, 2,4-	51-28-5					2.3E+03	5.5E+03		1.6E+03		
6.8E-01	I									1	0.1		1.4E+09		Dinitrotoluene Mixture, 2,4/2,6-	NA	4.8E+00	1.1E+01		3.4E+00						
3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		1.4E+09		Dinitrotoluene, 2,4-	121-14-2	1.1E+01	2.4E+01	1.9E+05	7.4E+00	2.3E+03	5.4E+03		1.6E+03		
1.5E+00	P			3.0E-04	X					1	0.099		1.4E+09		Dinitrotoluene, 2,6-	606-20-2	2.2E+00	5.2E+00		1.5E+00	3.5E+02	8.4E+02		2.5E+02		
				2.0E-03	S					1	0.006		1.4E+09		Dinitrotoluene, 2-Amino-4,6-	35572-78-2					2.3E+03	9.2E+04		2.3E+03		
				2.0E-03	S					1	0.009		1.4E+09		Dinitrotoluene, 4-Amino-2,6-	19406-51-0					2.3E+03	6.1E+04		2.3E+03		
4.5E-01	X			9.0E-04	X					1	0.1		1.4E+09		Dinitrotoluene, Technical grade	25321-14-6	7.3E+00	1.7E+01		5.1E+00	1.1E+03	2.5E+03		7.4E+02		
				1.0E-03	I					1	0.1		1.4E+09		Dinoseb	88-85-7					1.2E+03	2.8E+03		8.2E+02		
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	V		1		1.2E+05	1.4E+09	4.0E+04	Dioxane, 1,4- Dioxins	123-91-1	3.3E+01		9.7E+01	2.4E+01			5.2E+03	4.5E+03		
6.2E+03	I	1.3E+00	I							1	0.03		1.4E+09		**Hexachlorodibenzo-p-dioxin, Mixture	NA	5.3E-04	4.2E-03	1.3E+01	4.7E-04						
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C	V		1	0.03		1.4E+09	2.0E+06	*TCDD, 2,3,7,8- Diphenamid	1746-01-6 957-51-7	2.5E-05	2.0E-04	6.3E-04	2.2E-05	8.2E-04	6.4E-03	3.4E-01	7.2E-04		
				3.0E-02	I					1	0.1		1.4E+09								3.5E+04	8.3E+04		2.5E+04		
				8.0E-04	X					1	0.1		1.4E+09		Diphenyl Sulfone	127-63-9					9.3E+02	2.2E+03		6.6E+02		
				2.5E-02	I					1	0.1		1.4E+09		Diphenylamine	122-39-4					2.9E+04	6.9E+04		2.1E+04		
8.0E-01	I	2.2E-04	I							1	0.1		1.4E+09		Diphenylhydrazine, 1,2-	122-66-7	4.1E+00	9.7E+00	7.6E+04	2.9E+00						
				2.2E-03	I					1	0.1		1.4E+09		Diquat	85-00-7					2.6E+03	6.1E+03		1.8E+03		
7.1E+00	C	1.4E-01	C							1	0.1		1.4E+09		Direct Black 38	1937-37-7	4.6E-01	1.1E+00	1.2E+02	3.2E-01						
7.4E+00	C	1.4E-01	C							1	0.1		1.4E+09		Direct Blue 6	2602-46-2	4.4E-01	1.0E+00	1.2E+02	3.1E-01						
6.7E+00	C	1.4E-01	C							1	0.1		1.4E+09		Direct Brown 95	16071-86-6	4.9E-01	1.2E+00	1.2E+02	3.4E-01						
				4.0E-05	I					1	0.1		1.4E+09		Disulfoton	298-04-4					4.7E+01	1.1E+02		3.3E+01		
				1.0E-02	I			V		1		1.4E+09	4.5E+04		Dithiane, 1,4-	505-29-3					1.2E+04			1.2E+04		
				2.0E-03	I					1	0.1		1.4E+09		Diuron	330-54-1					2.3E+03	5.5E+03		1.6E+03		
				4.0E-03	I					1	0.1		1.4E+09		Dodine	2439-10-3					4.7E+03	1.1E+04		3.3E+03		
				2.5E-02	I			V		1		1.4E+09	1.2E+05		EPTC	759-94-4					2.9E+04			2.9E+04		
				6.0E-03	I			V		1		1.4E+09	4.1E+05		Endosulfan	115-29-7					7.0E+03			7.0E+03		
				2.0E-02	I					1	0.1		1.4E+09		Endothall	145-73-3					2.3E+04	5.5E+04		1.6E+04		
				3.0E-04	I					1	0.1		1.4E+09		Endrin	72-20-8					3.5E+02	8.3E+02		2.5E+02		
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	1.4E+09	1.9E+04	Epichlorohydrin	106-89-8	3.3E+02		1.9E+02	1.2E+02	7.0E+03		8.3E+01	8.2E+01		
				2.0E-02	I	V				1		1.5E+04	1.4E+09	7.7E+03	Epoxybutane, 1,2-	106-88-7							6.7E+02	6.7E+02		
				4.0E-02	P					1	0.1		1.4E+09		Ethanol, 2-(2-methoxyethoxy)-	111-77-3					4.7E+04	1.1E+05		3.3E+04		
				5.0E-03	I					1	0.1		1.4E+09		Ethephon	16672-87-0					5.8E+03	1.4E+04		4.1E+03		
				5.0E-04	I					1	0.1		1.4E+09		Ethion	563-12-2					5.8E+02	1.4E+03		4.1E+02		
				1.0E-01	P	6.0E-02	P	V		1		2.4E+04	1.4E+09	6.2E+04	Ethoxyethanol Acetate, 2-	111-15-9					1.2E+05		1.6E+04	1.4E+04		
				9.0E-02	P	2.0E-01	I	V		1		1.1E+05	1.4E+09	9.8E+04	Ethoxyethanol, 2-	110-80-5					1.1E+05		8.6E+04	4.7E+04		
				9.0E-01	I	7.0E-02	P	V		1		1.1E+04	1.4E+09	8.6E+03	Ethyl Acetate	141-78-6					1.1E+06		2.6E+03	2.6E+03		
				5.0E-03	P	8.0E-03	P	V		1		2.5E+03	1.4E+09	6.3E+03	Ethyl Acrylate	140-88-5					5.8E+03		2.2E+02	2.1E+02		
				1.0E+01	I	V				1		2.1E+03	1.4E+09	1.3E+03	Ethyl Chloride (Chloroethane)	75-00-3							5.7E+04	5.7E+04		
				2.0E-01	I	V				1		1.0E+04	1.4E+09	3.1E+03	Ethyl Ether	60-29-7							2.3E+05	2.3E+05		
				3.0E-01	P	V				1		1.1E+03	1.4E+09	5.8E+03	Ethyl Methacrylate	97-63-2							7.6E+03	7.6E+03		
				1.0E-05	I					1	0.1		1.4E+09		Ethyl-p-nitrophenyl Phosphonate	2104-64-5					1.2E+01	2.8E+01		8.2E+00		
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	1.4E+09	5.7E+03	Ethylbenzene	100-41-4	3.0E+02		2.8E+01	2.5E+01	1.2E+05		2.5E+04	2.0E+04		
				7.0E-02	P					1	0.1		1.4E+09		Ethylene Cyanohydrin	109-78-4					8.2E+04	1.9E+05		5.7E+04		
				9.0E-02	P			V		1		1.9E+05	1.4E+09	1.8E+05	Ethylene Diamine	107-15-3					1.1E+05			1.1E+05		
				2.0E+00	I	4.0E-01	C			1	0.1		1.4E+09		Ethylene Glycol	107-21-1					2.3E+06	5.5E+06	2.4E+09	1.6E+06		
				1.0E-01	I	1.6E+00	I			1	0.1		1.4E+09		Ethylene Glycol Monobutyl Ether	111-76-2					1.2E+05	2.8E+05	9.5E+09	8.2E+04		
3.1E-01	C	8.8E-05	C			3.0E-02	C	V																		

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Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³)	k _e y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)			
				6.0E-02	I				1	0.1	1.4E+09			Flutolanil	66332-96-5					7.0E+04	1.7E+05		4.9E+04			
				1.0E-02	I				1	0.1	1.4E+09			Fluvalinate	69409-94-5					1.2E+04	2.8E+04		8.2E+03			
3.5E-03	I			1.0E-01	I				1	0.1	1.4E+09			Folpet	133-07-3	9.3E+02	2.2E+03		6.6E+02	1.2E+05	2.8E+05		8.2E+04			
1.9E-01	I								1	0.1	1.4E+09			Fomesafen	72178-02-0	1.7E+01	4.1E+01		1.2E+01	2.3E+03	5.5E+03		1.6E+03			
				2.0E-03	I				1	0.1	1.4E+09			Fonofos	944-22-9											
1.3E-05	I	2.0E-01	I	9.8E-03	A	V			1		4.2E+04	1.4E+09	7.8E+04	Formaldehyde	50-00-0			7.3E+01	7.3E+01	2.3E+05		3.3E+03	3.3E+03			
		9.0E-01	P	3.0E-04	X	V			1		1.1E+05	1.4E+09	9.3E+04	Formic Acid	64-18-6					1.1E+06		1.2E+02	1.2E+02			
		3.0E+00	I						1	0.1	1.4E+09			Fosetyl-AL	39148-24-8					3.5E+06	8.3E+06		2.5E+06			
				1.0E-03	X			V	1	0.03	1.4E+09	2.0E+05		Furans												
				1.0E-03	I			V	1	0.03	6.2E+03	1.4E+09	2.6E+03	*Furan	110-00-9					1.2E+03	9.2E+03		1.0E+03			
				9.0E-01	I	2.0E+00	I	V	1	0.03	1.7E+05	1.4E+09	1.2E+04	*Tetrahydrofuran	109-99-9					1.1E+06	8.3E+06	1.1E+05	9.6E+04			
3.8E+00	H								1	0.1	1.4E+09			Furazolidone	67-45-8											
				3.0E-03	I	5.0E-02	H	V	1		1.0E+04	1.4E+09	4.9E+04	Furfural	98-01-1	8.6E-01	2.0E+00		6.0E-01	3.5E+03		1.1E+04	2.6E+03			
1.5E+00	C	4.3E-04	C						1	0.1	1.4E+09			Furium	531-82-8	2.2E+00	5.2E+00	3.9E+04	1.5E+00							
3.0E-02	I	8.6E-06	C						1	0.1	1.4E+09			Furmecyclo	60568-05-0	1.1E+02	2.6E+02	1.9E+06	7.7E+01	4.7E+02	1.1E+03		3.3E+02			
				4.0E-04	I				1	0.1	1.4E+09			Glufosinate, Ammonium	77182-82-2											
				8.0E-05	C				1	0.1	1.4E+09			Glutaraldehyde	111-30-8							4.8E+05	4.8E+05			
				4.0E-04	I	1.0E-03	H	V	1		1.1E+05	1.4E+09	8.4E+04	Glycidyl	765-34-4					4.7E+02		3.7E+02	2.1E+02			
				1.0E-01	I				1	0.1	1.4E+09			Glyphosate	1071-83-6					1.2E+05	2.8E+05		8.2E+04			
				1.0E-02	X			V	1		1.4E+09	1.5E+05		Guanidine	113-00-8					1.2E+04			1.2E+04			
				2.0E-02	P				1	0.1	1.4E+09			Guanidine Chloride	50-01-1					2.3E+04	5.5E+04		1.6E+04			
				5.0E-05	I				1	0.1	1.4E+09			Haloxypol, Methyl	69806-40-2					5.8E+01	1.4E+02		4.1E+01			
4.5E+00	I	1.3E-03	I	5.0E-04	I			V	1		1.4E+09	4.8E+05		Heptachlor	76-44-8	7.3E-01		4.5E+00	6.3E-01	5.8E+02			5.8E+02			
9.1E+00	I	2.6E-03	I	1.3E-05	I			V	1		1.4E+09	8.4E+05		Heptachlor Epoxide	1024-57-3	3.6E-01		4.0E+00	3.3E-01	1.5E+01			1.5E+01			
				2.0E-03	I			V	1		1.4E+09	3.8E+05		Hexabromobenzene	87-82-1					2.3E+03			2.3E+03			
				2.0E-04	I				1	0.1	1.4E+09			Hexabromodiphenyl ether, 2,2',4,4',5,5'-(BDE-153)	68531-49-2					2.3E+02	5.5E+02		1.6E+02			
1.6E+00	I	4.6E-04	I	8.0E-04	I			V	1		1.4E+09	6.8E+04		Hexachlorobenzene	118-74-1	2.0E+00		1.8E+00	9.6E-01	9.3E+02			9.3E+02			
7.8E-02	I	2.2E-05	I	1.0E-03	P			V	1		1.7E+01	1.4E+09	1.1E+04	Hexachlorobutadiene	87-68-3	4.2E+01		6.0E+00	5.3E+00	1.2E+03			1.2E+03			
6.3E+00	I	1.8E-03	I	8.0E-03	A				1	0.1	1.4E+09			Hexachlorocyclohexane, Alpha	519-84-6	5.2E-01	1.2E+00	9.3E+03	3.6E-01	9.3E+03	2.2E+04		6.6E+03			
1.8E+00	I	5.3E-04	I						1	0.1	1.4E+09			Hexachlorocyclohexane, Beta	519-85-7	1.8E+00	4.3E+00	3.1E+04	1.3E+00							
1.1E+00	C	3.1E-04	C	3.0E-04	I				1	0.04	1.4E+09			Hexachlorocyclohexane, Gamma-(Lindane)	58-89-9	3.0E+00	1.8E+01	5.4E+04	2.5E+00	3.5E+02	2.1E+03		3.0E+02			
1.8E+00	I	5.1E-04	I						1	0.1	1.4E+09			Hexachlorocyclohexane, Technical	608-73-1	1.8E+00	4.3E+00	3.3E+04	1.3E+00							
				6.0E-03	I	2.0E-04	I	V	1		1.6E+01	1.4E+09	8.5E+03	Hexachlorocyclopentadiene	77-47-4					7.0E+03		7.5E+00	7.5E+00			
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I	V	1		1.4E+09	8.0E+03		Hexachloroethane	67-72-1	8.2E+01		8.9E+00	8.0E+00	8.2E+02		1.1E+03	4.6E+02			
				3.0E-04	I				1	0.1	1.4E+09			Hexachlorophene	70-30-4					3.5E+02	8.3E+02		2.5E+02			
1.1E-01	I			3.0E-03	I				1	0.015	1.4E+09			Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	3.0E+01	4.7E+02		2.8E+01	3.5E+03	5.5E+04		3.3E+03			
				1.0E-05	I	V			1		3.4E+03	1.4E+09	3.0E+05	Hexamethylene Diisocyanate 1,6	822-06-0							1.3E+01	1.3E+01			
				4.0E-04	P				1	0.1	1.4E+09			Hexamethylphosphoramide	680-31-9					4.7E+02	1.1E+03		3.3E+02			
				7.0E-01	I	V			1		1.4E+02	1.4E+09	8.3E+02	Hexane, N-	110-54-3							2.5E+03	2.5E+03			
				2.0E+00	P				1	0.1	1.4E+09			Hexanedioic Acid	124-04-9					2.3E+06	5.5E+06		1.6E+06			
				5.0E-03	I	3.0E-02	I	V	1		3.3E+03	1.4E+09	1.3E+04	Hexanone, 2-	591-78-6					5.8E+03		1.7E+03	1.3E+03			
				3.3E-02	I				1	0.1	1.4E+09			Hexazinone	51235-04-2					3.9E+04	9.1E+04		2.7E+04			
				2.5E-02	I				1	0.1	1.4E+09			Hexythiazox	78587-05-0					2.9E+04	6.9E+04		2.1E+04			
				3.0E-04	I				1	0.1	1.4E+09			Hydramethylnon	67485-29-4					3.5E+02	8.3E+02		2.5E+02			
3.0E+00	I	4.9E-03	I			3.0E-05	P	V	1		1.4E+09			Hydrazine	302-01-2	1.1E+00		3.4E+03	1.1E+00			1.8E+05	1.8E+05			
3.0E+00	I	4.9E-03	I						1		1.4E+09			Hydrazine Sulfate	10034-93-2	1.1E+00		3.4E+03	1.1E+00							
				2.0E-02	I	V			1		1.4E+09			Hydrogen Chloride	7647-01-0							1.2E+08	1.2E+08			
				4.0E-02	C	1.4E-02	C	V	1		1.4E+09			Hydrogen Fluoride	7664-39-3					4.7E+04			4.7E+04			
				2.0E-03	I	V			1		1.4E+09			Hydrogen Sulfide	7783-06-4							1.2E+07	1.2E+07			
6.0E-02	P			4.0E-02	P				1	0.1	1.4E+09			Hydroquinone	123-31-9	5.5E+01	1.3E+02		3.8E+01	4.7E+04	1.1E+05		3.3E+04			
				1.3E-02	I				1	0.1	1.4E+09			Imazalil	35554-44-0					1.5E+04	3.6E+04		1.1E+04			
				2.5E-01	I				1	0.1	1.4E+09			Imazaquin	81335-37-7					2.9E+05	6.9E+05		2.1E+05			
				2.5E-01	I				1	0.1	1.4E+09			Imazethapyr	81335-77-5</											

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																										
Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1					
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³) ⁻¹	k _e y	o ₁ y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)		
5.0E-01 8.5E-03	C C	1.5E-01 1.2E-05	C C	2.0E-02	C	2.0E-04	C		M	0.025 1			1.4E+09 1.4E+09		Lead Compounds ~Lead Chromate ~Lead Phosphate	7758-97-6 7446-27-7	6.5E+00 3.8E+02			1.1E+02 1.4E+06	6.2E+00 3.8E+02	2.3E+04			1.2E+06	2.3E+04
2.8E-01 8.5E-03	C C	8.0E-05 1.2E-05	C C							1 1	0.1 0.1		1.4E+09 1.4E+09		~Lead acetate ~Lead and Compounds ~Lead subacetate	301-04-2 7439-92-1 1335-32-6	1.2E+01 2.8E+01 3.8E+02	2.8E+01 2.1E+05 9.1E+02	2.1E+05 8.2E+00 2.7E+02					8.0E+02		
				1.0E-07 5.0E-06 2.0E-03	I P I			V V		1 1 1		2.4E+00 3.8E+02 1.4E+09	1.4E+09 1.4E+09 1.4E+09	1.9E+03 2.6E+04	~Tetraethyl Lead Lewisite Linuron	78-00-2 541-25-3 330-55-2					1.2E-01 5.8E+00 2.3E+03		5.5E+03	1.2E-01 5.8E+00 1.6E+03		
				2.0E-03 5.0E-04 1.0E-02	P I I					1 1 1	0.1 0.1		1.4E+09 1.4E+09 1.4E+09		Lithium MCPA MCPB	7439-93-2 94-74-6 94-81-5					2.3E+03 5.8E+02 1.2E+04	1.4E+03 1.4E+03		2.3E+03 4.1E+02 8.2E+03		
				1.0E-03 2.0E-02 1.0E-01	I I I					1 1 1	0.1 0.1		1.4E+09 1.4E+09 1.4E+09		MCPP Malathion Maleic Anhydride	93-65-2 121-75-5 108-31-6					1.2E+03 2.3E+04 1.2E+05	2.8E+03 5.5E+04 2.8E+05	4.2E+06	8.2E+02 1.6E+04 8.0E+04		
				5.0E-01 1.0E-04 3.0E-02	I P H					1 1 1	0.1 0.1		1.4E+09 1.4E+09 1.4E+09		Maleic Hydrazide Malononitrile Mancozeb	123-33-1 109-77-3 8018-01-7					5.8E+05 1.2E+02 3.5E+04	1.4E+06 2.8E+02 8.3E+04		4.1E+05 8.2E+01 2.5E+04		
				5.0E-03 1.4E-01 2.4E-02	I I S	5.0E-05	I			1 1 0.04			1.4E+09 1.4E+09 1.4E+09		Maneb Manganese (Diet) Manganese (Non-diet)	12427-38-2 7439-96-5 7439-96-5					5.8E+03 2.8E+04	1.4E+04	3.0E+05	4.1E+03 2.6E+04		
				9.0E-05 3.0E-02	H I					1 1	0.1 0.1		1.4E+09 1.4E+09		Mephosfolan Mepiquat Chloride	950-10-7 24307-26-4					1.1E+02 3.5E+04	2.5E+02 8.3E+04		7.4E+01 2.5E+04		
				3.0E-04	I	3.0E-04	S			0.07			1.4E+09		~Mercuric Chloride (and other Mercury salts)	7487-94-7					3.5E+02			1.8E+06 4.6E+01	3.5E+02 4.6E+01	
				1.0E-04	I			I	V	1		3.1E+00	1.4E+09	3.5E+04	~Mercury (elemental) ~Methyl Mercury	7439-97-6 22967-92-6					1.2E+02				1.2E+02	
				8.0E-05 3.0E-05 3.0E-05	I I I					1 1 1	0.1 0.1		1.4E+09 1.4E+09 1.4E+09		~Phenylmercuric Acetate Merphos Merphos Oxide	67-38-4 150-50-5 78148-8					9.3E+01 3.5E+01 3.5E+01	2.2E+02		6.6E+01 3.5E+01 2.5E+01		
				6.0E-02 1.0E-04 5.0E-05	I I I					1 1 1	0.1 0.1		1.4E+09 1.4E+09 1.4E+09		Metalaxyl Methacrylonitrile Methamidophos	57837-19-1 126-98-7 10265-92-6					7.0E+04 1.2E+02 5.8E+01	1.7E+05 1.4E+02		4.9E+04 1.0E+02 4.1E+01		
				2.0E+00 1.0E-03 2.5E-02	I I I	2.0E+01	I	V		1		1.1E+05	1.4E+09	2.9E+04	Methanol Methidathion Methomyl	67-56-1 950-37-8 16752-77-5					2.3E+06 1.2E+03 2.9E+04	2.5E+06		1.2E+06 8.2E+02 2.1E+04		
4.9E-02	C	1.4E-05	C							1	0.1		1.4E+09		Methoxy-5-nitroaniline, 2- Methoxychlor Methoxyethanol, 2-	99-59-2 72-43-5 110-49-6	6.7E+01	1.6E+02	1.2E+06	4.7E+01						
				5.0E-03 8.0E-03	I P	1.0E-03	P	V		1		1.2E+05	1.4E+09	1.2E+05	Methoxyethanol, 2- Methyl Acetate	109-86-4 79-20-9					5.8E+03 9.3E+03	1.4E+04	5.4E+02	4.1E+03 5.1E+02		
				5.0E-03 1.0E+00	P X	2.0E-02	I	V		1		1.1E+05	1.4E+09	1.0E+05	Methoxyethanol, 2- Methyl Acetate	109-86-4 79-20-9					5.8E+03 1.2E+06	8.8E+03		3.5E+03 1.2E+06		
				6.0E-01 1.0E-03	I P	5.0E+00	I	V		1		2.8E+04	1.4E+09	1.2E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3					7.0E+05 1.2E+03	2.7E+05 4.4E+00		1.9E+05 1.4E+05		
										1		3.4E+03	1.4E+09	1.1E+04	Methyl Hydrazine Methyl Isobutyl Ketone (4-methyl-2-pentanone)	60-34-4 108-10-1			6.2E-01	6.2E-01						
										1		1.0E+04	1.4E+09	4.4E+03	Methyl Isocyanate	624-83-9								1.9E+01		
				1.4E+00 2.5E-04	I I	7.0E-01	I	V		1		2.4E+03	1.4E+09	6.3E+03	Methyl Methacrylate Methyl Parathion	80-62-6 298-00-0					1.6E+06 2.9E+02	6.9E+02		1.9E+04 2.1E+02		
				6.0E-02 6.0E-03	X H					1	0.1		1.4E+09		Methyl Phosphonic Acid Methyl Styrene (Mixed Isomers)	993-13-5 25013-15-4					7.0E+04 7.0E+03	1.7E+05		4.9E+04 2.6E+03		
9.9E-02	C	2.8E-05	C							1	0.1		1.4E+09		Methyl methanesulfonate	66-27-3	3.3E+01	7.8E+01	6.0E+05	2.3E+01						
1.8E-03	C	2.6E-07	C							1		8.9E+03	1.4E+09	4.9E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	1.8E+03		2.3E+02	2.1E+02				6.4E+04		
				3.0E-04 2.0E-02	X X					1	0.1		1.4E+09		Methyl-1,4-benzenediamine dihydrochloride, 2- Methyl-5-Nitroaniline, 2-	615-45-2 99-55-8					3.5E+02 2.3E+04	8.3E+02 5.5E+04		2.5E+02 1.6E+04		
8.3E+00 1.3E-01	C C	2.4E-03 3.7E-05	C C							1	0.1		1.4E+09		Methyl-N-nitro-N-nitrosoguanidine, N- Methylaniline Hydrochloride, 2- Methylarsonic acid	70-25-7 636-21-5 124-58-3	3.9E-01 2.5E+01	9.3E-01 5.9E+01	6.9E+03 4.5E+05	2.8E-01 1.8E+01				1.2E+04 2.3E+02 3.5E+02	2.8E+04 5.5E+02 8.3E+02	8.2E+03 1.6E+02 2.5E+02
1.0E-01 2.2E+01	X C	2.4E-03 6.3E-03	C C						M	1	0.1		1.4E+09		Methylbenzene,1,4-diamine monohydrochloride, 2- Methylbenzene-1,4-diamine sulfate, 2- Methylcholanthrene, 3-	74612-12-7 615-50-9 56-49-5	3.3E+01 1.5E-01	7.7E+01 3.5E-01	2.6E+03	2.3E+01 1.0E-01				2.3E+02 3.5E+02	5.5E+02 8.3E+02	1.6E+02 2.5E+02
2.0E-03 1.0E-01 4.6E-02	I P I	1.0E-08 4.3E-04 1.3E-05	I C C	6.0E-03	I	6.0E-01	I	V	M	1		3.3E+03	1.4E+09	2.2E+03	Methylene Chloride Methylene-bis(2-chloroaniline), 4,4'- Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	75-09-2 101-14-4 101-61-1	1.6E+03 3.3E+01 7.1E-01	2.7E+03 7.7E+01 1.7E+02	2.7E+03 3.9E+04 1.3E+06	1.0E+03 2.3E+01 5.0E+01	7.0E+03 2.3E+03	5.5E+03	5.8E+03	3.2E+03 1.6E+03		
1.6E+00	C	4.6E-04	C							1	0.1		1.4E+09		Methylenabisbenzenamine, 4,4'- Methylenediphenyl Diisocyanate	101-77-9 101-68-8	2.0E+00	4.8E+00	3.6E+04	1.4E+00			1.2E+08 3.6E+06	1.2E+08 3.6E+06		

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Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³)	k _e y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)	
				7.0E-02	H			V	1		5.0E+02	1.4E+09	1.3E+04	Methylstyrene, Alpha-	98-83-9						8.2E+04			8.2E+04
				1.5E-01	I				1	0.1		1.4E+09		Metolachlor	51218-45-2						1.8E+05	4.1E+05		1.2E+05
				2.5E-02	I				1	0.1		1.4E+09		Metribuzin	21087-64-9						2.9E+04	6.9E+04		2.1E+04
				2.5E-01	I				1	0.1		1.4E+09		Metsulfuron-methyl	74223-64-6						2.9E+05	6.9E+05		2.1E+05
1.8E+01	C	5.1E-03	C	3.0E+00	P			V	1		3.4E-01	1.4E+09	1.4E+03	Mineral oils	8012-95-1						3.5E+06			3.5E+06
				2.0E-04	I			V	1			1.4E+09	8.6E+05	Mirex	2385-85-5	1.8E-01		2.1E+00	1.7E-01	2.3E+02			2.3E+02	
				2.0E-03	I				1	0.1		1.4E+09		Molinate	2212-67-1						2.3E+03	5.5E+03		1.6E+03
				5.0E-03	I				1			1.4E+09		Molybdenum	7439-98-7						5.8E+03			5.8E+03
				1.0E-01	I				1			1.4E+09		Monochloramine	10599-90-3						1.2E+05			1.2E+05
				2.0E-03	P				1	0.1		1.4E+09		Monomethylaniline	100-61-8						2.3E+03	5.5E+03		1.6E+03
				2.5E-02	I				1	0.1		1.4E+09		Myclobutanil	88671-89-0						2.9E+04	6.9E+04		2.1E+04
				3.0E-04	X				1	0.1		1.4E+09		N,N'-Diphenyl-1,4-benzenediamine	74-31-7						3.5E+02	8.3E+02		2.5E+02
				2.0E-03	I			V	1			1.4E+09	5.7E+04	Naled	300-76-5						2.3E+03			2.3E+03
1.8E+00	C	0.0E+00	C	3.0E-02	X	1.0E-01	P	V	1			1.4E+09		Naphtha, High Flash Aromatic (HFAN)	64742-95-6						3.5E+04		6.0E+08	3.5E+04
				1.0E-01	I				1	0.1		1.4E+09		Naphthylamine, 2-	91-59-8	1.8E+00	4.3E+00		1.3E+00		1.2E+05	2.8E+05		8.2E+04
				2.6E-04	C	1.1E-02	C	1.4E-05	C	1	0.1	1.4E+09		Nickel Acetate	373-02-4			6.4E+04	6.4E+04	1.3E+04	3.0E+04	8.3E+04	8.1E+03	
				2.6E-04	C	1.1E-02	C	1.4E-05	C	1	0.1	1.4E+09		Nickel Carbonate	3333-67-3			6.4E+04	6.4E+04	1.3E+04	3.0E+04	8.3E+04	8.1E+03	
				2.6E-04	C	1.1E-02	C	1.4E-05	C	1	0.1	1.4E+09		Nickel Carbonyl	13463-39-3			6.4E+04	6.4E+04	1.3E+04	3.0E+04	8.3E+04	1.1E+04	
				2.6E-04	C	1.1E-02	C	1.4E-05	C	0.04		1.4E+09		Nickel Hydroxide	12054-48-7			6.4E+04	6.4E+04	1.3E+04	3.0E+04	8.3E+04	1.1E+04	
				2.6E-04	C	1.1E-02	C	2.0E-05	C	0.04		1.4E+09		Nickel Oxide	1313-99-1			6.4E+04	6.4E+04	1.3E+04	3.0E+04	8.3E+04	1.2E+04	
				2.4E-04	I	1.1E-02	C	1.4E-05	C	0.04		1.4E+09		Nickel Refinery Dust	NA			6.9E+04	6.9E+04	1.3E+04	3.0E+04	8.3E+04	1.1E+04	
1.7E+00	C	4.8E-04	I	2.0E-02	I	9.0E-05	A		0.04			1.4E+09		Nickel Soluble Salts	7440-02-0	1.9E+00		6.4E+04	6.4E+04	2.3E+04		5.4E+05	2.2E+04	
				4.8E-04	I	1.1E-02	C	1.4E-05	C	0.04		1.4E+09		Nickel Subsulfide	12035-72-2			3.5E+04	1.9E+00	1.3E+04		8.3E+04	1.1E+04	
				2.6E-04	C	1.1E-02	C	1.4E-05	C	1	0.1	1.4E+09		Nickelocene	1271-28-9			6.4E+04	6.4E+04	1.3E+04	3.0E+04	8.3E+04	8.1E+03	
				1.6E+00	I				1			1.4E+09		Nitrate	14797-55-8						1.9E+06			1.9E+06
				1.0E-01	I				1			1.4E+09		Nitrate, Nitrite (as N)	NA						1.2E+05			1.2E+05
				1.0E-01	I				1			1.4E+09		Nitrite	14797-65-0						1.2E+05			1.2E+05
2.0E-02	P			1.0E-02	X	5.0E-05	X		1	0.1		1.4E+09		Nitroaniline, 2-	88-74-4	1.6E+02	3.9E+02		1.1E+02	1.2E+04	2.8E+04	3.0E+05	8.0E+03	
				4.0E-05	I	2.0E-03	P	6.0E-03	P	1	0.1	1.4E+09		Nitroaniline, 4-	100-01-6						4.7E+03	1.1E+04	3.6E+07	3.3E+03
				2.0E-03	I	9.0E-03	I	V	1		3.1E+03	1.4E+09	7.3E+04	Nitrobenzene	98-95-3			2.2E+01	2.2E+01	2.3E+03		2.9E+03	1.3E+03	
1.3E+00	C	3.7E-04	C	3.0E+03	P				1	0.1		1.4E+09		Nitrocellulose	9004-70-0	2.5E+00	5.9E+00	4.5E+04	1.8E+00	3.5E+09	8.3E+09		2.5E+09	
				7.0E-02	H				1	0.1		1.4E+09		Nitrofurantoin	67-20-9					8.2E+04	1.9E+05		5.7E+04	
				1.0E-01	I				1	0.1		1.4E+09		Nitrofurazone	59-87-0									
1.7E-02	P			1.0E-04	P				1	0.1		1.4E+09		Nitroglycerin	55-63-0	1.9E+02	4.5E+02		1.4E+02	1.2E+02	2.8E+02		8.2E+01	
				8.8E-06	P				1	0.1		1.4E+09		Nitroguanidine	556-88-7					1.2E+05	2.8E+05		8.2E+04	
				2.7E-03	H				1	0.1		1.4E+09		Nitromethane	75-52-5			2.4E+01	2.4E+01			3.7E+02	3.7E+02	
2.7E+01	C	7.7E-03	C	2.0E-02	I	V			1		4.9E+03	1.4E+09	1.3E+04	Nitropropane, 2-	79-46-9	1.2E-01	2.9E-01	6.0E-02	6.0E-02			1.2E+03	1.2E+03	
1.2E+02	C	3.4E-02	C					M	1	0.1		1.4E+09		Nitroso-N-ethylurea, N-	759-73-9	2.7E-02	6.4E-02	4.9E+02	1.9E-02					
				5.0E-03	P	V		M	1	0.1		1.4E+09		Nitroso-N-methylurea, N-	684-93-5	2.7E-02	6.4E-02	4.9E+02	1.9E-02					
5.4E+00	I	1.6E-03	I					V	1			1.4E+09	2.4E+05	Nitroso-di-N-butylamine, N-	924-16-3	6.1E-01		1.9E+00	4.6E-01					
7.0E+00	I	2.0E-03	C						1	0.1		1.4E+09		Nitroso-di-N-propylamine, N-	621-64-7	4.7E-01	1.1E+00	8.3E+03	3.3E-01					
2.8E+00	I	8.0E-04	C						1	0.1		1.4E+09		Nitrosodiethanolamine, N-	1116-54-7	1.2E+00	2.8E+00	2.1E+04	8.2E-01					
1.5E+02	I	4.3E-02	I					M	1	0.1		1.4E+09		Nitrosodiethylamine, N-	55-18-5	2.2E-02	5.2E-02	3.9E+02	1.5E-02					
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	V	M	1		2.4E+05	1.4E+09	8.2E+04	Nitrosodimethylamine, N-	62-75-9	6.4E-02		7.2E-02	3.4E-02	9.3E+00		1.4E+01	5.7E+00
4.9E-03	I	2.6E-06	C						1	0.1		1.4E+09		Nitrosodiphenylamine, N-	86-30-6	6.7E+02	1.6E+03	6.4E+06	4.7E+02					
2.2E+01	I	6.3E-03	C					V	1		1.1E+05	1.4E+09	1.2E+05	Nitrosomethylethylamine, N-	10595-95-6	1.5E-01		2.4E-01	9.1E-02					
6.7E+00	C	1.9E-03	C						1	0.1		1.4E+09		Nitrosomorpholine [N-]	59-89-2	4.9E-01	1.2E+00	8.8E+03	3.4E-01					
9.4E+00	C	2.7E-03	C						1	0.1		1.4E+09		Nitrosopiperidine [N-]	100-75-4	3.5E-01	8.2E-01	6.2E+03	2.4E-01					
2.1E+00	I	6.1E-04	I						1	0.1		1.4E+09		Nitrosopyrrolidine, N-	930-55-2	1.6E+00	3.7E+00	2.7E+04	1.1E+00					
2.2E-01	P			1.0E-04	X				1	0.1		1.4E+09		Nitrotoluene, m-	99-08-1					1.2E+02	2.8E+02		8.2E+01	
				9.0E-04	P			V	1		1.5E+03	1.4E+09	1.4E+05	Nitrotoluene, o-	88-72-2	1.5E+01			1.5E+01	1.1E+03			1.1	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)														Regional Screening Level (RSL) Composite Worker Soil Table (TR=1E-06, HQ=1) November 2015									
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1			
SFO (mg/kg-day)	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³) ⁻¹	k _e y	o _l muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)
				5.0E-02	H		V		1			1.4E+09	4.5E+04	Pebulate	1114-71-2					5.8E+04			5.8E+04
				4.0E-02	I				1	0.1		1.4E+09		Pendimethalin	40487-42-1					4.7E+04	1.1E+05		3.3E+04
				2.0E-03	I		V		1		3.1E-01	1.4E+09	5.1E+05	Pentabromodiphenyl Ether	32534-81-9					2.3E+03			2.3E+03
				1.0E-04	I				1	0.1		1.4E+09		Pentabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-99)	60348-60-9					1.2E+02	2.8E+02		8.2E+01
				8.0E-04	I		V		1			1.4E+09	8.1E+04	Pentachlorobenzene	608-93-5					9.3E+02			9.3E+02
9.0E-02	P						V		1		4.6E+02	1.4E+09	9.7E+03	Pentachloroethane	76-01-7	3.6E+01			3.6E+01	3.5E+03			3.5E+03
2.6E-01	H			3.0E-03	I		V		1			1.4E+09	4.3E+05	Pentachloronitrobenzene	82-68-8	1.3E+01			1.3E+01	5.8E+03	5.5E+03		2.8E+03
4.0E-01	I	5.1E-06	C	5.0E-03	I				1	0.25		1.4E+09		Pentachlorophenol	87-86-5	8.2E+00	7.7E+00	3.3E+06	4.0E+00	5.8E+03	5.5E+03		2.8E+03
4.0E-03	X			2.0E-03	P				1	0.1		1.4E+09		Pentaerythritol tetranitrate (PETN)	78-11-5	8.2E+02	1.9E+03		5.7E+02	2.3E+03	5.5E+03		1.6E+03
						1.0E+00	P	V	1		3.9E+02	1.4E+09	7.8E+02	Pentane, n- Perchlorates	109-66-0							3.4E+03	3.4E+03
				7.0E-04	I				1			1.4E+09		~Ammonium Perchlorate	7790-98-9					8.2E+02			8.2E+02
				7.0E-04	I				1			1.4E+09		~Lithium Perchlorate	7791-03-9					8.2E+02			8.2E+02
				7.0E-04	I				1			1.4E+09		~Perchlorate and Perchlorate Salts	14797-73-0					8.2E+02			8.2E+02
				7.0E-04	I				1			1.4E+09		~Potassium Perchlorate	7778-74-7					8.2E+02			8.2E+02
				7.0E-04	I				1			1.4E+09		~Sodium Perchlorate	7601-89-0					8.2E+02			8.2E+02
				2.0E-02	P		V		1			1.4E+09	1.3E+05	Perfluorobutane Sulfonate	375-73-5					2.3E+04			2.3E+04
2.2E-03	C	6.3E-07	C	5.0E-02	I				1	0.1		1.4E+09		Permethrin	52645-53-1	1.5E+03	3.5E+03	2.6E+07	1.0E+03	5.8E+04	1.4E+05		4.1E+04
				2.5E-01	I				1	0.1		1.4E+09		Phenacetin	62-44-2					2.9E+05	6.9E+05		2.1E+05
									1	0.1		1.4E+09		Phenmedipham	13684-63-4								
				3.0E-01	I	2.0E-01	C		1	0.1		1.4E+09		Phenol	108-95-2					3.5E+05	8.3E+05	1.2E+09	2.5E+05
				5.0E-04	X				1	0.1		1.4E+09		Phenothiazine	92-84-2					5.8E+02	1.4E+03		4.1E+02
				6.0E-03	I				1	0.1		1.4E+09		Phenylenediamine, m-	108-45-2					7.0E+03	1.7E+04		4.9E+03
4.7E-02	H								1	0.1		1.4E+09		Phenylenediamine, o-	95-54-5	7.0E+01	1.6E+02		4.9E+01				
				1.9E-01	H				1	0.1		1.4E+09		Phenylenediamine, p-	106-50-3					2.2E+05	5.2E+05		1.6E+05
1.9E-03	H								1	0.1		1.4E+09		Phenylphenol, 2-	90-43-7	1.7E+03	4.0E+03		1.2E+03				
				2.0E-04	H				1	0.1		1.4E+09		Phorate	298-02-2					2.3E+02	5.5E+02		1.6E+02
						3.0E-04	I	V	1		1.6E+03	1.4E+09	9.8E+02	Phosgene	75-44-5							1.3E+00	1.3E+00
				2.0E-02	I				1	0.1		1.4E+09		Phosmet	732-11-6					2.3E+04	5.5E+04		1.6E+04
														Phosphates, Inorganic									
				4.9E+01	P				1			1.4E+09		~Aluminum metaphosphate	13776-88-0					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Ammonium polyphosphate	68333-79-9					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Calcium pyrophosphate	7790-76-3					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Diammonium phosphate	7783-28-0					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Dicalcium phosphate	7757-93-9					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Dimagnesium phosphate	7782-75-4					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Dipotassium phosphate	7758-11-4					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Disodium phosphate	7558-79-4					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Monoaluminum phosphate	13530-50-2					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Monoammonium phosphate	7722-76-1					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Monocalcium phosphate	7758-23-8					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Monomagnesium phosphate	7757-86-0					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Monopotassium phosphate	7778-77-0					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Monosodium phosphate	7558-80-7					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Polyphosphoric acid	8017-16-1					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Potassium triphosphate	13845-36-8					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium acid pyrophosphate	7758-16-9					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium aluminum phosphate (acidic)	7785-88-8					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium aluminum phosphate (anhydrous)	10279-59-1					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium aluminum phosphate (tetrahydrate)	10305-76-7					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium hexametaphosphate	10124-56-8					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium polyphosphate	68915-31-1					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium trimetaphosphate	7785-84-4					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Sodium triphosphate	7758-29-4					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Tetrapotassium phosphate	7320-34-5					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Tetrasodium pyrophosphate	7722-88-5					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Tricalcium phosphate	7758-87-4					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Trimagnesium phosphate	7757-87-1					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Tripotassium phosphate	7778-53-2					5.7E+07			5.7E+07
				4.9E+01	P				1			1.4E+09		~Trisodium phosphate	7601-54-9					5.7E+07			5.7E+07
				3.0E-04	I	3.0E-04	I	V	1			1.4E+09		Phosphine	7803-51-2					3.5E+02		1.8E+06	3.5E+02
				4.9E+01	P	1.0E-02	I		1			1.4E+09		Phosphoric Acid	7664-38-2					5.7E+07		6.0E+07	2.9E+07
				2.0E-05	I		V		1			1.4E+09	6.9E+03	Phosphorus, White	7723-14-0					2.3E+01			2.3E+01
														Phthalates									

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																										
Toxicity and Chemical-specific Information													Contaminant			Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1						
SFO (mg/kg-day) ⁻¹	k _e (y)	IUR (ug/m ³) ⁻¹	k _e (y)	RTD _o (mg/kg-day)	k _e (y)	RfC _i (mg/m ³)	k _e (y)	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)			
1.4E-02	I	2.4E-06	C	2.0E-02	I				1	0.1	1.4E+09			~Bis(2-ethylhexyl)phthalate	117-81-7	2.3E+02	5.5E+02	6.9E+06	1.6E+02	2.3E+04	5.5E+04		1.6E+04			
				1.0E+00	I				1	0.1	1.4E+09			~Butylphthalyl Butylglycolate	85-70-1					1.2E+06	2.8E+06		8.2E+05			
				1.0E-01	I				1	0.1	1.4E+09			~Dibutyl Phthalate	84-74-2					1.2E+05	2.8E+05		8.2E+04			
				8.0E-01	I				1	0.1	1.4E+09			~Diethyl Phthalate	84-66-2					9.3E+05	2.2E+06		6.6E+05			
				1.0E-01	I			V	1		1.4E+09	2.1E+04		~Dimethylterephthalate	120-61-6					1.2E+05			1.2E+05			
				1.0E-02	P				1	0.1	1.4E+09			~Octyl Phthalate, di-N-	117-84-0					1.2E+04	2.8E+04		8.2E+03			
				1.0E+00	H				1	0.1	1.4E+09			~Phthalic Acid, P-	100-21-0					1.2E+06	2.8E+06		8.2E+05			
				2.0E+00	I	2.0E-02	C		1	0.1	1.4E+09			~Phthalic Anhydride	85-44-9					2.3E+06	5.5E+06	1.2E+08	1.6E+06			
				7.0E-02	I				1	0.1	1.4E+09			Picloram	1918-02-1					8.2E+04	1.9E+05		5.7E+04			
				1.0E-04	X				1	0.1	1.4E+09			Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3					1.2E+02	2.8E+02		8.2E+01			
				9.0E-04	X				1	0.1	1.4E+09			Picric Acid (2,4,6-Trinitrophenol)	88-89-1					1.1E+03	2.5E+03		7.4E+02			
				1.0E-02	I				1	0.1	1.4E+09			Pirimiphos, Methyl	29232-93-7					1.2E+04	2.8E+04		8.2E+03			
3.0E+01	C	8.6E-03	C	7.0E-06	H				1	0.1	1.4E+09			Polybrominated Biphenyls	59536-65-1	1.1E-01	2.6E-01	1.9E+03	7.7E-02	8.2E+00	1.9E+01		5.7E+00			
														Polychlorinated Biphenyls (PCBs)												
7.0E-02	S	2.0E-05	S	7.0E-05	I			V	1	0.14	1.4E+09	7.1E+05		~Aroclor 1016	12674-11-2	4.7E+01	7.9E+01	4.4E+02	2.7E+01	8.2E+01	1.4E+02		5.1E+01			
2.0E+00	S	5.7E-04	S					V	1	0.14	1.4E+09	2.0E+05		~Aroclor 1221	11104-28-2	1.6E+00	2.8E+00	4.4E+00	8.3E-01							
2.0E+00	S	5.7E-04	S					V	1	0.14	1.4E+09	1.1E+05		~Aroclor 1232	11141-16-5	1.6E+00	2.8E+00	2.4E+00	7.2E-01							
2.0E+00	S	5.7E-04	S					V	1	0.14	1.4E+09	5.9E+05		~Aroclor 1242	53469-21-9	1.6E+00	2.8E+00	1.3E+01	9.5E-01							
2.0E+00	S	5.7E-04	S					V	1	0.14	1.4E+09	6.3E+05		~Aroclor 1248	12672-29-6	1.6E+00	2.8E+00	1.3E+01	9.5E-01							
2.0E+00	S	5.7E-04	S	2.0E-05	I			V	1	0.14	1.4E+09	8.4E+05		~Aroclor 1254	11097-69-1	1.6E+00	2.8E+00	1.8E+01	9.7E-01	2.3E+01	3.9E+01		1.5E+01			
2.0E+00	S	5.7E-04	S					V	1	0.14	1.4E+09	1.3E+06		~Aroclor 1260	11096-82-5	1.6E+00	2.8E+00	2.8E+01	9.9E-01							
				6.0E-04	X			V	1	0.14	1.4E+09	9.6E+05		~Aroclor 5460	11126-42-4					7.0E+02	1.2E+03		4.4E+02			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	3.3E+06		*Heptachlorobiphenyl, 2,3,3',4,4',5,5'-(PCB 189)	39635-31-9	8.4E-01	1.4E+00	3.6E+01	5.2E-01	2.7E+01	4.6E+01	1.9E+04	1.7E+01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	2.2E+06		*Hexachlorobiphenyl, 2,3',4,4',5,5'-(PCB 167)	52663-72-6	8.4E-01	1.4E+00	2.4E+01	5.2E-01	2.7E+01	4.6E+01	1.3E+04	1.7E+01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	1.5E+06		*Hexachlorobiphenyl, 2,3,3',4,4',5'-(PCB 157)	69782-90-7	8.4E-01	1.4E+00	1.6E+01	5.1E-01	2.7E+01	4.6E+01	8.5E+03	1.7E+01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	1.5E+06		*Hexachlorobiphenyl, 2,3,3',4,4',5'-(PCB 156)	38380-08-4	8.4E-01	1.4E+00	1.7E+01	5.1E-01	2.7E+01	4.6E+01	9.0E+03	1.7E+01			
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V	1	0.14	1.4E+09	2.2E+06		*Hexachlorobiphenyl, 5,3',4,4',5,5'-(PCB 169)	32774-16-6	8.4E-04	1.4E-03	2.4E-02	5.2E-04	2.7E-02	4.6E-02	1.3E+01	1.7E-02			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	1.0E+06		*Pentachlorobiphenyl, 2,3,3',4,4',5'-(PCB 123)	65510-44-3	8.4E-01	1.4E+00	1.1E+01	5.0E-01	2.7E+01	4.6E+01	6.0E+03	1.7E+01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	8.3E+05		*Pentachlorobiphenyl, 2,3',4,4',5'-(PCB 118)	31508-00-6	8.4E-01	1.4E+00	8.9E+00	5.0E-01	2.7E+01	4.6E+01	4.8E+03	1.7E+01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	8.5E+05		*Pentachlorobiphenyl, 2,3,3',4,4'-(PCB 105)	32598-14-4	8.4E-01	1.4E+00	9.1E+00	5.0E-01	2.7E+01	4.6E+01	4.9E+03	1.7E+01			
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V	1	0.14	1.4E+09	1.5E+06		*Pentachlorobiphenyl, 2,3,4,4',5'-(PCB 114)	74472-37-0	8.4E-01	1.4E+00	1.6E+01	5.1E-01	2.7E+01	4.6E+01	8.6E+03	1.7E+01			
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V	1	0.14	1.4E+09	1.0E+06		*Pentachlorobiphenyl, 3,3',4,4',5'-(PCB 126)	57465-28-8	2.5E-04	4.2E-04	3.3E-03	1.5E-04	8.2E-03	1.4E-02	1.8E+00	5.1E-03			
2.0E+00	I	5.7E-04	I					V	1	0.14	1.4E+09	5.3E+05		*Polychlorinated Biphenyls (high risk)	1336-36-3	1.6E+00	2.8E+00	1.1E+01	9.4E-01							
4.0E-01	I	1.0E-04	I					V	1	0.14				*Polychlorinated Biphenyls (low risk)	1336-36-3											
7.0E-02	I	2.0E-05	I					V	1	0.14				*Polychlorinated Biphenyls (lowest risk)	1336-36-3											
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E	V	1	0.14	1.4E+09			*Tetrachlorobiphenyl, 3,3',4,4'-(PCB 77)	32598-13-3	2.5E-01	4.2E-01	4.4E+03	1.6E-01	8.2E+00	1.4E+01	2.4E+06	5.1E+00			
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V	1	0.14	1.4E+09	7.3E+05		*Tetrachlorobiphenyl, 3,4,4',5'-(PCB 81)	70362-50-4	8.4E-02	1.4E-01	7.8E-01	4.9E-02	2.7E+00	4.6E+00	4.2E+02	1.7E+00			
				6.0E-04	I			V	1	0.1	1.4E+09			Polymeric Methylene Diphenyl Disocyanate (PMDI)	9016-87-9							3.6E+06	3.6E+06			
														Polynuclear Aromatic Hydrocarbons (PAHs)												
				6.0E-02	I			V	1	0.13	1.4E+09	1.4E+05		*Acenaphthene	83-32-9					7.0E+04	1.3E+05		4.5E+04			
7.3E-01	E	1.1E-04	C	3.0E-01	I			V	1	0.13	1.4E+09	5.2E+05		*Anthracene	120-12-7					3.5E+05	6.4E+05		2.3E+05			
								V	M	1	0.13	1.4E+09	4.4E+06	*Benz[a]anthracene	56-55-3	4.5E+00	8.1E+00	4.9E+02	2.9E+00							
1.2E+00	C	1.1E-04	C						1	0.13	1.4E+09			*Benzo[<i>j</i>]fluoranthene	205-82-3	2.7E+00	5.0E+00	1.5E+05	1.8E+00							
7.3E+00	I	1.1E-03	C						M	1	0.13	1.4E+09		*Benzo[<i>a</i>]pyrene	50-32-8	4.5E-01	8.1E-01	1.5E+04	2.9E-01							
7.3E-01	E	1.1E-04	C						M	1	0.13	1.4E+09		*Benzo[<i>b</i>]fluoranthene	205-99-2	4.5E+00	8.1E+00	1.5E+05	2.9E+00							
7.3E-02	E	1.1E-04	C						M	1	0.13	1.4E+09		*Benzo[<i>k</i>]fluoranthene	207-08-9	4.5E+01	8.1E+01	1.5E+05	2.9E+01							
7.3E-03	E	1.1E-05	C	8.0E-02	I			V	1	0.13	1.4E+09	8.0E+04		*Chloronaphthalene, Beta-</												

Regional Screening Level (RSL) Composite Worker Soil Table (TR=1E-06, HQ=1) November 2015

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1				
SFO (mg/kg-day) ¹	k _e y	IUR (ug/m ³) ^{1,2}	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³) ³	k _e y	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)	
		4.0E-03	I						1	0.1		1.4E+09		Propanediol, 1,2-	114-26-1					4.7E+03	1.1E+04		3.3E+03	
		5.0E-03	I						1	0.1		1.4E+09		Propanil	709-98-8					5.8E+03	1.4E+04		4.1E+03	
		2.0E-02	I						1	0.1		1.4E+09		Propargite	2312-35-8					2.3E+04	5.5E+04		1.6E+04	
		2.0E-03	I					V	1		1.1E+05	1.4E+09	6.3E+04	Propargyl Alcohol	107-19-7					2.3E+03			2.3E+03	
		2.0E-02	I						1	0.1		1.4E+09		Propazine	139-40-2					2.3E+04	5.5E+04		1.6E+04	
		2.0E-02	I						1	0.1		1.4E+09		Propham	122-42-9					2.3E+04	5.5E+04		1.6E+04	
		1.3E-02	I						1	0.1		1.4E+09		Propiconazole	60207-90-1					1.5E+04	3.6E+04		1.1E+04	
						8.0E-03	I	V	1		3.3E+04	1.4E+09	8.9E+03	Propionaldehyde	123-38-6							3.1E+02	3.1E+02	
		1.0E-01	X	1.0E+00	X	V			1		2.6E+02	1.4E+09	7.0E+03	Propyl benzene	103-65-1					1.2E+05		3.1E+04	2.4E+04	
						3.0E+00	C	V	1		3.5E+02	1.4E+09	7.0E+02	Propylene	115-07-1							9.3E+03	9.3E+03	
		2.0E+01	P						1	0.1		1.4E+09		Propylene Glycol	57-55-6					2.3E+07	5.5E+07		1.6E+07	
						2.7E-04	A		1	0.1		1.4E+09		Propylene Glycol Dinitrate	6423-43-4							1.6E+06	1.6E+06	
		7.0E-01	H	2.0E+00	I	V			1		1.1E+05	1.4E+09	7.8E+04	Propylene Glycol Monomethyl Ether	107-98-2					8.2E+05		6.9E+05	3.7E+05	
2.4E-01	I	3.7E-06	I			3.0E-02	I	V	1		7.8E+04	1.4E+09	1.0E+04	Propylene Oxide	75-56-9	1.4E+01		3.4E+01	9.7E+00			1.4E+03	1.4E+03	
		7.5E-02	I						1	0.1		1.4E+09		Propyzamide	23950-58-5					8.8E+04	2.1E+05		6.2E+04	
		1.0E-03	I					V	1		5.3E+05	1.4E+09	5.5E+04	Pyridine	110-86-1					1.2E+03			1.2E+03	
		5.0E-04	I						1	0.1		1.4E+09		Quinalphos	13593-03-8					5.8E+02	1.4E+03		4.1E+02	
3.0E+00	I								1	0.1		1.4E+09		Quinoline	91-22-5	1.1E+00	2.6E+00		7.7E-01					
		9.0E-03	I						1	0.1		1.4E+09		Quizalofop-ethyl	76578-14-8					1.1E+04	2.5E+04		7.4E+03	
						3.0E-02	A		1		1.4E+09			Refractory Ceramic Fibers	NA							1.8E+08	1.8E+08	
		3.0E-02	I						1	0.1		1.4E+09		Resmethrin	10453-86-8					3.5E+04	8.3E+04		2.5E+04	
		5.0E-02	H					V	1		1.4E+09	4.7E+05		Ronnel	299-84-3					5.8E+04			5.8E+04	
2.2E-01	C	6.3E-05	C						1	0.1		1.4E+09		Rotenone	83-79-4	1.5E+01	3.5E+01	2.6E+05	1.0E+01	4.7E+03	1.1E+04		3.3E+03	
		5.0E-03	I						1		1.4E+09			Safrole	94-59-7					5.8E+03			5.8E+03	
						2.0E-02	C		1		1.4E+09			Selenium	7782-49-2					5.8E+03		1.2E+08	5.8E+03	
		5.0E-03	C	2.0E-02	C				1		1.4E+09			Selenium Sulfide	7446-34-6					5.8E+03		1.2E+08	5.8E+03	
		9.0E-02	I						1	0.1		1.4E+09		Sethoxydim	74051-80-2					1.1E+05	2.5E+05		7.4E+04	
						3.0E-03	C		1		1.4E+09			Silica (crystalline, respirable)	7631-86-9							1.8E+07	1.8E+07	
1.2E-01	H			5.0E-03	I				0.04		1.4E+09			Silver	7440-22-4					5.8E+03			5.8E+03	
		5.0E-03	I						1	0.1		1.4E+09		Simazine	122-34-9	2.7E+01	6.4E+01		1.9E+01	5.8E+03	1.4E+04		4.1E+03	
		1.3E-02	I						1	0.1		1.4E+09		Sodium Acifluorfen	62476-59-9					1.5E+04	3.6E+04		1.1E+04	
5.0E-01	C	1.5E-01	C	4.0E-03	I				1		1.4E+09			Sodium Azide	26628-22-8					4.7E+03			4.7E+03	
		2.0E-02	C	2.0E-04	C			M	0.025		1.4E+09			Sodium Dichromate	10588-01-9	6.5E+00		1.1E+02	6.2E+00	2.3E+04		1.2E+06	2.3E+04	
2.7E-01	H			3.0E-02	I				1	0.1		1.4E+09		Sodium Diethyldithiocarbamate	148-18-5	1.2E+01	2.9E+01		8.5E+00	3.5E+04	8.3E+04		2.5E+04	
		5.0E-02	A	1.3E-02	C				1		1.4E+09			Sodium Fluoride	7681-49-4					5.8E+04		7.7E+07	5.8E+04	
		2.0E-05	I						1	0.1		1.4E+09		Sodium Fluoroacetate	62-74-8					2.3E+01	5.5E+01		1.6E+01	
		1.0E-03	H						1		1.4E+09			Sodium Metavanadate	18718-26-8					1.2E+03			1.2E+03	
		8.0E-04	P						1		1.4E+09			Sodium Tungstate	13472-45-2					9.3E+02			9.3E+02	
		8.0E-04	P						1		1.4E+09			Sodium Tungstate Dihydrate	10213-10-2					9.3E+02			9.3E+02	
2.4E-02	H			3.0E-02	I				1	0.1		1.4E+09		Stirofos (Tetrachlorovinphos)	961-11-5	1.4E+02	3.2E+02		9.6E+01	3.5E+04	8.3E+04		2.5E+04	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025		1.4E+09		Strontium Chromate	7789-06-2	6.5E+00		1.1E+02	6.2E+00	2.3E+04		1.2E+06	2.3E+04	
		6.0E-01	I						1		1.4E+09			Strontium, Stable	7440-24-6					7.0E+05			7.0E+05	
		3.0E-04	I						1	0.1		1.4E+09		Strychnine	57-24-9					3.5E+02	8.3E+02		2.5E+02	
		2.0E-01	I	1.0E+00	I	V			1		8.7E+02	1.4E+09	9.4E+03	Styrene	100-42-5					2.3E+05		4.1E+04	3.5E+04	
		3.0E-03	P						1	0.1		1.4E+09		Styrene-Acrylonitrile (SAN) Trimer	NA					3.5E+03	8.3E+03		2.5E+03	
		1.0E-03	P	2.0E-03	X				1	0.1		1.4E+09		Sulfolane	126-33-0					1.2E+03	2.8E+03	1.2E+07	8.2E+02	
		8.0E-04	P						1	0.1		1.4E+09		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					9.3E+02	2.2E+03		6.6E+02	
						1.0E-03	C	V	1		1.4E+09			Sulfur Trioxide	7446-11-9							6.0E+06	6.0E+06	
2.5E-02	I	7.1E-06	I	5.0E-02	H				1	0.1		1.4E+09		Sulfuric Acid	7664-93-9	1.3E+02	3.1E+02	2.3E+06	9.2E+01	5.8E+04	1.4E+05		4.1E+04	
		3.0E-02	H						1	0.1		1.4E+09		Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8					3.5E+04	8.3E+04		2.5E+04	
									1	0.1		1.4E+09		TCMTB	21564-17-0									
		7.0E-02	I						1	0.1		1.4E+09		Tebuthiuron	34014-18-1					8.2E+04	1.9E+05		5.7E+04	
		2.0E-02	H						1	0.1		1.4E+09		Temphos	3383-96-8					2.3E+04	5.5E+04		1.6E+04	
		1.3E-02	I						1	0.1		1.4E+09		Terbacil	5902-51-2					1.5E+04	3.6E+04		1.1E+04	
		2.5E-05	H					V	1		3.1E+01	1.4E+09	2.6E+05	Terbufos	13071-79-9					2.9E+01			2.9E+01	
		1.0E-03	I						1	0.1		1.4E+09		Terbutryn	886-50-0					1.2E+03	2.8E+03		8.2E+02	
		1.0E-04	I						1	0.1		1.4E+09		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1					1.2E+02	2.8E+02			

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; n = noncancer; * = where n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)																								
Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e (ug/m ³) ⁻¹	IUR (ug/m ³) ⁻¹	k _e (ug/m ³) ⁻¹	RTD _o (mg/kg-day)	k _e (ug/m ³) ⁻¹	RfC _i (mg/m ³) ⁻¹	k _e (ug/m ³) ⁻¹	muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)	
				2.0E-03	P	8.0E+01	I	V	1	0.0007	2.1E+03	1.4E+09	1.2E+03	Tetrafluoroethane, 1,1,1,2-Tetryl (Trinitrophenylmethylnitramine)	811-97-2 479-45-8					2.3E+03	8.5E+05	4.3E+05	4.3E+05	
				7.0E-06	X				1			1.4E+09		Thallium (I) Nitrate	10102-45-1					8.2E+00			8.2E+00	
				1.0E-05	X				1			1.4E+09		Thallium (Soluble Salts)	7440-28-0					1.2E+01			1.2E+01	
				6.0E-06	X			V	1			1.4E+09		Thallium Acetate	563-68-8					7.0E+00			7.0E+00	
				2.0E-05	X			V	1			1.4E+09		Thallium Carbonate	6533-73-9					2.3E+01			2.3E+01	
				6.0E-06	X				1			1.4E+09		Thallium Chloride	7791-12-0					7.0E+00			7.0E+00	
				2.0E-05	X				1			1.4E+09		Thallium Sulfate	7446-18-6					2.3E+01			2.3E+01	
				1.3E-02	I				1	0.1		1.4E+09		Thiophensulfuron-methyl	79277-27-3					1.5E+04	3.6E+04		1.1E+04	
				1.0E-02	I				1	0.1		1.4E+09		Thiobencarb	28249-77-6					1.2E+04	2.8E+04		8.2E+03	
				7.0E-02	X				1	0.0075		1.4E+09		Thiodiglycol	111-48-8					8.2E+04	2.6E+06		7.9E+04	
				3.0E-04	H				1	0.1		1.4E+09		Thiofanox	39196-18-4					3.5E+02	8.3E+02		2.5E+02	
				8.0E-02	I				1	0.1		1.4E+09		Thiophanate, Methyl	23564-05-8					9.3E+04	2.2E+05		6.6E+04	
				5.0E-03	I				1	0.1		1.4E+09		Thiram	137-26-8					5.8E+03	1.4E+04		4.1E+03	
				6.0E-01	H				1			1.4E+09		Tin	7440-31-5					7.0E+05			7.0E+05	
						1.0E-04	A	V	1			1.4E+09		Titanium Tetrachloride	7550-45-0							6.0E+05	6.0E+05	
				8.0E-02	I	5.0E+00	I	V	1		8.2E+02	1.4E+09	4.3E+03	Toluene	108-88-3					9.3E+04		9.4E+04	4.7E+04	
1.8E-01	X			2.0E-04	X				1	0.1		1.4E+09		Toluene-2,5-diamine	95-70-5	1.8E+01	4.3E+01		1.3E+01	2.3E+02	5.5E+02		1.6E+02	
3.0E-02	P			4.0E-03	X				1	0.1		1.4E+09		Toluidine, p-	106-49-0	1.1E+02	2.6E+02		7.7E+01	4.7E+03	1.1E+04		3.3E+03	
				3.0E+00	P			V	1		3.4E-01	1.4E+09	1.1E+03	Total Petroleum Hydrocarbons (Aliphatic High)	NA					3.5E+06			3.5E+06	
						6.0E-01	P	V	1		1.4E+02	1.4E+09	8.3E+02	Total Petroleum Hydrocarbons (Aliphatic Low)	NA							2.2E+03	2.2E+03	
				1.0E-02	X	1.0E-01	P	V	1		6.9E+00	1.4E+09	1.0E+03	Total Petroleum Hydrocarbons (Aliphatic Medium)	NA					1.2E+04		4.6E+02	4.4E+02	
				4.0E-02	P				1	0.1		1.4E+09		Total Petroleum Hydrocarbons (Aromatic High)	NA					4.7E+04	1.1E+05		3.3E+04	
				4.0E-03	P	3.0E-02	P	V	1		1.8E+03	1.4E+09	3.5E+03	Total Petroleum Hydrocarbons (Aromatic Low)	NA					4.7E+03		4.6E+02	4.2E+02	
				4.0E-03	P	3.0E-03	P	V	1		1.4E+09	5.2E+04		Total Petroleum Hydrocarbons (Aromatic Medium)	NA					4.7E+03		6.9E+02	6.0E+02	
1.1E+00	I	3.2E-04	I						1	0.1		1.4E+09		Toxaphene	8001-35-2	3.0E+00	7.0E+00	5.2E+04	2.1E+00					
				7.5E-03	I				1	0.1		1.4E+09		Tralometrin	66841-25-6					8.8E+03	2.1E+04		6.2E+03	
				3.0E-04	A			V	1		1.4E+09	3.4E+03		Tri-n-butyltin	688-73-3					3.5E+02			3.5E+02	
				8.0E+01	X				1	0.1		1.4E+09		Triacetin	102-76-1					9.3E+07	2.2E+08		6.6E+07	
				3.0E-02	I				1	0.1		1.4E+09		Triadimefon	43121-43-3					3.5E+04	8.3E+04		2.5E+04	
				1.3E-02	I			V	1		1.4E+09	3.6E+05		Triallate	2303-17-5					1.5E+04			1.5E+04	
				1.0E-02	I				1	0.1		1.4E+09		Triasulfuron	82097-50-5					1.2E+04	2.8E+04		8.2E+03	
				8.0E-03	I				1	0.1		1.4E+09		Tribenuron-methyl	101200-48-0					9.3E+03	2.2E+04		6.6E+03	
				5.0E-03	I			V	1		1.4E+09	4.8E+04		Tribromobenzene, 1,2,4-	615-54-3					5.8E+03			5.8E+03	
9.0E-03	P			1.0E-02	P				1	0.1		1.4E+09		Tributyl Phosphate	126-73-8	3.6E+02	8.6E+02		2.6E+02	1.2E+04	2.8E+04		8.2E+03	
				3.0E-04	P				1	0.1		1.4E+09		Tributyltin Compounds	NA					3.5E+02	8.3E+02		2.5E+02	
				3.0E-04	I				1	0.1		1.4E+09		Tributyltin Oxide	56-35-9					3.5E+02	8.3E+02		2.5E+02	
				3.0E+01	I	3.0E+01	H	V	1		9.1E+02	1.4E+09	1.3E+03	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-18-1					3.5E+07		1.7E+05	1.7E+05	
7.0E-02	I			2.0E-02	I				1	0.1		1.4E+09		Trichloroacetic Acid	76-03-9	4.7E+01	1.1E+02		3.3E+01	2.3E+04	5.5E+04		1.6E+04	
2.9E-02	H								1	0.1		1.4E+09		Trichloroaniline HCl, 2,4,6-	33663-50-2	1.1E+02	2.7E+02		7.9E+01					
7.0E-03	X			3.0E-05	X				1	0.1		1.4E+09		Trichloroaniline, 2,4,6-	634-93-5	4.7E+02	1.1E+03		3.3E+02	3.5E+01	8.3E+01		2.5E+01	
				8.0E-04	X			V	1		1.4E+09	3.2E+04		Trichlorobenzene, 1,2,3-	87-61-6					9.3E+02			9.3E+02	
2.9E-02	P			1.0E-02	I	2.0E-03	P	V	1		4.0E+02	1.4E+09	3.0E+04	Trichlorobenzene, 1,2,4-	120-82-1	1.1E+02		1.1E+02		1.2E+04		2.6E+02	2.6E+02	
				2.0E+00	I	5.0E+00	I	V	1		6.4E+02	1.4E+09	1.7E+03	Trichloroethane, 1,1,1-	71-55-6					2.3E+06		3.6E+04	3.6E+04	
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V	1		2.2E+03	1.4E+09	7.2E+03	Trichloroethane, 1,1,2	79-00-5	5.7E+02		5.5E+00	5.0E+00	4.7E+03		6.3E+00	6.3E+00	
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1	6.9E+02	1.4E+09	2.2E+03	Trichloroethylene	79-01-6	7.1E+01		6.6E+00	6.0E+00	5.8E+02		1.9E+01	1.9E+01	
				3.0E-01	I			V	1		1.2E+03	1.4E+09	1.0E+03	Trichlorofluoromethane	75-69-4					3.5E+05			3.5E+05	
				1.0E-01	I				1	0.1		1.4E+09		Trichlorophenol, 2,4,5-	95-95-4					1.2E+05	2.8E+05		8.2E+04	
				1.0E-03	P				1	0.1		1.4E+09		Trichlorophenol, 2,4,6-	88-06-2	3.0E+02	7.0E+02	5.4E+06	2.1E+02	1.2E+03	2.8E+03		8.2E+02	
				1.0E-02	I				1	0.1		1.4E+09		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					1.2E+04	2.8E+04		8.2E+03	
				8.0E-03	I				1	0.1		1.4E+09		Trichlorophenoxypropionic acid, -2,4,5	93-72-1					9.3E+03	2.2E+04		6.6E+03	
				5.0E-03	I			V	1		1.3E+03	1.4E+09	1.5E+04	Trichloropropane, 1,1,2-	598-77-6					5.8E+03			5.8E+03	
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1	1.4E+03	1.4E+09	1.6E+04	Trichloropropane, 1,2,3-	96-18-4	1.1E-01			1.1E-01	4.7E+03		2.1E+01	2.1E+01	
				3.0E-03	X	3.0E-04	P	V	1		3.1E+02	1.4E+09	2.3E+03	Trichloropropene, 1,2,3-	96-19-5									

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Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Hazard Index (HI) = 1				
SFO (mg/kg-day) ⁻¹	k _e y	IUR (ug/m ³) ⁻¹	k _e y	RTD _o (mg/kg-day)	k _e y	RfC _i (mg/m ³)	k _e y	o muta- gen	GIABS	ABS	C _{sat} (mg/kg)	PEF (m ³ /kg)	VF (m ³ /kg)	Analyte	CAS No.	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL THQ=1 (mg/kg)	Dermal SL THQ=1 (mg/kg)	Inhalation SL THQ=1 (mg/kg)	Noncarcinogenic SL THI=1 (mg/kg)	
3.0E-02	I			3.0E-02	I				1	0.019	1.4E+09			Trinitrobenzene, 1,3,5-	99-35-4	1.1E+02	8.0E+02		9.6E+01	3.5E+04	4.4E+05		3.2E+04	
				5.0E-04	I				1	0.032	1.4E+09			Trinitrotoluene, 2,4,6-	118-96-7					5.8E+02	4.3E+03		5.1E+02	
				2.0E-02	P				1	0.1	1.4E+09			Triphenylphosphine Oxide	755-28-6					2.3E+04	5.5E+04		1.6E+04	
2.3E+00	C	6.6E-04	C	2.0E-02	A				1	0.1	1.4E+09			Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	1.4E+00		1.7E+01	1.3E+00	2.3E+04	5.5E+04		1.6E+04	
				1.0E-02	X				1	0.1	1.4E+09			Tris(1-chloro-2-propyl)phosphate	13674-84-5					1.2E+04	2.8E+04		8.2E+03	
									1		4.7E+02	1.4E+09	9.0E+05	Tris(2,3-dibromopropyl)phosphate	126-72-7									
2.0E-02	P			7.0E-03	P				1	0.1	1.4E+09			Tris(2-chloroethyl)phosphate	115-96-8	1.6E+02	3.9E+02		1.1E+02	8.2E+03	1.9E+04		5.7E+03	
3.2E-03	P			1.0E-01	P				1	0.1	1.4E+09			Tris(2-ethylhexyl)phosphate	78-42-3	1.0E+03	2.4E+03		7.2E+02	1.2E+05	2.8E+05		8.2E+04	
				8.0E-04	P				1		1.4E+09			Tungsten	7440-33-7					9.3E+02			9.3E+02	
1.0E+00	C	2.9E-04	C	3.0E-03	I	4.0E-05	A		1		1.4E+09			Uranium (Soluble Salts)	NA	3.3E+00	7.7E+00	5.7E+04	2.3E+00	3.5E+03		2.4E+05	3.5E+03	
		8.3E-03	P	9.0E-03	I	7.0E-06	P	M	0.026		1.4E+09			Urethane	51-79-6					1.1E+04		4.2E+04	8.4E+03	
											1.4E+09			Vanadium Pentoxide	1314-62-1			2.0E+03	2.0E+03					
				5.0E-03	S	1.0E-04	A		0.026		1.4E+09			Vanadium and Compounds	7440-62-2					5.9E+03		6.0E+05	5.8E+03	
				1.0E-03	I		V		1		1.4E+09	1.2E+05		Vernolate	1929-77-7					1.2E+03			1.2E+03	
				2.5E-02	I				1	0.1	1.4E+09			Vindozolin	50471-44-8					2.9E+04	6.9E+04		2.1E+04	
				1.0E+00	H	2.0E-01	I	V	1		2.8E+03	1.4E+09	4.4E+03	Vinyl Acetate	108-05-4					1.2E+06		3.9E+03	3.8E+03	
		3.2E-05	H			3.0E-03	I	V	1		2.5E+03	1.4E+09	1.4E+03	Vinyl Bromide	593-60-2			5.2E-01	5.2E-01		1.8E+01		1.8E+01	
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1	3.9E+03	1.4E+09	9.6E+02	Vinyl Chloride	75-01-4	4.5E+00		2.7E+00	1.7E+00	3.5E+03		4.2E+02	3.7E+02	
				3.0E-04	I				1	0.1	1.4E+09			Warfarin	81-81-2					3.5E+02	8.3E+02		2.5E+02	
				2.0E-01	S	1.0E-01	S	V	1		3.9E+02	1.4E+09	5.6E+03	Xylene, P-	106-42-3					2.3E+05		2.4E+03	2.4E+03	
				2.0E-01	S	1.0E-01	S	V	1		3.9E+02	1.4E+09	5.5E+03	Xylene, m-	108-38-3					2.3E+05		2.4E+03	2.4E+03	
				2.0E-01	S	1.0E-01	S	V	1		4.3E+02	1.4E+09	6.5E+03	Xylene, o-	95-47-6					2.3E+05		2.8E+03	2.8E+03	
				2.0E-01	I	1.0E-01	I	V	1		2.6E+02	1.4E+09	5.7E+03	Xylenes	1330-20-7					2.3E+05		2.5E+03	2.5E+03	
				3.0E-04	I				1		1.4E+09			Zinc Phosphide	1314-84-7					3.5E+02			3.5E+02	
				3.0E-01	I				1		1.4E+09			Zinc and Compounds	7440-66-6					3.5E+05			3.5E+05	
				5.0E-02	I				1	0.1	1.4E+09			Zineb	12122-67-7					5.8E+04	1.4E+05		4.1E+04	
				8.0E-05	X				1		1.4E+09			Zirconium	7440-67-7					9.3E+01			9.3E+01	

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Toxicity and Chemical-specific						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	muta- gen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)
2.2E-06	I	9.0E-03	I	V		Acephate	30560-19-1		
						Acetaldehyde	75-07-0	5.6E+00	3.9E+01
						Acetochlor	34256-82-1		
		3.1E+01	A	V		Acetone	67-64-1		1.4E+05
		2.0E-03	X			Acetone Cyanohydrin	75-86-5		8.8E+00
		6.0E-02	I	V		Acetonitrile	75-05-8		2.6E+02
				V		Acetophenone	98-86-2		
1.3E-03	C					Acetylaminofluorene, 2-	53-96-3	9.4E-03	
		2.0E-05	I	V		Acrolein	107-02-8		8.8E-02
1.0E-04	I	6.0E-03	I		M	Acrylamide	79-06-1	1.2E-01	2.6E+01
		1.0E-03	I	V		Acrylic Acid	79-10-7		4.4E+00
6.8E-05	I	2.0E-03	I	V		Acrylonitrile	107-13-1	1.8E-01	8.8E+00
		6.0E-03	P			Adiponitrile	111-69-3		2.6E+01
						Alachlor	15972-60-8		
						Aldicarb	116-06-3		
						Aldicarb Sulfone	1646-88-4		
4.9E-03	I			V		Aldicarb sulfoxide	1646-87-3	2.5E-03	
						Aldrin	309-00-2		
		1.0E-04	X	V		Allyl Alcohol	107-18-6		4.4E-01
6.0E-06	C	1.0E-03	I	V		Allyl Chloride	107-05-1	2.0E+00	4.4E+00
		5.0E-03	P			Aluminum	7429-90-5		2.2E+01
						Aluminum Phosphide	20859-73-8		
6.0E-03	C					Ametryn	834-12-8		
						Aminobiphenyl, 4-	92-67-1	2.0E-03	
						Aminophenol, m-	591-27-5		
						Aminophenol, p-	123-30-8		
						Amitraz	33089-61-1		
		1.0E-01	I	V		Ammonia	7664-41-7		4.4E+02
		3.0E-03	X	V		Ammonium Sulfamate	7773-06-0		1.3E+01
						Amyl Alcohol, tert-	75-85-4		
1.6E-06	C	1.0E-03	I			Aniline	62-53-3	7.7E+00	4.4E+00
						Anthraquinone, 9,10-	84-65-1		
						Antimony (metallic)	7440-36-0		
						Antimony Pentoxide	1314-60-9		
		2.0E-04	I			Antimony Tetroxide	1332-81-6		8.8E-01
						Antimony Trioxide	1309-64-4		
4.3E-03	I	1.5E-05	C			Arsenic, Inorganic	7440-38-2	2.9E-03	6.6E-02
		5.0E-05	I			Arsine	7784-42-1		2.2E-01
						Asulam	3337-71-1		
						Atrazine	1912-24-9		
2.5E-04	C					Auramine	492-80-8	4.9E-02	
						Avermectin B1	65195-55-3		
		1.0E-02	A			Azinphos-methyl	86-50-0		4.4E+01
3.1E-05	I			V		Azobenzene	103-33-3	4.0E-01	
		7.0E-06	P			Azodicarbonamide	123-77-3		3.1E-02
		5.0E-04	H			Barium	7440-39-3		2.2E+00
1.5E-01	C	2.0E-04	C		M	Barium Chromate	10294-40-3	8.2E-05	8.8E-01
				V		Benfluralin	1861-40-1		
						Benomyl	17804-35-2		
						Bensulfuron-methyl	83055-99-6		
						Bentazon	25057-89-0		
				V		Benzaldehyde	100-52-7		
7.8E-06	I	3.0E-02	I	V		Benzene	71-43-2	1.6E+00	1.3E+02
						Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1		
				V		Benzenethiol	108-98-5		
6.7E-02	I				M	Benzidine	92-87-5	1.8E-04	
						Benzoic Acid	65-85-0		
				V		Benzotrithloride	98-07-7		
						Benzyl Alcohol	100-51-6		
4.9E-05	C	1.0E-03	P	V		Benzyl Chloride	100-44-7	2.5E-01	4.4E+00
2.4E-03	I	2.0E-05	I			Beryllium and compounds	7440-41-7	5.1E-03	8.8E-02
						Bifenox	42576-02-3		
						Biphenthrin	82657-04-3		
		4.0E-04	X	V		Biphenyl, 1,1'-	92-52-4		1.8E+00
				V		Bis(2-chloro-1-methylethyl) ether	108-60-1		
						Bis(2-chloroethoxy)methane	111-91-1		
3.3E-04	I			V		Bis(2-chloroethyl)ether	111-44-4	3.7E-02	
6.2E-02	I			V		Bis(chloromethyl)ether	542-88-1	2.0E-04	

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
					Bisphenol A	80-05-7			
		2.0E-02 H			Boron And Borates Only	7440-42-8		8.8E+01	
		2.0E-02 P V			Boron Trichloride	10294-34-5		8.8E+01	
		1.3E-02 C V			Boron Trifluoride	7637-07-2		5.7E+01	
6.0E-04 X				V	Bromate	15541-45-4	2.0E-02		
		6.0E-02 I V			Bromo-2-chloroethane, 1-	107-04-0		2.6E+02	
					Bromobenzene	108-86-1			
		4.0E-02 X V			Bromochloromethane	74-97-5		1.8E+02	
3.7E-05 C				V	Bromodichloromethane	75-27-4	3.3E-01		
1.1E-06 I				V	Bromoform	75-25-2	1.1E+01		
		5.0E-03 I V			Bromomethane	74-83-9		2.2E+01	
				V	Bromophos	2104-96-3			
					Bromoxynil	1689-84-5			
3.0E-05 I		2.0E-03 I V			Bromoxynil Octanoate	1689-99-2	4.1E-01	8.8E+00	
				V	Butadiene, 1,3-	106-99-0			
				V	Butanol, N-	71-36-3			
		3.0E+01 P V			Butyl Benzyl Phthalate	85-68-7		1.3E+05	
				V	Butyl alcohol, sec-	78-92-2			
					Butylate	2008-41-5			
5.7E-08 C					Butylated hydroxyanisole	25013-16-5	2.2E+02		
					Butylated hydroxytoluene	128-37-0			
				V	Butylbenzene, n-	104-51-8			
				V	Butylbenzene, sec-	135-98-8			
				V	Butylbenzene, tert-	98-06-6			
					Cacodylic Acid	75-60-5			
1.8E-03 I		1.0E-05 A			Cadmium (Diet)	7440-43-9			
1.8E-03 I		1.0E-05 A			Cadmium (Water)	7440-43-9	6.8E-03	4.4E-02	
1.5E-01 C		2.0E-04 C		M	Calcium Chromate	13765-19-0	8.2E-05	8.8E-01	
		2.2E-03 C			Caprolactam	105-60-2		9.6E+00	
4.3E-05 C					Captafol	2425-06-1	2.9E-01		
6.6E-07 C					Captan	133-06-2	1.9E+01		
					Carbaryl	63-25-2			
					Carbofuran	1563-66-2			
7.0E-01 I V					Carbon Disulfide	75-15-0		3.1E+03	
6.0E-06 I		1.0E-01 I V			Carbon Tetrachloride	56-23-5	2.0E+00	4.4E+02	
		1.0E-01 P V			Carbonyl Sulfide	463-58-1		4.4E+02	
					Carbosulfan	85285-14-8			
					Carboxin	5234-68-4			
9.0E-04 I					Ceric oxide	1306-38-3		3.9E+00	
				V	Chloral Hydrate	302-17-0			
					Chloramben	133-90-4			
1.0E-04 I		7.0E-04 I V			Chloranil	118-75-2	1.2E-01	3.1E+00	
					Chlordane	12789-03-6			
4.6E-03 C					Chlordecone (Kepone)	143-50-0	2.7E-03		
					Chlorfenvinphos	470-90-6			
					Chlorimuron, Ethyl-	90982-32-4			
1.5E-04 A V					Chlorine	7782-50-5		6.4E-01	
2.0E-04 I V					Chlorine Dioxide	10049-04-4		8.8E-01	
					Chlorite (Sodium Salt)	7758-19-2			
5.0E+01 I V					Chloro-1,1-difluoroethane, 1-	75-68-3		2.2E+05	
3.0E-04 I		2.0E-02 I V			Chloro-1,3-butadiene, 2-	126-99-8	4.1E-02	8.8E+01	
					Chloro-2-methylaniline HCl, 4-	3165-93-3			
7.7E-05 C					Chloro-2-methylaniline, 4-	95-69-2	1.6E-01		
				V	Chloroacetaldehyde, 2-	107-20-0			
					Chloroacetic Acid	79-11-8			
3.0E-05 I					Chloroacetophenone, 2-	532-27-4		1.3E-01	
					Chloroaniline, p-	106-47-8			
5.0E-02 P V					Chlorobenzene	108-90-7		2.2E+02	
3.1E-05 C					Chlorobenzilate	510-15-6	4.0E-01		
					Chlorobenzoic Acid, p-	74-11-3			
3.0E-01 P V					Chlorobenzotrifluoride, 4-	98-56-6		1.3E+03	
				V	Chlorobutane, 1-	109-69-3			
5.0E+01 I V					Chlorodifluoromethane	75-45-6		2.2E+05	
				V	Chloroethanol, 2-	107-07-3			
2.3E-05 I		9.8E-02 A V			Chloroform	67-66-3	5.3E-01	4.3E+02	
		9.0E-02 I V			Chloromethane	74-87-3		3.9E+02	
6.9E-04 C				V	Chloromethyl Methyl Ether	107-30-2	1.8E-02		
1.0E-05 X					Chloronitrobenzene, o-	88-73-3		4.4E-02	

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC, (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)
6.0E-04	P			V	Chloronitrobenzene, p- Chlorophenol, 2-	100-00-5 95-57-8		2.6E+00
8.9E-07	C	4.0E-04	C	V	Chloropicrin Chlorothalonil Chlorotoluene, o-	76-06-2 1897-45-6 95-49-8	1.4E+01	1.8E+00
6.9E-02	C			V	Chlorotoluene, p- Chlorozotocin Chlorpropham	106-43-4 54749-90-5 101-21-3	1.8E-04	
					Chlorpyrifos Chlorpyrifos Methyl Chlorsulfuron	2921-88-2 5598-13-0 64902-72-3		
					Chlorthal-dimethyl Chlorthiophos Chromium(III), Insoluble Salts	1861-32-1 60238-56-4 16065-83-1		
8.4E-02	S	1.0E-04	I	M	Chromium(VI) Chromium, Total Clofentazine	18540-29-9 7440-47-3 74115-24-5	1.5E-04	4.4E-01
9.0E-03	P	6.0E-06	P		Cobalt	7440-48-4	1.4E-03	2.6E-02
6.2E-04	I		V	M	Coke Oven Emissions Copper	8007-45-2 7440-50-8	2.0E-02	
6.0E-01	C				Cresol, m-	108-39-4		2.6E+03
6.0E-01	C				Cresol, o-	95-48-7		2.6E+03
6.0E-01	C				Cresol, p-	106-44-5		2.6E+03
6.0E-01	C			V	Cresol, p-chloro-m- Cresols Crotonaldehyde, trans-	59-50-7 1319-77-3 123-73-9		2.6E+03
6.3E-05	C	4.0E-01	I	V	Cumene Cupferron Cyanazine	98-82-8 135-20-6 21725-46-2	1.9E-01	1.8E+03
					Cyanides ~Calcium Cyanide ~Copper Cyanide	592-01-8 544-92-3		
8.0E-04	S		V		~Cyanide (CN-)	57-12-5		3.5E+00
			V		~Cyanogen	460-19-5		
			V		~Cyanogen Bromide	506-68-3		
8.0E-04	I		V		~Cyanogen Chloride ~Hydrogen Cyanide ~Potassium Cyanide	506-77-4 74-90-8 151-50-8		3.5E+00
					~Potassium Silver Cyanide ~Silver Cyanide ~Sodium Cyanide	506-61-6 506-64-9 143-83-9		
			V		~Thiocyanates ~Thiocyanic Acid ~Zinc Cyanide	NA 463-56-9 557-21-1		
6.0E+00	I		V		Cyclohexane Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro- Cyclohexanone	110-82-7 87-84-3 108-94-1		2.6E+04
7.0E-01	P		V					3.1E+03
1.0E+00	X		V		Cyclohexene Cyclohexylamine Cyfluthrin	110-83-8 108-91-8 68359-37-5		4.4E+03
					Cyhalothrin Cypermethrin Cyromazine	68085-85-8 52315-07-8 66215-27-8		
6.9E-05	C				DDD	72-54-8	1.8E-01	
9.7E-05	C		V		DDE, p,p'- DDT	72-55-9 50-29-3	1.3E-01 1.3E-01	
5.1E-06	C				Dalapon Daminozide Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	75-99-0 1596-84-5 1163-19-5	2.4E+00	
					Demeton Di(2-ethylhexyl)adipate Diallate	8065-48-3 103-23-1 2303-16-4		
6.0E-03	P	2.0E-04	I	V	Diazinon Dibenzothiophene Dibromo-3-chloropropane, 1,2-	333-41-5 132-65-0 96-12-8	2.0E-03	8.8E-01
			V		Dibromobenzene, 1,3- Dibromobenzene, 1,4- Dibromochloromethane	108-36-1 106-37-6 124-48-1		

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
6.0E-04	I	9.0E-03	I	V	Dibromoethane, 1,2-	106-93-4	2.0E-02	3.9E+01	
		4.0E-03	X	V	Dibromomethane (Methylene Bromide)	74-95-3		1.8E+01	
					Dibutyltin Compounds	NA			
4.2E-03	P			V	Dicamba	1918-00-9			
4.2E-03	P			V	Dichloro-2-butene, 1,4-	764-41-0	2.9E-03		
					Dichloro-2-butene, cis-1,4-	1476-11-5	2.9E-03		
4.2E-03	P			V	Dichloro-2-butene, trans-1,4-	110-57-6	2.9E-03		
		2.0E-01	H	V	Dichloroacetic Acid	79-43-6		8.8E+02	
					Dichlorobenzene, 1,2-	95-50-1			
1.1E-05	C	8.0E-01	I	V	Dichlorobenzene, 1,4-	106-46-7	1.1E+00	3.5E+03	
3.4E-04	C				Dichlorobenzidine, 3,3'-	91-94-1	3.6E-02		
					Dichlorobenzophenone, 4,4'-	90-98-2			
		1.0E-01	X	V	Dichlorodifluoromethane	75-71-8		4.4E+02	
1.6E-06	C			V	Dichloroethane, 1,1-	75-34-3	7.7E+00		
2.6E-05	I	7.0E-03	P	V	Dichloroethane, 1,2-	107-06-2	4.7E-01	3.1E+01	
		2.0E-01	I	V	Dichloroethylene, 1,1-	75-35-4		8.8E+02	
				V	Dichloroethylene, 1,2-cis-	156-59-2			
				V	Dichloroethylene, 1,2-trans-	156-60-5			
					Dichlorophenol, 2,4-	120-83-2			
					Dichlorophenoxy Acetic Acid, 2,4-	94-75-7			
					Dichlorophenoxybutyric Acid, 4-(2,4-	94-82-6			
1.0E-05	C	4.0E-03	I	V	Dichloropropane, 1,2-	78-87-5	1.2E+00	1.8E+01	
				V	Dichloropropane, 1,3-	142-28-9			
					Dichloropropanol, 2,3-	616-23-9			
4.0E-06	I	2.0E-02	I	V	Dichloropropene, 1,3-	542-75-6	3.1E+00	8.8E+01	
8.3E-05	C	5.0E-04	I		Dichlorvos	62-73-7	1.5E-01	2.2E+00	
					Dicrotophos	141-66-2			
		3.0E-04	X	V	Dicyclopentadiene	77-73-6		1.3E+00	
4.6E-03	I				Dieldrin	60-57-1	2.7E-03		
3.0E-04	C	5.0E-03	I		Diesel Engine Exhaust	NA	4.1E-02	2.2E+01	
		2.0E-04	P		Diethanolamine	111-42-2		8.8E-01	
		1.0E-04	P		Diethylene Glycol Monobutyl Ether	112-34-5		4.4E-01	
		3.0E-04	P		Diethylene Glycol Monoethyl Ether	111-90-0		1.3E+00	
				V	Diethylformamide	617-84-5			
1.0E-01	C				Diethylstilbestrol	56-53-1	1.2E-04		
					Difenzoquat	43222-48-6			
					Diflubenzuron	35367-38-5			
		4.0E+01	I	V	Difluoroethane, 1,1-	75-37-6		1.8E+05	
1.3E-05	C			V	Dihydrosafrole	94-58-6	9.4E-01		
		7.0E-01	P	V	Diisopropyl Ether	108-20-3		3.1E+03	
				V	Diisopropyl Methylphosphonate	1445-75-6			
					Dimethipin	55290-64-7			
					Dimethoate	60-51-5			
					Dimethoxybenzidine, 3,3'-	119-90-4			
					Dimethyl methylphosphonate	756-79-6			
1.3E-03	C				Dimethylamino azobenzene [p-]	60-11-7	9.4E-03		
					Dimethylaniline HCl, 2,4-	21436-96-4			
					Dimethylaniline, 2,4-	95-68-1			
				V	Dimethylaniline, N,N-	121-69-7			
					Dimethylbenzidine, 3,3'-	119-93-7			
		3.0E-02	I	V	Dimethylformamide	68-12-2		1.3E+02	
		2.0E-06	X	V	Dimethylhydrazine, 1,1-	57-14-7		8.8E-03	
1.6E-01	C			V	Dimethylhydrazine, 1,2-	540-73-8	7.7E-05		
					Dimethylphenol, 2,4-	105-67-9			
					Dimethylphenol, 2,6-	576-26-1			
1.3E-05	C			V	Dimethylphenol, 3,4-	95-65-8	9.4E-01		
					Dimethylvinylchloride	513-37-1			
					Dinitro-o-cresol, 4,6-	534-52-1			
					Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5			
					Dinitrobenzene, 1,2-	528-29-0			
					Dinitrobenzene, 1,3-	99-65-0			
					Dinitrobenzene, 1,4-	100-25-4			
					Dinitrophenol, 2,4-	51-28-5			
8.9E-05	C				Dinitrotoluene Mixture, 2,4/2,6-	NA	1.4E-01		
					Dinitrotoluene, 2,4-	121-14-2			
					Dinitrotoluene, 2,6-	606-20-2			
					Dinitrotoluene, 2-Amino-4,6-	35572-78-2			
					Dinitrotoluene, 4-Amino-2,6-	19406-51-0			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
					Dinitrotoluene, Technical grade	25321-14-6			
5.0E-06	I	3.0E-02	I	V	Dinoseb Dioxane, 1,4- Dioxins	88-85-7 123-91-1	2.5E+00	1.3E+02	
1.3E+00 3.8E+01	I C	4.0E-08	C	V	~Hexachlorodibenzo-p-dioxin, Mixture ~TCDD, 2,3,7,8- Diphenamid	NA 1746-01-6 957-51-7	9.4E-06 3.2E-07	1.8E-04	
2.2E-04	I				Diphenyl Sulfone Diphenylamine Diphenylhydrazine, 1,2-	127-63-9 122-39-4 122-66-7	5.6E-02		
1.4E-01 1.4E-01	C C				Diquat Direct Black 38 Direct Blue 6	85-00-7 1937-37-7 2602-46-2	8.8E-05 8.8E-05		
1.4E-01	C				Direct Brown 95 Disulfoton Dithiane, 1,4-	16071-86-6 298-04-4 505-29-3	8.8E-05		
				V	Diuron Dodine EPTC	330-54-1 2439-10-3 759-94-4			
				V	Endosulfan Endothall Endrin	115-29-7 145-73-3 72-20-8			
1.2E-06	I	1.0E-03 2.0E-02	I V	V	Epichlorohydrin Epoxybutane, 1,2 Ethanol, 2-(2-methoxyethoxy)-	106-89-8 106-88-7 111-77-3	1.0E+01	4.4E+00 8.8E+01	
					Ethephon Ethion Ethoxyethanol Acetate, 2-	16672-87-0 563-12-2 111-15-9		2.6E+02	
6.0E-02	P		V		Ethoxyethanol, 2- Ethyl Acetate Ethyl Acrylate	110-80-5 141-78-6 140-88-5		8.8E+02 3.1E+02 3.5E+01	
1.0E+01 3.0E-01	I V P		V	V	Ethyl Chloride (Chloroethane) Ethyl Ether Ethyl Methacrylate	75-00-3 60-29-7 97-63-2		4.4E+04 1.3E+03	
2.5E-06	C	1.0E+00	I	V	Ethyl-p-nitrophenyl Phosphonate Ethylbenzene Ethylene Cyanohydrin	2104-64-5 100-41-4 109-78-4	4.9E+00	4.4E+03	
				V	Ethylene Diamine Ethylene Glycol Ethylene Glycol Monobutyl Ether	107-15-3 107-21-1 111-76-2		1.8E+03 7.0E+03	
8.8E-05 1.3E-05 1.9E-02	C C C	3.0E-02	C	V	Ethylene Oxide Ethylene Thiourea Ethyleneimine	75-21-8 96-45-7 151-56-4	1.4E-01 5.4E-01 6.5E-04	1.3E+02	
					Ethylphthalyl Ethyl Glycolate Fenamiphos Fenpropathrin	84-72-0 22224-92-6 39515-41-8			
1.3E-02	C				Fenvalerate Fluometuron Fluoride	51630-58-1 2164-17-2 16984-48-8		5.7E+01	
1.3E-02	C				Fluorine (Soluble Fluoride) Fluridone Flurprimidol	7782-41-4 59756-60-4 56425-91-3		5.7E+01	
					Flusilazole Flutolanil Fluvalinate	85509-19-9 66332-96-5 69409-94-5			
					Folpet Fomesafen Fonofos	133-07-3 72178-02-0 944-22-9			
1.3E-05	I	9.8E-03 3.0E-04	A X	V	Formaldehyde Formic Acid Fosetyl-AL	50-00-0 64-18-6 39148-24-8	9.4E-01	4.3E+01 1.3E+00	
				V	Furans ~Dibenzofuran ~Furan	132-64-9 110-00-9			
2.0E+00 5.0E-02	I H		V	V	~Tetrahydrofuran Furazolidone Furfural	109-99-9 67-45-8 98-01-1		8.8E+03 2.2E+02	
4.3E-04	C				Furium	531-82-8	2.9E-02		

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a b i l i t y	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
8.6E-06	C				Furmecycloz Glufosinate, Ammonium	60568-05-0 77182-82-2	1.4E+00		
8.0E-05	C				Glutaraldehyde	111-30-8		3.5E-01	
1.0E-03	H V				Glycidyl Glyphosate	765-34-4 1071-83-6		4.4E+00	
				V	Guanidine Guanidine Chloride Haloxypol, Methyl	113-00-8 50-01-1 69806-40-2			
1.3E-03	I			V	Heptachlor	76-44-8	9.4E-03		
2.6E-03	I			V	Heptachlor Epoxide	1024-57-3	4.7E-03		
				V	Hexabromobenzene	87-82-1			
4.6E-04	I			V	Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2			
2.2E-05	I			V	Hexachlorobenzene	118-74-1	2.7E-02		
				V	Hexachlorobutadiene	87-68-3	5.6E-01		
1.8E-03	I				Hexachlorocyclohexane, Alpha-	319-84-6	6.8E-03		
5.3E-04	I				Hexachlorocyclohexane, Beta-	319-85-7	2.3E-02		
3.1E-04	C				Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	4.0E-02		
5.1E-04	I				Hexachlorocyclohexane, Technical	608-73-1	2.4E-02		
2.0E-04	I V				Hexachlorocyclopentadiene	77-47-4		8.8E-01	
1.1E-05	C	3.0E-02	I V		Hexachloroethane	67-72-1	1.1E+00	1.3E+02	
					Hexachlorophene	70-30-4			
1.0E-05	I V				Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4			
					Hexamethylene Diisocyanate, 1,6-	822-06-0		4.4E-02	
					Hexamethylphosphoramide	680-31-9			
7.0E-01	I V				Hexane, N-	110-54-3		3.1E+03	
					Hexanedioic Acid	124-04-9			
3.0E-02	I V				Hexanone, 2-	591-78-6		1.3E+02	
					Hexazinone	51235-04-2			
					Hexythiazox	78587-05-0			
4.9E-03	I	3.0E-05	P V		Hydramethylnon	67485-29-4	2.5E-03	1.3E-01	
4.9E-03	I				Hydrazine	302-01-2	2.5E-03		
					Hydrazine Sulfate	10034-93-2			
2.0E-02	I V				Hydrogen Chloride	7647-01-0		8.8E+01	
1.4E-02	C V				Hydrogen Fluoride	7664-39-3		6.1E+01	
2.0E-03	I V				Hydrogen Sulfide	7783-06-4		8.8E+00	
					Hydroquinone	123-31-9			
					Imazalil	35554-44-0			
					Imazaquin	81335-37-7			
					Imazethapyr	81335-77-5			
					Iodine	7553-56-2			
					Iprodione	36734-19-7			
					Iron	7439-89-6			
2.0E+00	C				Isobutyl Alcohol	78-83-1		8.8E+03	
					Isophorone	78-59-1			
2.0E-01	P V				Isopropalin	33820-53-0		8.8E+02	
					Isopropanol	67-63-0			
					Isopropyl Methyl Phosphonic Acid	1832-54-8			
3.0E-01	A V				Isoxaben	82558-50-7		1.3E+03	
					JP-7	NA			
					Lactofen	77501-63-4			
1.5E-01	C	2.0E-04	C	M	Lead Compounds				
1.2E-05	C				~Lead Chromate	7758-97-6	8.2E-05	8.8E-01	
					~Lead Phosphate	7446-27-7	1.0E+00		
8.0E-05	C				~Lead acetate	301-04-2	1.5E-01		
1.2E-05	C				~Lead and Compounds	7439-92-1			
					~Lead subacetate	1335-32-6	1.0E+00		
				V	~Tetraethyl Lead	78-00-2			
				V	Lewisite	541-25-3			
					Linuron	330-55-2			
					Lithium	7439-93-2			
					MCPA	94-74-6			
					MCPB	94-81-5			
7.0E-04	C				MCPB	93-65-2			
					Malathion	121-75-5			
					Maleic Anhydride	108-31-6		3.1E+00	
					Maleic Hydrazide	123-33-1			
					Malononitrile	109-77-3			
					Mancozeb	8018-01-7			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
5.0E-05	I				Maneb	12427-38-2			
5.0E-05	I				Manganese (Diet)	7439-96-5			
					Manganese (Non-diet)	7439-96-5			2.2E-01
					Mephosfolan	950-10-7			
					Mepiquat Chloride	24307-26-4			
					Mercury Compounds				
3.0E-04	S				~Mercuric Chloride (and other Mercury salts)	7487-94-7			1.3E+00
3.0E-04	I V				~Mercury (elemental)	7439-97-6			1.3E+00
					~Methyl Mercury	22967-92-6			
					~Phenylmercuric Acetate	62-38-4			
	V				Merphos	150-50-5			
					Merphos Oxide	78-48-8			
3.0E-02	P V				Metalaxyl	57837-19-1			
					Methacrylonitrile	126-98-7			1.3E+02
					Methamidophos	10265-92-6			
2.0E+01	I V				Methanol	67-56-1			8.8E+04
					Methidathion	950-37-8			
					Methomyl	16752-77-5			
1.4E-05	C				Methoxy-5-nitroaniline, 2-	99-59-2	8.8E-01		
					Methoxychlor	72-43-5			
1.0E-03	P V				Methoxyethanol Acetate, 2-	110-49-6			4.4E+00
2.0E-02	I V				Methoxyethanol, 2-	109-86-4			8.8E+01
	V				Methyl Acetate	79-20-9			
2.0E-02	P V				Methyl Acrylate	96-33-3			8.8E+01
5.0E+00	I V				Methyl Ethyl Ketone (2-butanone)	78-93-3			2.2E+04
1.0E-03	X	2.0E-05	X V		Methyl Hydrazine	60-34-4	1.2E-02		8.8E-02
3.0E+00	I V				Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1			1.3E+04
1.0E-03	C V				Methyl Isocyanate	624-83-9			4.4E+00
7.0E-01	I V				Methyl Methacrylate	80-62-6			3.1E+03
					Methyl Parathion	298-00-0			
4.0E-02	H V				Methyl Phosphonic Acid	993-13-5			
2.8E-05	C				Methyl Styrene (Mixed Isomers)	25013-15-4			1.8E+02
					Methyl methanesulfonate	66-27-3	4.4E-01		
2.6E-07	C	3.0E+00	I V		Methyl tert-Butyl Ether (MTBE)	1634-04-4	4.7E+01		1.3E+04
					Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2			
					Methyl-5-Nitroaniline, 2-	99-55-8			
2.4E-03	C				Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	5.1E-03		
3.7E-05	C				Methylaniline Hydrochloride, 2-	636-21-5	3.3E-01		
					Methylarsonic acid	124-58-3			
					Methylbenzene, 1,4-diamine monohydrochloride, 2-	74612-12-7			
6.3E-03	C			M	Methylbenzene-1,4-diamine sulfate, 2-	615-50-9			
					Methylcholanthrene, 3-	56-49-5	1.9E-03		
1.0E-08	I	6.0E-01	I V	M	Methylene Chloride	75-09-2	1.2E+03		2.6E+03
4.3E-04	C			M	Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	2.9E-02		
1.3E-05	C				Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	9.4E-01		
4.6E-04	C	2.0E-02	C		Methylenebisbenzenamine, 4,4'-	101-77-9	2.7E-02		8.8E+01
		6.0E-04	I		Methylenediphenyl Diisocyanate	101-68-8			2.6E+00
			V		Methylstyrene, Alpha-	98-83-9			
					Metolachlor	51218-45-2			
					Metribuzin	21087-64-9			
					Metsulfuron-methyl	74223-64-6			
5.1E-03	C			V	Mineral oils	8012-95-1	2.4E-03		
				V	Mirex	2385-85-5			
					Molinate	2212-67-1			
					Molybdenum	7439-98-7			
					Monochloramine	10599-90-3			
					Monomethylaniline	100-61-8			
					Myclobutanil	88671-89-0			
				V	N,N'-Diphenyl-1,4-benzenediamine	74-31-7			
					Naled	300-76-5			
1.0E-01	P V				Naphtha, High Flash Aromatic (HFAN)	64742-95-6			4.4E+02
0.0E+00	C				Naphthylamine, 2-	91-59-8			
					Napropamide	15299-99-7			
2.6E-04	C	1.4E-05	C		Nickel Acetate	373-02-4	4.7E-02		6.1E-02
2.6E-04	C	1.4E-05	C		Nickel Carbonate	3333-67-3	4.7E-02		6.1E-02
2.6E-04	C	1.4E-05	C V		Nickel Carbonyl	13463-39-3	4.7E-02		6.1E-02
2.6E-04	C	1.4E-05	C		Nickel Hydroxide	12054-48-7	4.7E-02		6.1E-02
2.6E-04	C	2.0E-05	C		Nickel Oxide	1313-99-1	4.7E-02		8.8E-02

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
2.4E-04	I	1.4E-05	C		Nickel Refinery Dust	NA	5.1E-02	6.1E-02	
2.6E-04	C	9.0E-05	A		Nickel Soluble Salts	7440-02-0	4.7E-02	3.9E-01	
4.8E-04	I	1.4E-05	C		Nickel Subsulfide	12035-72-2	2.6E-02	6.1E-02	
2.6E-04	C	1.4E-05	C		Nickelocene	1271-28-9	4.7E-02	6.1E-02	
					Nitrate	14797-55-8			
					Nitrate + Nitrite (as N)	NA			
					Nitrite	14797-65-0			
		5.0E-05	X		Nitroaniline, 2-	88-74-4		2.2E-01	
		6.0E-03	P		Nitroaniline, 4-	100-01-6		2.6E+01	
4.0E-05	I	9.0E-03	I	V	Nitrobenzene	98-95-3	3.1E-01	3.9E+01	
					Nitrocellulose	9004-70-0			
					Nitrofurantoin	67-20-9			
3.7E-04	C				Nitrofurazone	59-87-0	3.3E-02		
					Nitroglycerin	55-63-0			
					Nitroguanidine	556-88-7			
8.8E-06	P	5.0E-03	P	V	Nitromethane	75-52-5	1.4E+00	2.2E+01	
2.7E-03	H	2.0E-02	I	V	Nitropropane, 2-	79-46-9	4.5E-03	8.8E+01	
7.7E-03	C			M	Nitroso-N-ethylurea, N-	759-73-9	1.6E-03		
3.4E-02	C			M	Nitroso-N-methylurea, N-	684-93-5	3.6E-04		
1.6E-03	I			V	Nitroso-di-N-butylamine, N-	924-16-3	7.7E-03		
2.0E-03	C				Nitroso-di-N-propylamine, N-	621-64-7	6.1E-03		
8.0E-04	C				Nitrosodiethanolamine, N-	1116-54-7	1.5E-02		
4.3E-02	I			M	Nitrosodiethylamine, N-	55-18-5	2.9E-04		
1.4E-02	I	4.0E-05	X	V	Nitrosodimethylamine, N-	62-75-9	8.8E-04	1.8E-01	
2.6E-06	C				Nitrosodiphenylamine, N-	86-30-6	4.7E+00		
6.3E-03	C			V	Nitrosomethylethylamine, N-	10595-95-6	1.9E-03		
1.9E-03	C				Nitrosomorpholine [N-]	59-89-2	6.5E-03		
2.7E-03	C				Nitrosopiperidine [N-]	100-75-4	4.5E-03		
6.1E-04	I				Nitrosopyrrolidine, N-	930-55-2	2.0E-02		
				V	Nitrotoluene, m-	99-08-1			
					Nitrotoluene, o-	88-72-2			
					Nitrotoluene, p-	99-99-0			
2.0E-02	P			V	Nonane, n-	111-84-2		8.8E+01	
					Norflurazon	27314-13-2			
					Octabromodiphenyl Ether	32536-52-0			
					Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0			
					Octamethylpyrophosphoramide	152-16-9			
					Oryzalin	19044-88-3			
					Oxadiazon	19666-30-9			
					Oxamyl	23135-22-0			
					Oxyfluorfen	42874-03-3			
					Paclobutrazol	76738-62-0			
					Paraquat Dichloride	1910-42-5			
				V	Parathion	56-38-2			
					Pebulate	1114-71-2			
					Pendimethalin	40487-42-1			
				V	Pentabromodiphenyl Ether	32534-81-9			
				V	Pentabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-99)	60348-60-9			
				V	Pentachlorobenzene	608-93-5			
				V	Pentachloroethane	76-01-7			
5.1E-06	C			V	Pentachloronitrobenzene	82-68-8	2.4E+00		
					Pentachlorophenol	87-86-5			
					Pentaerythritol tetranitrate (PETN)	78-11-5			
1.0E+00	P			V	Pentane, n-	109-66-0		4.4E+03	
					Perchlorates				
					~Ammonium Perchlorate	7790-98-9			
					~Lithium Perchlorate	7791-03-9			
					~Perchlorate and Perchlorate Salts	14797-73-0			
				V	~Potassium Perchlorate	7778-74-7			
					~Sodium Perchlorate	7601-89-0			
					Perfluorobutane Sulfonate	375-73-5			
6.3E-07	C				Permethrin	52645-53-1	1.9E+01		
					Phenacetin	62-44-2			
					Phenmedipham	13684-63-4			
2.0E-01	C				Phenol	108-95-2		8.8E+02	
					Phenothiazine	92-84-2			
					Phenylenediamine, m-	108-45-2			
					Phenylenediamine, o-	95-54-5			

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Toxicity and Chemical-specific						Contaminant		Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l	muta- gen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)
						Phenylenediamine, p- Phenylphenol, 2-	106-50-3 90-43-7		
3.0E-04	I			V		Phorate Phosgene Phosmet	298-02-2 75-44-5 732-11-6		1.3E+00
						Phosphates, Inorganic ~Aluminum metaphosphate ~Ammonium polyphosphate	13776-88-0 68333-79-9		
						~Calcium pyrophosphate ~Diammonium phosphate ~Dicalcium phosphate	7790-76-3 7783-28-0 7757-93-9		
						~Dimagnesium phosphate ~Dipotassium phosphate ~Disodium phosphate	7782-75-4 7758-11-4 7558-79-4		
						~Monoaluminum phosphate ~Monoammonium phosphate ~Monocalcium phosphate	13530-50-2 7722-76-1 7758-23-8		
						~Monomagnesium phosphate ~Monopotassium phosphate ~Monosodium phosphate	7757-86-0 7778-77-0 7558-80-7		
						~Polyphosphoric acid ~Potassium triphosphate ~Sodium acid pyrophosphate	8017-16-1 13845-36-8 7758-16-9		
						~Sodium aluminum phosphate (acidic) ~Sodium aluminum phosphate (anhydrous) ~Sodium aluminum phosphate (tetrahydrate)	7785-88-8 10279-59-1 10305-76-7		
						~Sodium hexametaphosphate ~Sodium polyphosphate ~Sodium trimetaphosphate	10124-56-8 68915-31-1 7785-84-4		
						~Sodium triphosphate ~Tetrapotassium phosphate ~Tetrasodium pyrophosphate	7758-29-4 7320-34-5 7722-88-5		
						~Trialuminum sodium tetra decahydrogen octaorthophosphate (dihydrate) ~Tricalcium phosphate ~Trimagnesium phosphate	15136-87-5 7758-87-4 7757-87-1		
3.0E-04	I			V		~Tripotassium phosphate ~Trisodium phosphate Phosphine	7778-53-2 7601-54-9 7803-51-2		1.3E+00
1.0E-02	I				V	Phosphoric Acid Phosphorus, White Phthalates	7664-38-2 7723-14-0		4.4E+01
2.4E-06	C					~Bis(2-ethylhexyl)phthalate ~Butylphthalyl Butylglycolate ~Dibutyl Phthalate	117-81-7 85-70-1 84-74-2	5.1E+00	
					V	~Diethyl Phthalate ~Dimethylterephthalate ~Octyl Phthalate, di-N-	84-66-2 120-61-6 117-84-0		
2.0E-02	C					~Phthalic Acid, P- ~Phthalic Anhydride Picloram	100-21-0 85-44-9 1918-02-1		8.8E+01
						Picramic Acid (2-Amino-4,6-dinitrophenol) Picric Acid (2,4,6-Trinitrophenol) Pirimiphos, Methyl	96-91-3 88-89-1 29232-93-7		
8.6E-03	C					Polybrominated Biphenyls Polychlorinated Biphenyls (PCBs) ~Aroclor 1016	59536-65-1 12674-11-2	1.4E-03 6.1E-01	
5.7E-04	S				V	~Aroclor 1221	11104-28-2	2.1E-02	
5.7E-04	S				V	~Aroclor 1232	11141-16-5	2.1E-02	
5.7E-04	S				V	~Aroclor 1242	53469-21-9	2.1E-02	
5.7E-04	S				V	~Aroclor 1248	12672-29-6	2.1E-02	
5.7E-04	S				V	~Aroclor 1254	11097-69-1	2.1E-02	
5.7E-04	S				V	~Aroclor 1260	11096-82-5	2.1E-02	
					V	~Aroclor 5460	11126-42-4		
1.1E-03	E	1.3E-03	E		V	~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.1E-02	5.8E+00
1.1E-03	E	1.3E-03	E		V	~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.1E-02	5.8E+00
1.1E-03	E	1.3E-03	E		V	~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.1E-02	5.8E+00
1.1E-03	E	1.3E-03	E		V	~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 156)	38380-08-4	1.1E-02	5.8E+00
1.1E+00	E	1.3E-06	E		V	~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.1E-05	5.8E-03

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.1E-02	5.8E+00	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.1E-02	5.8E+00	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.1E-02	5.8E+00	
1.1E-03	E	1.3E-03	E	V	~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.1E-02	5.8E+00	
3.8E+00	E	4.0E-07	E	V	~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	3.2E-06	1.8E-03	
5.7E-04	I			V	~Polychlorinated Biphenyls (high risk)	1336-36-3	2.1E-02		
1.0E-04	I			V	~Polychlorinated Biphenyls (low risk)	1336-36-3	1.2E-01		
2.0E-05	I			V	~Polychlorinated Biphenyls (lowest risk)	1336-36-3	6.1E-01		
3.8E-03	E	4.0E-04	E		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	3.2E-03	1.8E+00	
1.1E-02	E	1.3E-04	E	V	~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.1E-03	5.8E-01	
		6.0E-04	I		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9		2.6E+00	
					Polynuclear Aromatic Hydrocarbons (PAHs)				
				V	~Acenaphthene	83-32-9			
				V	~Anthracene	120-12-7			
1.1E-04	C			V M	~Benz[a]anthracene	56-55-3	1.1E-01		
1.1E-04	C				~Benzo(j)fluoranthene	205-82-3	1.1E-01		
1.1E-03	C			M	~Benzo[a]pyrene	50-32-8	1.1E-02		
1.1E-04	C			M	~Benzo[b]fluoranthene	205-99-2	1.1E-01		
1.1E-04	C			M	~Benzo[k]fluoranthene	207-08-9	1.1E-01		
				V	~Chloronaphthalene, Beta-	91-58-7			
1.1E-05	C			M	~Chrysene	218-01-9	1.1E+00		
1.2E-03	C			M	~Dibenz[a,h]anthracene	53-70-3	1.0E-02		
1.1E-03	C				~Dibenzo[a,e]pyrene	192-65-4	1.1E-02		
7.1E-02	C			M	~Dimethylbenz(a)anthracene, 7,12-	57-97-6	1.7E-04		
				V	~Fluoranthene	206-44-0			
					~Fluorene	86-73-7			
1.1E-04	C			M	~Indeno[1,2,3-cd]pyrene	193-39-5	1.1E-01		
				V	~Methylnaphthalene, 1-	90-12-0			
				V	~Methylnaphthalene, 2-	91-57-6			
3.4E-05	C	3.0E-03	I	V	~Naphthalene	91-20-3	3.6E-01	1.3E+01	
1.1E-04	C			V	~Nitropyrene, 4-	57835-92-4	1.1E-01		
					~Pyrene	129-00-0			
					Potassium Perfluorobutane Sulfonate	29420-49-3			
				V	Prochloraz	67747-09-5			
					Profluralin	26399-36-0			
					Prometon	1610-18-0			
					Prometryn	7287-19-6			
					Propachlor	1918-16-7			
					Propanediol, 1,2-	114-26-1			
				V	Propanil	709-98-8			
					Propargite	2312-35-8			
					Propargyl Alcohol	107-19-7			
					Propazine	139-40-2			
					Propham	122-42-9			
					Propiconazole	60207-90-1			
		8.0E-03	I	V	Propionaldehyde	123-38-6		3.5E+01	
		1.0E+00	X	V	Propyl benzene	103-65-1		4.4E+03	
		3.0E+00	C	V	Propylene	115-07-1		1.3E+04	
					Propylene Glycol	57-55-6			
		2.7E-04	A		Propylene Glycol Dinitrate	6423-43-4		1.2E+00	
		2.0E+00	I	V	Propylene Glycol Monomethyl Ether	107-98-2		8.8E+03	
3.7E-06	I	3.0E-02	I	V	Propylene Oxide	75-56-9	3.3E+00	1.3E+02	
				V	Propylamine	23950-58-5			
					Pyridine	110-86-1			
					Quinalphos	13593-03-8			
					Quinoline	91-22-5			
					Quizalofop-ethyl	76578-14-8			
		3.0E-02	A		Refractory Ceramic Fibers	NA		1.3E+02	
				V	Resmethrin	10453-86-8			
					Ronnel	299-84-3			
6.3E-05	C			M	Rotenone	83-79-4			
					Safrole	94-59-7	1.9E-01		
					Selenious Acid	7783-00-8			
		2.0E-02	C		Selenium	7782-49-2		8.8E+01	
		2.0E-02	C		Selenium Sulfide	7446-34-6		8.8E+01	
					Sethoxydim	74051-80-2			
		3.0E-03	C		Silica (crystalline, respirable)	7631-86-9		1.3E+01	
					Silver	7440-22-4			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	v o l u t a g e n	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
					Simazine	122-34-9			
1.5E-01	C	2.0E-04	C	M	Sodium Acifluorfen	62476-59-9			
					Sodium Azide	26628-22-8			
					Sodium Dichromate	10588-01-9	8.2E-05	8.8E-01	
1.3E-02	C				Sodium Diethyldithiocarbamate	148-18-5			
					Sodium Fluoride	7681-49-4		5.7E+01	
					Sodium Fluoroacetate	62-74-8			
					Sodium Metavanadate	13718-26-8			
					Sodium Tungstate	13472-45-2			
					Sodium Tungstate Dihydrate	10213-10-2			
1.5E-01	C	2.0E-04	C	M	Stirofos (Tetrachlorovinphos)	961-11-5			
					Strontium Chromate	7789-06-2	8.2E-05	8.8E-01	
					Strontium, Stable	7440-24-6			
1.0E+00	I	V			Strychnine	57-24-9			
					Styrene	100-42-5		4.4E+03	
					Styrene-Acrylonitrile (SAN) Trimer	NA			
2.0E-03	X				Sulfolane	126-33-0		8.8E+00	
1.0E-03	C	V			Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9		4.4E+00	
					Sulfur Trioxide	7446-11-9		4.4E+00	
7.1E-06	I				Sulfuric Acid	7664-93-9	1.7E+00	4.4E+00	
					Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8			
					TCMTB	21564-17-0			
					Tebuthiuron	34014-18-1			
					Temephos	3383-96-8			
					Terbacil	5902-51-2			
				V	Terbufos	13071-79-9			
					Terbutryn	886-50-0			
					Tetrabromodiphenyl ether, 2,2',4,4'-(BDE-47)	5436-43-1			
7.4E-06	I			V	Tetrachlorobenzene, 1,2,4,5-	95-94-3	1.7E+00		
5.8E-05	C			V	Tetrachloroethane, 1,1,1,2-	630-20-6	2.1E-01		
				V	Tetrachloroethane, 1,1,2,2-	79-34-5			
2.6E-07	I	4.0E-02	I	V	Tetrachloroethylene	127-18-4	4.7E+01	1.8E+02	
				V	Tetrachlorophenol, 2,3,4,6-	58-90-2			
					Tetrachlorotoluene, p- alpha, alpha-	5216-25-1			
8.0E+01	I	V			Tetraethyl Dithiopyrophosphate	3689-24-5		3.5E+05	
					Tetrafluoroethane, 1,1,1,2-	811-97-2			
					Tetryl (Trinitrophenylmethylnitramine)	479-45-8			
					Thallium (I) Nitrate	10102-45-1			
				V	Thallium (Soluble Salts)	7440-28-0			
					Thallium Acetate	563-68-8			
				V	Thallium Carbonate	6533-73-9			
					Thallium Chloride	7791-12-0			
					Thallium Sulfate	7446-18-6			
					Thifensulfuron-methyl	79277-27-3			
					Thiobencarb	28249-77-6			
					Thiodiglycol	111-48-8			
					Thiofanox	39196-18-4			
					Thiophanate, Methyl	23564-05-8			
					Thiram	137-26-8			
1.0E-04	A	V			Tin	7440-31-5		4.4E-01	
5.0E+00	I	V			Titanium Tetrachloride	7550-45-0		2.2E+04	
					Toluene	108-88-3			
				V	Toluene-2,5-diamine	95-70-5			
					Toluidine, p-	106-49-0			
					Total Petroleum Hydrocarbons (Aliphatic High)	NA			
6.0E-01	P	V			Total Petroleum Hydrocarbons (Aliphatic Low)	NA		2.6E+03	
1.0E-01	P	V			Total Petroleum Hydrocarbons (Aliphatic Medium)	NA		4.4E+02	
					Total Petroleum Hydrocarbons (Aromatic High)	NA			
3.0E-02	P	V			Total Petroleum Hydrocarbons (Aromatic Low)	NA		1.3E+02	
3.0E-03	P	V			Total Petroleum Hydrocarbons (Aromatic Medium)	NA		1.3E+01	
3.2E-04	I				Toxaphene	8001-35-2	3.8E-02		
				V	Tralothrin	66841-25-6			
					Tri-n-butyltin	688-73-3			
					Triacetin	102-76-1			
				V	Triadimefon	43121-43-3			
					Triallate	2303-17-5			
					Triasulfuron	82097-50-5			
					Tribenuron-methyl	101200-48-0			

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Toxicity and Chemical-specific					Contaminant		Carcinogenic Target Risk (TR) = 1E-06		Noncancer Hazard Index (HI) = 1
IUR (ug/m ³) ⁻¹	k e y	RfC _i (mg/m ³)	k e y	muta- gen	Analyte	CAS No.	Carcinogenic SL TR=1E-06 (ug/m ³)	Noncarcinogenic SL HI=1 (ug/m ³)	
			V		Tribromobenzene, 1,2,4-	615-54-3			
					Tributyl Phosphate	126-73-8			
					Tributyltin Compounds	NA			
3.0E+01	H		V		Tributyltin Oxide	56-35-9			
					Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1		1.3E+05	
					Trichloroacetic Acid	76-03-9			
					Trichloroaniline HCl, 2,4,6-	33663-50-2			
					Trichloroaniline, 2,4,6-	634-93-5			
			V		Trichlorobenzene, 1,2,3-	87-61-6			
2.0E-03	P		V		Trichlorobenzene, 1,2,4-	120-82-1		8.8E+00	
5.0E+00	I		V		Trichloroethane, 1,1,1-	71-55-6		2.2E+04	
1.6E-05	I	2.0E-04	X	V	Trichloroethane, 1,1,2-	79-00-5	7.7E-01	8.8E-01	
4.1E-06	I	2.0E-03	I	V	Trichloroethylene	79-01-6	3.0E+00	8.8E+00	
				V	Trichlorofluoromethane	75-69-4			
3.1E-06	I				Trichlorophenol, 2,4,5-	95-95-4			
					Trichlorophenol, 2,4,6-	88-06-2	4.0E+00		
					Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5			
			V		Trichlorophenoxypropionic acid, -2,4,5	93-72-1			
3.0E-04	I		V	M	Trichloropropane, 1,1,2-	598-77-6			
					Trichloropropane, 1,2,3-	96-18-4		1.3E+00	
3.0E-04	P		V		Trichloropropene, 1,2,3-	96-19-5		1.3E+00	
					Tricresyl Phosphate (TCP)	1330-78-5			
					Tridiphenyl	58138-08-2			
7.0E-03	I		V		Triethylamine	121-44-8		3.1E+01	
					Triethylene Glycol	112-27-6			
2.0E+01	P		V		Trifluoroethane, 1,1,1-	420-46-2		8.8E+04	
			V		Trifluralin	1582-09-8			
					Trimethyl Phosphate	512-56-1			
5.0E-03	P		V		Trimethylbenzene, 1,2,3-	526-73-8		2.2E+01	
7.0E-03	P		V		Trimethylbenzene, 1,2,4-	95-63-6		3.1E+01	
					Trimethylbenzene, 1,3,5-	108-67-8			
					Trimethylpentene, 2,4,4-	25167-70-8			
					Trinitrobenzene, 1,3,5-	99-35-4			
					Trinitrotoluene, 2,4,6-	118-96-7			
					Triphenylphosphine Oxide	791-28-6			
6.6E-04	C			V	Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8			
					Tris(1-chloro-2-propyl)phosphate	13674-84-5			
					Tris(2,3-dibromopropyl)phosphate	126-72-7	1.9E-02		
					Tris(2-chloroethyl)phosphate	115-96-8			
					Tris(2-ethylhexyl)phosphate	78-42-2			
					Tungsten	7440-33-7			
4.0E-05	A				Uranium (Soluble Salts)	NA		1.8E-01	
2.9E-04	C			M	Urethane	51-79-6	4.2E-02		
8.3E-03	P	7.0E-06	P		Vanadium Pentoxide	1314-62-1	1.5E-03	3.1E-02	
1.0E-04	A				Vanadium and Compounds	7440-62-2		4.4E-01	
			V		Vernolate	1929-77-7			
					Vinclozolin	50471-44-8			
2.0E-01	I		V		Vinyl Acetate	108-05-4		8.8E+02	
3.2E-05	H	3.0E-03	I	V	Vinyl Bromide	593-60-2	3.8E-01	1.3E+01	
4.4E-06	I	1.0E-01	I	V	Vinyl Chloride	75-01-4	2.8E+00	4.4E+02	
					Warfarin	81-81-2			
1.0E-01	S		V		Xylene, p-	106-42-3		4.4E+02	
1.0E-01	S		V		Xylene, m-	108-38-3		4.4E+02	
1.0E-01	S		V		Xylene, o-	95-47-6		4.4E+02	
1.0E-01	I		V		Xylenes	1330-20-7		4.4E+02	
					Zinc Phosphide	1314-84-7			
					Zinc and Compounds	7440-66-6			
					Zineb	12122-67-7			
					Zirconium	7440-67-7			

Contaminant		Molecular Weight		Volatility Parameters				Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients			Water Partition		Water Solubility		Tapwater Dermal Parameters									
Analyte	CAS No.	MW (unitless)	MW Ref	H' (cm ² /s)	H' and HLC Ref	VP	VP Ref	MP (°C)	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀₀ (cm ² /s)	D ₁₀₀₀ (cm ² /s)	D ₁₀₀₀₀ (cm ² /s)	K _d (L/kg)	K _{oc} (L/kg)	K _{oc} (L/kg)	log K _{ow} (unitless)	log K _{ow} (unitless)	S (mg/L)	S Ref	B (unitless)	t _{1/2} (hr)	t ⁺ (hr)	K _p (hr)	KPREF					
Acetate	30560-19-1	1.8E+02	PHYSPROP	2.0E-11	5.0E-13	EPI	1.7E-06	PHYSPROP	8.8E+01	PHYSPROP	1.4E+00	CRC89	3.7E-02	8.0E-06	EPA WATER	1.0E+01	EPI	-8.5E-01	PHYSPROP	8.2E+05	PHYSPROP	2.1E-04	1.1E+00	2.7E+00	4.0E-05	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acetaldehyde	75-07-0	4.4E+01	PHYSPROP	2.7E-03	6.7E-05	PHYSPROP	9.0E-02	PHYSPROP	1.3E-01	1.4E-05	PHYSPROP	7.8E-01	CRC89	1.3E-01	1.4E-05	EPA WATER	1.0E+00	EPI	-3.4E-01	PHYSPROP	1.0E+06	PHYSPROP	1.0E-03	1.9E-01	4.5E-01	5.3E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI
Acetochlor	34256-82-1	2.7E+02	PHYSPROP	9.1E-07	2.2E-08	PHYSPROP	2.8E-05	PHYSPROP	1.1E+01	PubChem	1.1E+00	PubChem	2.2E-02	5.6E-06	EPA WATER	3.0E+02	EPI	3.0E+00	PHYSPROP	2.2E+02	PHYSPROP	3.1E-02	3.4E+00	8.2E+00	5.0E-03	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acetone	67-64-1	5.8E+01	PHYSPROP	1.4E-03	3.5E-05	PHYSPROP	2.3E-02	PHYSPROP	-9.5E+01	PHYSPROP	7.8E-01	CRC89	1.1E-01	1.2E-05	EPA WATER	2.4E+00	EPI	2.4E-01	PHYSPROP	1.0E+06	PHYSPROP	1.5E-03	2.2E-01	5.3E-01	5.1E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acetone Cyanohydrin	75-86-5	8.5E+01	PHYSPROP	8.1E-08	2.0E-09	PHYSPROP	3.4E-01	PHYSPROP	1.9E+01	PHYSPROP	9.3E-01	CRC89	8.6E-02	1.0E-05	EPA WATER	1.0E+00	EPI	3.0E-02	PHYSPROP	1.0E+06	PHYSPROP	1.8E-03	3.2E-01	7.6E-01	5.0E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acetonitrile	75-05-8	4.1E+01	PHYSPROP	1.4E-03	3.5E-05	PHYSPROP	8.9E-01	PHYSPROP	1.4E+01	PHYSPROP	7.9E-01	CRC89	1.3E-01	1.4E-05	EPA WATER	4.7E+00	EPI	3.4E-01	PHYSPROP	1.0E+06	PHYSPROP	1.4E-03	1.8E-01	4.3E-01	5.5E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acetophenone	98-86-2	1.2E+02	PHYSPROP	4.3E-04	1.0E-05	PHYSPROP	4.0E-01	PHYSPROP	2.0E+01	PHYSPROP	1.0E+00	CRC89	6.5E-02	8.7E-06	EPA WATER	5.2E+01	EPI	1.6E+00	PHYSPROP	6.1E+03	PHYSPROP	1.6E-02	5.0E-01	1.2E+00	3.7E-03	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acetylaminofluorene, 2-	53-96-3	2.2E+02	PHYSPROP	7.8E-09	1.9E-10	PHYSPROP	9.4E-08	PHYSPROP	1.9E+02	PHYSPROP	1.0E+00	CRC89	5.2E-02	6.0E-06	EPA WATER	2.2E+03	EPI	3.1E+00	PHYSPROP	5.5E+00	PHYSPROP	7.2E-02	1.9E+00	5.2E+00	1.2E-02	RAGSE	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acrolein	107-02-8	5.6E+01	PHYSPROP	5.0E-03	1.2E-04	PHYSPROP	2.7E-02	PHYSPROP	-8.8E+01	PHYSPROP	8.4E-01	CRC89	1.1E-01	1.2E-05	EPA WATER	1.0E+00	EPI	1.0E-02	PHYSPROP	2.1E+05	PHYSPROP	7.2E-02	2.2E-01	5.2E-01	7.5E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acrylamide	79-06-1	7.1E+01	PHYSPROP	7.0E-08	1.7E-09	EPI	7.0E-03	PHYSPROP	8.5E+01	PHYSPROP	1.2E+00	LANGE	1.1E-01	1.3E-05	EPA WATER	5.7E+00	EPI	6.7E-01	PHYSPROP	3.9E+05	PHYSPROP	7.3E-04	2.6E-01	6.3E-01	2.2E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Acrylic Acid	79-10-7	7.2E+01	PHYSPROP	1.5E-05	3.7E-07	EPI	4.0E+00	PHYSPROP	1.3E-01	1.2E-05	EPA WATER	1.1E+00	CRC89	1.0E-01	1.2E-05	EPA WATER	1.4E+00	EPI	3.5E-01	PHYSPROP	1.0E+06	PHYSPROP	3.4E-03	2.7E-01	6.4E-01	1.1E-03	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI
Acrylonitrile	107-13-1	5.3E+01	PHYSPROP	5.6E-03	1.4E-04	PHYSPROP	1.1E-02	PHYSPROP	-8.4E+01	PHYSPROP	8.0E-01	CRC89	1.1E-01	1.2E-05	EPA WATER	8.5E+00	EPI	2.5E-01	PHYSPROP	7.5E+04	PHYSPROP	9.3E-04	2.1E-01	5.0E-01	1.2E-03	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Adiponitrile	111-69-3	1.1E+02	PHYSPROP	4.9E-08	1.2E-09	EPI	6.8E-04	PHYSPROP	1.0E+00	PHYSPROP	9.7E-01	CRC89	7.1E-02	9.0E-06	EPA WATER	2.0E+01	EPI	3.2E-01	PHYSPROP	8.0E+04	PHYSPROP	3.5E-04	4.2E-01	1.0E+00	2.4E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Alcohol	15972-60-8	2.7E+02	PHYSPROP	3.4E-07	8.3E-09	PHYSPROP	2.2E-05	PHYSPROP	4.0E+01	PHYSPROP	1.1E+00	CRC89	2.3E-02	5.7E-06	EPA WATER	3.1E+02	EPI	3.5E+00	PHYSPROP	2.4E+02	PHYSPROP	6.6E-02	3.4E+00	8.2E+00	1.1E-02	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aldicarb	116-06-3	1.9E+02	PHYSPROP	5.9E-08	1.4E-09	EPI	3.5E-05	PHYSPROP	9.9E+01	PHYSPROP	1.2E+00	CRC89	3.2E-02	7.2E-06	EPA WATER	2.5E+01	EPI	1.1E+00	PHYSPROP	6.0E+03	PHYSPROP	4.0E-03	1.2E+00	2.9E+00	7.6E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aldicarb Sulfone	1646-88-4	2.2E+02	PHYSPROP	1.4E-07	3.4E-09	EPI	9.0E-05	PHYSPROP	1.4E+02	PHYSPROP	1.0E+00	EPI	5.2E-02	6.1E-06	EPA WATER	1.0E+01	EPI	-5.7E-01	PHYSPROP	1.0E+04	PHYSPROP	2.1E-04	1.8E+00	4.4E+00	3.7E-05	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aldicarb sulfoxide	1646-87-3	2.1E+02	PHYSPROP	4.0E-08	9.7E-10	EPI	1.0E-04	PHYSPROP	7.8E+01	EPI	1.0E+00	EPI	5.4E-02	6.4E-06	EPA WATER	1.0E+01	EPI	-7.8E-01	PHYSPROP	2.8E+04	PHYSPROP	1.8E-04	1.5E+00	3.6E+00	3.3E-05	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aldrin	309-00-2	3.6E+02	PHYSPROP	1.8E-03	4.4E-05	PHYSPROP	1.2E-04	PHYSPROP	1.0E+02	PHYSPROP	1.6E+00	PubChem	2.3E-02	5.8E-06	EPA WATER	8.2E+04	EPI	6.5E+00	PHYSPROP	1.7E+02	PHYSPROP	2.2E+00	1.2E+01	4.8E+01	2.9E-01	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Allyl Alcohol	107-18-6	5.8E+01	PHYSPROP	2.0E-04	5.0E-06	PHYSPROP	2.6E+01	PHYSPROP	-1.3E+02	PHYSPROP	8.5E-01	CRC89	1.1E-01	1.2E-05	EPA WATER	1.9E+00	EPI	1.7E-01	PHYSPROP	1.0E+06	PHYSPROP	2.8E-02	2.2E-01	5.3E-01	9.6E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Allyl Chloride	107-05-1	7.7E+01	PHYSPROP	4.5E-01	1.1E-02	EPI	3.7E+02	PHYSPROP	-1.3E+02	PHYSPROP	9.4E-01	CRC89	9.4E-02	1.1E-05	EPA WATER	4.0E+01	EPI	1.9E+00	PHYSPROP	3.4E+03	PHYSPROP	3.8E-02	2.8E-01	6.8E-01	1.1E-02	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aluminum	7429-90-5	2.7E+01	CRC89	2.6E+02	2.7E-02	EPI	0.0E+00	NIOSH	2.6E+02	CRC89	2.4E+00	CRC89	5.1E-02	6.0E-06	EPA WATER	4.3E+02	EPI	3.0E+00	PHYSPROP	2.1E+02	PHYSPROP	4.6E-02	2.0E+00	4.7E+00	7.9E-03	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aluminum Phosphide	20859-73-8	5.8E+01	PHYSPROP	9.9E-08	2.4E-09	EPI	2.7E-06	PHYSPROP	8.8E+01	PHYSPROP	1.2E+00	CRC89	6.2E-02	7.3E-06	EPA WATER	2.5E+03	EPI	2.9E+00	PHYSPROP	2.2E+02	PHYSPROP	7.0E-02	3.9E-01	2.2E+00	1.4E-02	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Ametrin	834-12-8	2.3E+02	PHYSPROP	6.0E-06	1.5E-07	PHYSPROP	1.2E-04	PHYSPROP	5.4E+01	PHYSPROP	1.2E+00	CRC89	8.3E-02	9.7E-06	EPA WATER	9.0E+01	EPI	2.1E-01	PHYSPROP	2.7E+04	PHYSPROP	2.1E-03	4.3E-01	1.0E+00	5.3E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aminobiphenyl, 4-	92-67-1	1.7E+02	PHYSPROP	6.0E-06	1.5E-07	PHYSPROP	1.2E-04	PHYSPROP	5.4E+01	PHYSPROP	1.2E+00	CRC89	8.3E-02	9.7E-06	EPA WATER	9.0E+01	EPI	2.1E-01	PHYSPROP	2.7E+04	PHYSPROP	2.1E-03	4.3E-01	1.0E+00	5.3E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aminophenol, m-	951-27-5	1.1E+02	PHYSPROP	8.1E-09	2.0E-10	PHYSPROP	9.6E-03	PHYSPROP	1.2E+02	PHYSPROP	1.2E+00	CRC89	8.3E-02	9.7E-06	EPA WATER	9.0E+01	EPI	2.1E-01	PHYSPROP	2.7E+04	PHYSPROP	2.1E-03	4.3E-01	1.0E+00	5.3E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aminophenol, p-	123-30-8	1.1E+02	PHYSPROP	1.5E-08	3.6E-10	EPI	4.0E-05	EPI	1.9E+02	PHYSPROP	1.2E+00	CRC89	8.3E-02	9.7E-06	EPA WATER	9.0E+01	EPI	2.1E-01	PHYSPROP	2.7E+04	PHYSPROP	2.1E-03	4.3E-01	1.0E+00	5.3E-04	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Amtraz	33089-61-1	2.9E+02	PHYSPROP	4.0E-04	9.9E-06	PHYSPROP	2.0E-06	PHYSPROP	8.6E+01	PHYSPROP	1.1E+00	CRC89	2.2E-02	5.4E-06	EPA WATER	2.6E+05	EPI	5.5E+00	PHYSPROP	1.0E+00	PHYSPROP	1.1E+00	4.6E+00	1.8E+01	1.6E-01	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Ammonia	7664-41-7	1.7E+01	PHYSPROP	6.6E-04	1.6E-05	PHYSPROP	7.5E-03	PHYSPROP	-7.8E+01	PHYSPROP	7.0E-01	CRC89	2.3E-01	2.2E-05	EPA WATER	2.3E-01	OTHER	4.8E+05	PHYSPROP	1.1E+00	PHYSPROP	1.1E+00	1.3E-01	3.1E-01	1.0E-03	RAGSE	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Ammonium Sulfamate	7773-06-0	1.1E+02	CRC89	2.7E+02	2.7E-02	EPI	0.0E+00	NIOSH	1.3E+02	CRC89	1.8E+00	PubChem	7.9E-02	9.1E-06	EPA WATER	4.1E+00	EPI	8.9E-01	PHYSPROP	1.3E+06	PERRY	4.1E-03	4.6E-01	1.1E+00	1.0E-03	RAGSE	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Amyl Alcohol, tert-	75-85-4	8.8E+01	PHYSPROP	5.6E-04	1.4E-05	PHYSPROP	1.7E+01	PHYSPROP	-9.1E+00	PHYSPROP	8.1E-01	CRC89	7.9E-02	9.1E-06	EPA WATER	4.1E+00	EPI	8.9E-01	PHYSPROP	1.3E+06	PERRY	4.1E-03	4.6E-01	1.1E+00	1.0E-03	RAGSE	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Aniline	62-53-3	9.3E+01	PHYSPROP	8.3E-05	2.0E-06	PHYSPROP	6.7E-01	PHYSPROP	-6.0E+00	PHYSPROP	1.0E+00	CRC89	8.3E-02	1.0E-05	EPA WATER	7.0E+01	EPI	9.0E-01	PHYSPROP	3.6E+04	PHYSPROP	6.9E-03	3.5E-01	8.4E-01	1.9E-03	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Anthraquinone, 9,10-	84-65-1	2.1E+02	PHYSPROP	9.6E-07	2.4E-08	PHYSPROP	1.2E-07	PHYSPROP	2.9E+02	PHYSPROP	1.0E+00	CRC89	5.4E-02	6.3E-06	EPA WATER	5.0E+03	EPI	3.4E+00	PHYSPROP	1.3E+06	PHYSPROP	1.1E-01	1.5E+00	3.7E+00	1.9E-02	EPI	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Antimony (metallic)	7440-36-0	1.2E+02	PHYSPROP	1.2E-02	2.9E-04	EPI	0.0E+00	NIOSH	6.3E+02	PHYSPROP	6.7E+00	CRC89	5.1E-02	5.9E-06	EPA WATER	4.5E+01	SSL	4.5E+01	SSL	4.5E+01	SSL	4.3E-03	5.3E-01	1.3E+00	1.0E-03	RAGSE	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Antimony Pentoxide	1314-60-9	3.2E+02	CRC89	3.8E+00	3.8E+00	CRC89	3.8E+00	CRC89	6.6E+00	CRC89	3.8E+00	CRC89	5.1E-02	5.9E-06	EPA WATER	4.5E+01	SSL	4.5E+01	SSL	4.5E+01	SSL	4.3E-03	5.3E-01	1.3E+00	1.0E-03	RAGSE	1.3E-03	1.9E-01	4.5E-01	5.3E-04	EPI	
Antimony Tetroxide	1332-81-6	3.1E+02	EPI	3.8E+00	3.8E+00	CRC89	3.8E+00	CRC89	6.6E+00	CRC89																						

Contaminant		Molecular Weight		Volatility Parameters				Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients				Water Partition		Water Solubility		Tapwater Dermal Parameters									
Analyte	CAS No.	MW	MW Ref	H ¹ (unitless)	HLC (atm·m ³ /mole)	H ¹ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀₀ (cm ² /s)	D ₁₀₀₀ (cm ² /s)	D ₁₀₀₀ and D ₁₀₀₀₀ Ref	K _d (L/kg)	K _{oc} Ref	K _{oc} Ref	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	t _{1/2} (hr)	t _{1/2} (hr)	K _p (cm/hr)	KPREF				
Butylate	2008-41-5	2.2E+02	PHYSPROP	3.5E-03	8.5E-05	EPI	1.3E-02	PHYSPROP	6.0E+01	EPI	9.4E-01	CRCB9	2.3E-02	5.8E-06	EPA WATER9		3.9E+02	EPI	4.2E+00	PHYSPROP	4.5E+01	PHYSPROP	3.1E-01	1.7E+00	4.2E+00	5.4E-02	EPI						
Butylated hydroxyanisole	25013-16-5	3.6E+02	PHYSPROP	4.8E-05	1.2E-06	PHYSPROP	2.5E-03	PHYSPROP	5.1E+01	EPI	8.9E-01	CRCB9	3.8E-02	4.4E-06	EPA WATER9		2.5E-03	EPI	3.5E+00	PHYSPROP	2.1E+02	PHYSPROP	2.4E-01	1.1E+01	2.6E+01	3.3E-02	EPI						
Butylated hydroxytoluene	128-37-0	2.2E+02	PHYSPROP	1.7E-04	4.1E-06	PHYSPROP	5.2E-03	EPI	7.1E+01	PHYSPROP	8.6E-01	CRCB9	2.3E-02	5.6E-06	EPA WATER9		1.5E+04	EPI	5.1E+00	PHYSPROP	6.0E-01	PHYSPROP	1.3E+00	1.8E+00	7.1E+00	2.2E-01	EPI						
Butylbenzene, n-	104-51-8	1.3E+02	PHYSPROP	6.5E-01	1.6E-02	EPI	1.1E+00	PHYSPROP	4.8E+01	PHYSPROP	8.6E-01	CRCB9	5.3E-02	7.3E-06	EPA WATER9		1.5E+03	EPI	4.4E+00	PHYSPROP	1.2E+01	PHYSPROP	1.0E+00	5.9E-01	2.3E+00	2.3E-01	EPI						
Butylbenzene, sec-	135-98-8	1.3E+02	PHYSPROP	7.2E-01	1.8E-02	EPI	1.8E+00	PHYSPROP	4.8E+01	PHYSPROP	8.6E-01	LANGE	5.3E-02	7.3E-06	EPA WATER9		1.3E+03	EPI	4.6E+00	PHYSPROP	1.8E+01	PHYSPROP	1.3E+00	5.9E-01	2.3E+00	3.0E-01	EPI						
Butylbenzene, tert-	98-06-6	1.3E+02	PHYSPROP	5.4E-01	1.3E-02	EPI	2.2E+00	PHYSPROP	5.8E+01	PHYSPROP	8.7E-01	CRCB9	5.3E-02	7.4E-06	EPA WATER9		1.0E+03	EPI	4.1E+00	PHYSPROP	3.0E+01	PHYSPROP	1.6E-01	5.9E-01	2.3E+00	1.5E-01	EPI						
Cacodylic Acid	75-50-5	1.4E+02	PHYSPROP	7.4E-13	1.8E-14	PHYSPROP	1.0E-07	PHYSPROP	2.0E+02	PHYSPROP	1.0E+00	CRCB9	7.1E-02	8.3E-06	EPA WATER9		4.4E+01	EPI	3.6E-01	PHYSPROP	2.0E+06	PHYSPROP	2.1E-03	6.2E-01	1.5E+00	4.6E-04	EPI						
Cadmium (Diet)	7440-43-9	1.1E+02	PHYSPROP				0.0E+00	NIOSH	3.2E+02	PHYSPROP	8.7E+00	CRCB9					7.5E+01	SSL					4.1E-03	4.5E-01	1.1E+00	1.0E-03	RAGSE						
Cadmium (Water)	7440-43-9	1.1E+02	PHYSPROP				0.0E+00	NIOSH	3.2E+02	PHYSPROP	8.7E+00	CRCB9					7.5E+01	SSL					4.1E-03	4.5E-01	1.1E+00	1.0E-03	RAGSE						
Calcium Chromate	13765-19-0	1.6E+02	CRCB9						1.0E+03	CRCB9													4.1E-03	4.5E-01	1.1E+00	1.0E-03	RAGSE						
Caprolactam	105-60-2	1.1E+02	PHYSPROP	1.0E-06	2.5E-08	PHYSPROP	1.6E-03	EPI	6.9E+01	PHYSPROP	1.0E+00	LANGE	6.9E-02	9.0E-06	EPA WATER9		2.5E+01	EPI	1.9E-01	YAWS	7.7E+05	PHYSPROP	4.1E-03	4.5E-01	1.1E+00	1.0E-03	RAGSE						
Captafol	2425-06-1	3.5E+02	PHYSPROP	2.0E-07	4.9E-09	EPI	1.5E-08	EPI	1.6E+02	PHYSPROP			3.8E-02	4.5E-06	EPA WATER9		7.8E+02	EPI	3.8E+00	PHYSPROP	1.4E+00	PHYSPROP	4.1E-02	9.5E+00	2.3E+01	5.8E-03	EPI						
Captan	133-06-2	3.0E+02	PHYSPROP	2.9E-07	7.0E-09	EPI	9.0E-08	PHYSPROP	1.8E+02	PHYSPROP	1.7E+00	CRCB9	2.6E-02	6.9E-06	EPA WATER9		2.5E+02	EPI	2.8E+00	PHYSPROP	5.1E+00	PHYSPROP	1.6E-02	5.5E+00	1.2E+01	2.3E-03	EPI						
Carbaryl	63-25-2	2.0E+02	PHYSPROP	1.3E-07	3.3E-09	EPI	1.4E-06	PHYSPROP	1.5E+02	PHYSPROP	1.2E+00	CRCB9	2.7E-02	7.1E-06	EPA WATER9		3.5E+02	EPI	2.4E+00	PHYSPROP	1.1E+02	PHYSPROP	2.4E-02	1.4E+00	3.4E+00	4.3E-03	EPI						
Carbofuran	1563-66-2	2.2E+02	PHYSPROP	1.3E-07	3.1E-09	EPI	4.9E-06	PHYSPROP	1.5E+02	PHYSPROP	1.2E+00	CRCB9	2.6E-02	6.6E-06	EPA WATER9		9.5E+01	EPI	2.3E+00	PHYSPROP	3.2E+02	PHYSPROP	1.8E-02	1.8E+00	4.4E+00	3.1E-03	EPI						
Carbon Disulfide	75-15-0	7.6E+01	PHYSPROP	5.9E-01	1.4E-02	PHYSPROP	3.6E+02	PHYSPROP	1.1E+02	PHYSPROP	1.3E+00	CRCB9	1.1E-01	1.3E-05	EPA WATER9		2.2E+01	EPI	1.9E+00	PHYSPROP	2.2E+03	PHYSPROP	3.8E-02	2.8E-01	6.7E-01	1.1E-02	EPI						
Carbon Tetrachloride	56-23-5	1.5E+02	PHYSPROP	1.1E+00	2.8E-02	PHYSPROP	1.2E+02	PHYSPROP	2.3E+01	PHYSPROP	1.6E+00	CRCB9	5.7E-02	9.8E-06	EPA WATER9		4.4E+01	EPI	2.8E+00	PHYSPROP	7.9E+02	PHYSPROP	7.8E-02	7.6E-01	1.8E+00	1.6E-02	EPI						
Carbonyl Sulfide	463-58-1	6.0E+01	PHYSPROP	2.5E-01	6.1E-01	EPI	9.4E-03	PHYSPROP	1.4E+02	PHYSPROP	1.0E+00	CRCB9	1.2E-01	1.3E-05	EPA WATER9		1.0E+00	EPI	1.3E+00	PHYSPROP	1.2E+03	PHYSPROP	2.8E-04	2.3E-01	5.5E-01	9.4E-05	EPI						
Carbosulfan	55285-14-8	3.8E+02	PHYSPROP	2.1E-05	1.1E-07	EPI	3.1E-07	PHYSPROP	1.8E+02	EPI	1.1E+00	CRCB9	1.8E-02	4.4E-06	EPA WATER9		1.2E+04	EPI	5.6E+00	PHYSPROP	3.0E-01	PHYSPROP	4.3E-01	1.4E+01	3.4E+01	5.8E-02	EPI						
Carboxin	5234-68-4	2.4E+02	PHYSPROP	1.3E-08	3.2E-10	EPI	1.5E-07	PHYSPROP	9.2E+01	PHYSPROP	7.2E+00	CRCB9	5.0E-02	5.8E-06	EPA WATER9		1.7E+02	EPI	2.1E+00	PHYSPROP	1.5E+02	PHYSPROP	1.2E-02	2.2E+00	5.2E+00	2.0E-03	EPI						
Ceric oxide	1306-38-3	1.7E+02	CRCB9						2.5E+03	CRCB9			7.2E+00	CRCB9									5.0E-03	9.7E-01	2.3E+00	1.0E-03	RAGSE						
Chloral Hydrate	302-17-0	1.7E+02	PHYSPROP	2.3E-07	5.7E-09	PHYSPROP	1.5E+01	PHYSPROP	5.7E+01	PHYSPROP	1.9E+00	CRCB9	5.4E-02	1.0E-05	EPA WATER9		1.0E+00	EPI	9.9E-01	PHYSPROP	7.9E+05	PHYSPROP	4.2E-03	8.9E-01	2.1E+00	8.4E-04	EPI						
Chloramben	133-90-4	2.1E+02	PHYSPROP	1.6E-09	3.9E-11	EPI	1.0E-07	PHYSPROP	2.0E+02	PHYSPROP			5.4E-02	6.4E-06	EPA WATER9		2.1E+01	EPI	1.9E+00	PHYSPROP	7.0E+02	PHYSPROP	1.1E-02	1.5E+00	3.6E+00	2.0E-03	EPI						
Chloranil	118-75-2	2.5E+02	PHYSPROP	1.3E-08	3.3E-10	PHYSPROP	2.3E-06	PHYSPROP	2.9E+02	PHYSPROP			4.8E-02	5.7E-06	EPA WATER9		3.1E+02	EPI	2.2E+00	PHYSPROP	2.5E+02	PHYSPROP	1.2E-02	2.5E+00	6.0E+00	1.9E-03	EPI						
Chlordane	12789-03-6	4.1E+02	PHYSPROP	2.9E-03	7.0E-05	PHYSPROP	1.0E-05	PHYSPROP	4.1E+02	PhysProp	1.6E+00	PubChem	2.1E-02	5.4E-06	EPA WATER9		3.4E+04	EPI	6.3E+00	PHYSPROP	1.3E-02	PHYSPROP	9.3E-01	2.1E+01	8.0E+01	1.1E-01	EPI						
Chlordecone (Kepone)	143-50-0	4.9E+02	PHYSPROP	2.2E-06	5.4E-08	EPI	2.3E-07	PHYSPROP	3.5E+02	EPI	1.6E+00	CRCB9	2.0E-02	4.9E-06	EPA WATER9		1.8E+04	EPI	5.4E+00	PHYSPROP	2.7E+00	PHYSPROP	9.3E-02	5.9E+01	1.4E+02	1.1E-02	EPI						
Chlorofenvinphos	470-90-6	3.6E+02	PHYSPROP	1.2E-06	2.9E-08	EPI	7.5E-06	PHYSPROP	2.0E+01	PHYSPROP			3.8E-02	4.4E-06	EPA WATER9		1.3E+03	EPI	3.8E+00	PHYSPROP	1.2E+02	PHYSPROP	3.7E-02	1.1E+01	2.6E+01	5.1E-03	EPI						
Chlorimuron, Ethyl-	90982-32-4	4.1E+02	PHYSPROP	7.4E-14	1.8E-15	EPI	4.0E-12	PHYSPROP	1.8E+02	PHYSPROP			3.4E-02	4.0E-06	EPA WATER9		7.2E+01	EPI	2.5E+00	PHYSPROP	1.2E+03	PHYSPROP	2.6E-03	2.2E+01	5.3E+01	3.4E-04	EPI						
Chlorine	7782-50-5	7.1E+01	PHYSPROP	4.8E-01	1.2E-02	PHYSPROP	5.9E+03	PHYSPROP	1.0E+02	PHYSPROP	2.9E+00	CRCB9	1.5E-01	2.2E-05	EPA WATER9	2.5E-01	BAES		8.5E-01	OTHER	6.3E+03	PHYSPROP	3.2E-03	2.6E-01	6.3E-01	1.0E-03	RAGSE						
Chlorine Dioxide	10049-04-4	6.7E+01	EPI	1.6E+00	4.0E-02	Toxnet HSDB	7.6E+02	Toxnet HSDB	5.9E+01	PHYSPROP	2.8E+00	CRCB9	1.6E-01	2.2E-05	EPA WATER9								3.2E-03	2.5E-01	6.0E-01	1.0E-03	RAGSE						
Chlorite (Sodium Salt)	7758-19-2	9.0E+01	EPI						1.8E+02	CRCB9													6.4E+05	CRCB9	3.7E-03	3.4E-01	8.1E-01	1.0E-03	RAGSE				
Chloro-1,1-difluoroethane, 1-	75-68-3	1.0E+02	PHYSPROP	2.4E+00	5.9E-02	PHYSPROP	2.5E+03	PHYSPROP	1.3E+02	PHYSPROP	1.1E+00	CRCB9	8.0E-02	1.0E-05	EPA WATER9		4.4E+01	EPI	2.1E+00	PHYSPROP	1.4E+03	PHYSPROP	3.8E-02	3.8E-01	9.2E-01	9.9E-03	EPI						
Chloro-1,3-butanediol, 2-	126-99-8	8.9E+01	PHYSPROP	2.3E+00	5.6E-02	PHYSPROP	2.2E+02	PHYSPROP	1.3E+02	PHYSPROP	9.6E-01	CRCB9	8.4E-02	1.0E-05	EPA WATER9		6.1E+01	EPI	2.5E+00	PHYSPROP	8.7E+02	PHYSPROP											

Contaminant		Molecular Weight		Volatility Parameters		Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients				Water Partition		Water Solubility		Tapwater Dermal Parameters									
Analyte	CAS No.	MW	MW Ref	H ¹ (unitless)	HLC (atm-m ³ /mole)	H ¹ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀ (cm ² /s)	D ₁₀ and D ₁₀ Ref	K _{oc} (L/kg)	K _{oc} Ref	K _{oc} (L/kg)	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	t _{1/2} (hr)	t [†] (hr)	K _p	KPREF			
*Hydrogen Cyanide	74-90-8	2.7E+01	PHYSPROP	5.4E-03	1.3E-04	PHYSPROP	7.4E+02	PHYSPROP	-1.3E+01	PHYSPROP	6.9E-01	CRC89	1.7E-01	1.7E-05	EPA WATER9	9.9E+00	SSL			-2.5E-01	PHYSPROP	1.0E+06	PHYSPROP	2.0E-03	1.5E-01	3.6E-01	1.0E-03	RAGSE			
*Potassium Cyanide	151-50-8	6.5E+01	PHYSPROP				0.0E+00	NIOSH	6.3E+02	PHYSPROP	1.6E+00	CRC89									7.2E+05	PHYSPROP	6.2E-03	2.4E-01	5.8E-01	2.0E-03	RAGSE				
*Potassium Silver Cyanide	506-61-6	2.0E+02	PHYSPROP																												
*Silver Cyanide	506-64-9	1.3E+02	PHYSPROP																												
*Sodium Cyanide	143-33-9	4.9E+01	PHYSPROP				0.0E+00	NIOSH	5.6E+02	PHYSPROP	1.6E+00	CRC89											2.3E+01	PHYSPROP	4.5E-03	5.9E-01	1.4E+00	1.0E-03	RAGSE		
*Thiocyanates	NA																						5.8E+05	OTHER	4.7E+00	CRC89	3.0E-03	2.3E-01	5.4E-01	1.0E-03	RAGSE
*Thiocyanic Acid	463-56-9	5.9E+01	PHYSPROP				4.7E+00	PPRTV	5.0E+00	PPRTV	1.1E+00	PPRTV	1.2E-01	1.4E-05	EPA WATER9																
*Zinc Cyanide	557-21-1	1.2E+02	PHYSPROP						8.0E+01	PERRY	1.9E+00	CRC89																			
Cyclohexane	110-82-7	8.4E+01	PHYSPROP	6.1E+00	1.5E-01	PHYSPROP	9.7E+01	PHYSPROP	6.6E+00	PHYSPROP	7.7E-01	CRC89	8.0E-02	9.1E-06	EPA WATER9	1.5E+02	EPI	3.4E+00	PHYSPROP	5.5E+01	PHYSPROP	6.6E-01	3.1E-01	1.1E+00	1.0E-01	EPI					
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	5.1E+02	PHYSPROP	3.9E-05	9.6E-07	PHYSPROP	3.5E-06	PHYSPROP	2.0E+02	CRC89			3.0E-02	3.5E-06	EPA WATER9	2.8E+03	EPI	4.7E+00	PHYSPROP	5.5E-02	PHYSPROP	2.5E-02	7.9E+01	1.9E+02	2.8E-03	EPI					
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	108-94-1	9.8E+01	PHYSPROP	3.7E-04	9.0E-06	PHYSPROP	4.3E+00	PHYSPROP	-3.1E+01	PHYSPROP	9.5E-01	CRC89	7.7E-02	9.4E-06	EPA WATER9	1.7E+01	EPI	8.1E-01	PHYSPROP	2.5E+04	PHYSPROP	5.8E-03	3.7E-01	8.9E-01	1.5E-03	EPI					
Cyclohexene	110-83-8	8.2E+01	PHYSPROP	1.9E+00	4.6E-02	PHYSPROP	8.9E+01	PHYSPROP	-1.0E+02	PHYSPROP	8.1E-01	NIOSH	8.3E-02	9.5E-06	EPA WATER9	1.5E+02	EPI	2.9E+00	PHYSPROP	2.1E+02	PHYSPROP	1.5E-01	3.0E-01	7.3E-01	4.3E-02	EPI					
Cyclohexylamine	108-91-8	9.9E+01	PHYSPROP	1.7E-04	4.2E-06	PHYSPROP	1.0E+01	PHYSPROP	-1.8E+01	PHYSPROP	8.2E-01	CRC89	7.1E-02	8.5E-06	EPA WATER9	1.5E+00	EPI	1.5E+00	PHYSPROP	1.0E+06	PHYSPROP	1.6E-02	3.8E-01	9.1E-01	4.3E-03	EPI					
Cyfluthrin	68359-37-5	4.3E+02	PHYSPROP	1.2E-06	2.9E-08	EPI	1.5E-10	PHYSPROP	6.0E+01	PHYSPROP			3.3E-02	3.9E-06	EPA WATER9	1.3E+05	EPI	6.0E+00	PHYSPROP	3.0E-03	PHYSPROP	4.1E-01	2.8E+01	6.8E+01	5.2E-02	EPI					
Cyhalothrin	68085-85-8	4.5E+02	PHYSPROP	6.1E-05	1.5E-06	EPI	1.5E-09	EPI	4.9E+01	EPI			3.2E-02	3.8E-06	EPA WATER9	3.4E+05	EPI	6.9E+00	PHYSPROP	5.0E-03	PHYSPROP	1.7E+00	3.5E+01	1.4E+02	2.1E-01	EPI					
Cypermethrin	52315-07-8	4.2E+02	PHYSPROP	1.7E-05	4.2E-07	EPI	3.1E-09	PHYSPROP	8.1E+01	PHYSPROP	1.3E+00	CRC89	1.9E-02	4.7E-06	EPA WATER9	8.0E+04	EPI	6.6E+00	PHYSPROP	4.0E-03	PHYSPROP	6.0E-01	2.3E+01	9.1E+01	7.7E-02	EPI					
Cyromazine	17E-02	PHYSPROP	2.3E-12	5.7E-14	EPI	3.4E-09	PHYSPROP	2.2E+02	PHYSPROP				6.3E-02	7.3E-06	EPA WATER9	2.9E+01	EPI	6.1E-02	PHYSPROP	1.3E+04	PHYSPROP	4.0E-02	9.0E-01	2.2E+00	8.0E-04	EPI					
DDD	72-54-8	3.2E+02	PHYSPROP	2.7E-04	6.6E-06	PHYSPROP	1.4E-06	PHYSPROP	1.1E+02	PHYSPROP			4.1E-02	4.7E-06	EPA WATER9	1.2E+05	EPI	6.0E+00	PHYSPROP	9.0E-02	PHYSPROP	1.7E+00	6.5E+00	2.6E+01	2.5E-01	EPI					
DDE, p,p'-	72-55-9	3.2E+02	PHYSPROP	1.7E-03	4.2E-05	PHYSPROP	6.0E-06	EPI	8.9E+01	PHYSPROP	1.4E+00	LookChem	6.3E-02	5.9E-06	EPA WATER9	1.2E+05	EPI	6.5E+00	PHYSPROP	4.0E-02	PHYSPROP	3.7E+00	6.4E+00	2.7E+01	5.5E-01	EPI					
DDT	50-29-3	3.5E+02	PHYSPROP	3.4E-04	8.3E-06	PHYSPROP	1.6E-07	PHYSPROP	1.1E+02	PHYSPROP			3.8E-02	4.4E-06	EPA WATER9	1.7E+05	EPI	6.9E+00	PHYSPROP	5.5E-03	PHYSPROP	4.5E+00	1.0E+01	4.4E+01	6.3E-01	EPI					
Dalapon	75-99-0	1.4E+02	PHYSPROP	2.3E-06	5.7E-08	EPI	1.5E-01	EPI	-5.0E+00	PHYSPROP	1.4E+00	CRC89	6.0E-02	9.4E-06	EPA WATER9	3.2E+00	EPI	7.8E-01	PHYSPROP	5.0E+05	PHYSPROP	3.7E-03	6.6E-01	1.6E+00	8.2E-04	EPI					
Daminozide	1596-84-5	1.6E+02	PHYSPROP	1.7E-08	4.2E-10	EPI	2.0E-04	PHYSPROP	1.5E+02	PHYSPROP			1.5E-02	5.9E-06	EPA WATER9	1.0E+01	EPI	3.5E+00	PHYSPROP	1.0E+05	PHYSPROP	9.7E-05	8.3E-01	2.0E+00	2.0E-05	EPI					
Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'-(BDE-209)	1169-13-9	9.6E+02	PHYSPROP	4.9E-07	1.1E-08	PHYSPROP	4.7E-12	PHYSPROP	3.1E+02	PHYSPROP	3.0E+00	IRIS	1.9E-02	4.8E-06	EPA WATER9	2.8E+05	EPI	1.2E+01	PHYSPROP	1.0E+04	PHYSPROP	8.6E+00	2.5E+04	1.1E+05	7.3E-01	EPI					
Deceton	8065-48-3	5.2E+02	PHYSPROP	1.6E-04	3.8E-06	PHYSPROP	3.4E-04	PHYSPROP	1.1E+00	PHYSPROP			3.2E+00	3.8E-06	EPA WATER9	6.7E+02	PHYSPROP	6.7E+02	PHYSPROP	6.7E+02	PHYSPROP	8.6E-02	8.2E+01	2.0E+02	7.6E-03	RAGSE					
Di(2-ethylhexyl)adipate	103-23-1	3.7E+02	PHYSPROP	1.8E-05	4.3E-07	PHYSPROP	8.5E-07	PHYSPROP	-6.8E+01	PHYSPROP	9.2E-01	CRC89	1.7E-02	4.2E-06	EPA WATER9	3.6E+04	EPI	6.1E+00	PHYSPROP	7.8E-01	PHYSPROP	2.4E+01	1.3E+01	8.8E+01	3.2E+00	EPI					
Diallate	2303-16-4	2.7E+02	PHYSPROP	1.6E-04	3.8E-06	EPI	1.5E-04	PHYSPROP	2.5E+01	PHYSPROP			4.5E-02	5.3E-06	EPA WATER9	6.4E+02	EPI	4.5E+00	PHYSPROP	1.4E+01	PHYSPROP	2.9E+01	3.4E+00	5.2E+00	4.6E-02	EPI					
Diazinon	333-41-5	3.0E+02	PHYSPROP	4.6E-06	1.1E-07	PHYSPROP	9.0E-05	PHYSPROP	8.8E+01	EPI	1.1E+00	CRC89	2.1E-02	5.2E-06	EPA WATER9	3.0E+03	EPI	3.8E+00	PHYSPROP	4.0E+01	PHYSPROP	7.0E-02	5.3E+00	1.3E+01	1.0E-02	EPI					
Dibenzothioephene	132-65-0	1.8E+02	PHYSPROP	1.4E-03	3.4E-05	EPI	2.1E-04	EPI	9.7E+01	PHYSPROP	1.3E+00	ChemNet	3.6E-02	7.6E-06	EPA WATER9	9.2E+03	EPI	4.4E+00	PHYSPROP	1.5E+00	PHYSPROP	6.0E-01	1.1E+00	4.5E+00	1.2E-01	EPI					
Dibromo-3-chloropropane, 1,2-	96-12-8	2.4E+02	PHYSPROP	6.0E-03	1.5E-04	EPI	5.8E-01	PHYSPROP	6.0E+00	PHYSPROP	2.1E+00	CRC89	3.2E-02	8.9E-06	EPA WATER9	1.2E+02	EPI	3.0E+00	PHYSPROP	1.2E+03	PHYSPROP	4.1E-02	2.2E+00	5.3E+00	6.9E-03	EPI					
Dibromobenzene, 1,3-	108-36-1	2.4E+02	PHYSPROP	5.1E-02	1.2E-03	EPI	2.7E-01	PHYSPROP	-7.0E+00	PHYSPROP	2.0E+00	CRC89	3.1E-02	8.5E-06	EPA WATER9	3.8E+02	EPI	3.8E+00	PHYSPROP	6.8E+01	PHYSPROP	1.4E-01	2.2E+00	5.3E+00	2.3E-02	EPI					
Dibromobenzene, 1,4-	106-37-6	2.4E+02	PHYSPROP	3.7E-02	8.9E-04	EPI	5.8E-02	PHYSPROP	8.7E+01	PHYSPROP	2.3E+00	CRC89	3.3E-02	9.3E-06	EPA WATER9	3.8E+02	EPI	3.8E+00	PHYSPROP	2.0E+01	PHYSPROP	1.4E-01	2.2E+00	5.3E+00	2.5E-02	EPI					
Dibromochloromethane	124-48-1	2.1E+02	PHYSPROP	3.2E-02	7.8E-04	PHYSPROP	5.5E+00	PHYSPROP	-2.0E+01	PHYSPROP	2.5E+00	CRC89	3.7E-02	1.1E-05	EPA WATER9	3.2E+01	EPI	2.2E+00	PHYSPROP	2.7E+03	PHYSPROP	1.6E-02	1.5E+00	3.7E+00	2.9E-03	EPI					
Dibromomethane, 1,2-	106-93-4	1.9E+02	PHYSPROP	2.7E-02	6.5E-04	PHYSPROP	1.1E+01	PHYSPROP	9.9E+00	PHYSPROP	2.2E+00	CRC89	4.3E-02	1.0E-05	EPA WATER9	4.0E+01	EPI	2.0E+00	PHYSPROP	3.9E+03	PHYSPROP	1.5E-02	1.2E+00	2.8E+00	2.8E-03	EPI					
Dibromomethane (Methylene Bromide)	74-95-3	1.7E+02	PHYSPROP	3.4E-02	8.2E-04	PHYSPROP	4.4E+01	PHYSPROP	-5.3E+01	PHYSPROP	2.5E+00	CRC89	5.5E-02	1.2E-05	EPA WATER9	2.2E+01	EPI	1.7E+00	PHYSPROP	1.2E+04	PHYSPROP	1.1E-02	9.9E-01	2.4E+00	2.2E-03	EPI					
DiButyltin Compounds	NA																														
Dicamba	1918-00-9	2.2E+02	PHYSPROP	8.9E-08	2.2E-09	EPI	1.3E-05	PHYSPROP	1.2E+02	PHYSPROP	1.6E+00	CRC89	2.9E-02	7.8E-06	EPA WATER9	2.9E+01	EPI	2.2E+00	PHYSPROP	8.3E+03	PHYSPROP	1.5E-02	1.8E+00	4.4E+00	2.7E-03	EPI					
Dichloro-2-butene, cis-1,4-	764-41-0	1.3E+02	PHYSPROP	3.5E-01	8.5E-03	EPI	3.0E+00	EPI	3.5E+00	PHYSPROP	1.2E+00	LANGE	6.7E-02	9.3E-06	EPA WATER9	1.3E+02	EPI	2.6E+00	PHYSPROP	5.8E-02	PHYSPROP	7.1E-02	5.3E-01	1.3E+00	1.7E-02	EPI					
Dichloro-2-butene, trans-1,4-	1476-11-5	1.3E+02	PHYSPROP	2.7E-02	6.6E-04	EPI	4.1E+00	PHYSPROP	4.8E+01	PHYSPROP	1.2E+00	CRC89	6.6E-02	9.3E-06	EPA WATER9	1.3E+02	EPI	2.6E+00	PHYSPROP	5.8E-02	PHYSPROP	7.1E-02	5.3E-01	1.3E+00	1.7E-02	EPI					
Dichloro-2-butene, trans-1,4-	110-57-6	1.3E+02	PHYSPROP	2.7E-02	6.6E-04	EPI	4.1E+00	PHYSPROP	2.0E+00	PHYSPROP	1.2E+00	CRC89	6.6E-02	9.3E-06	EPA WATER9	1.3E+02	EPI	2.6E+00	PHYSPROP	5.8E-02	PHYSPROP	7.1E-02	5.3E-01	1.3E+00	1.7E-02	EPI					
Dichloroacetic Acid	79-43-6	1.3E+02	PHYSPROP	3.4E-07	8.4E-09	PHYSPROP	1.8E-01	PHYSPROP	1.4E+01	PHYSPROP	1.6E+00	CRC89	7.2E-02	1.1E-05	EPA WATER9	2.3E+00	EPI	9.2E-01	PHYSPROP	1.0E+06	PHYSPROP	5.3E-03	5.5E-01	1.3E+00	1.2E-03	EPI					
Dichlorobenzene, 1,2-	95-50-1	1.5E+02	PHYSPROP	7.8E-02	1.9E-03	PHYSPROP	1.4E+00	PHYSPROP	-1.7E+01	PHYSPROP	1.3E+00	CRC89	5.6E-02	8.9E-06	EPA WATER9	3.8E+02	EPI	3.4E+00	PHYSPROP	1.6E+02	PHYSPROP	2.1E+01	3.0E-01	1.7E+00	4.5E-02	EPI					
Dichlorobenzene, 1,4-	106-46-7	1.5E+02	PHYSPROP	9.9E-02	2.4E-03	PHYSPROP	1.7E+00	PHYSPROP	5.2E+01	PHYSPROP	1.2E+00	CRC89	5.5E-02	8.7E-06	EPA WATER9	3.8E+02	EPI	3.4E+00	PHYSPROP	8.1E+01	PHYSPROP	2.1E-01	7.0E-01	1.7E+00	4.5E-02	EPI					
Dichlorobenzidine, 3,3'-	91-94-1	2.5E+02	PHYSPROP	1.2E-09	2.8E-11	PHYSPROP	2.6E-07	PHYSPROP	1.3E+02	PHYSPROP	1.3E+00	ChemNet	4.7E-02	5.5E-06	EPA WATER9	3.2E+03	EPI	3.5E+00	PHYSPROP	3.1E+00	PHYSPROP	7.8E-02	2.8E+00	6.6E+00	1.3E-02	EPI					
Dichlorobenzophenone, 4,4'-	90-98-2	2.5E+02	PHYSPROP	4.4E-05	1.1E-06	PHYSPROP	6.4E-06	PHYSPROP	1.5E+02	PHYSPROP	1.5E+00	CRC89	2.6E-02	6.9E-06	EPA WATER9	2.9E+03	EPI	4.4E+00	PHYSPROP	8.3E-01	PHYSPROP</										

Contaminant		Molecular Weight		Volatility Parameters				Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients				Water Partition		Water Solubility		Tapwater Dermal Parameters					
Analyte	CAS No.	MW	MW Ref	H ¹ (unitless)	HLC (atm-m ³ /mole)	H ¹ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀₀ (cm ² /s)	D ₁₀₀₀ (cm ² /s)	K _{oc} (L/kg)	K _{oc} Ref	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	t _{1/2} (hr/vent)	t ⁺ (hr)	K _p (hr)	KPREF		
Glyphosate	1071-83-6	1.7E+02	PHYSPROP	8.6E-11	2.1E-12	EPI	9.8E-08	PHYSPROP	1.9E+02	PHYSPROP	1.6E+00	1.6E+00	6.2E-02	7.3E-06	EPA WATER	2.1E+03	USDA ARS	3.4E+00	PHYSPROP	1.1E+04	PHYSPROP	2.3E-07	9.3E-01	2.2E+00	4.5E-08	EPI			
Guanidine	113-00-8	5.9E+01	PHYSPROP	9.6E-01	2.3E-11	PHYSPROP	2.2E+00	PHYSPROP	5.0E+01	PHYSPROP	1.6E+00	GuideChem	1.4E+00	CR89	1.4E+00	1.6E+00	1.4E+00	1.2E+01	EPI	1.6E+00	PHYSPROP	1.8E+03	PHYSPROP	1.8E-04	2.3E-01	5.4E-01	6.0E-05	EPI	
Guanidine Chloride	50-01-1	9.6E+01	PHYSPROP	8.9E-17	2.2E-18	PHYSPROP	1.8E-06	PHYSPROP	1.8E+02	PHYSPROP	1.4E+00	CR89	1.4E+00	9.2E-02	1.2E-05	EPA WATER	3.6E+00	PHYSPROP	3.6E+00	PHYSPROP	1.0E+06	PHYSPROP	1.5E-07	3.6E-01	8.7E-01	3.9E-08	EPI		
Haloxypol, Methyl	6980-04-2	3.8E+02	PHYSPROP	1.3E-05	3.2E-07	EPI	6.0E-06	PHYSPROP	5.6E+01	PHYSPROP	1.6E+00	1.6E+00	3.6E-02	4.3E-06	EPA WATER	5.5E+03	EPI	4.1E+00	PHYSPROP	9.3E+00	PHYSPROP	4.5E-02	1.3E+01	3.2E+01	6.0E-03	EPI			
Heptachlor	76-44-8	3.7E+02	PHYSPROP	1.2E-02	2.9E-04	PHYSPROP	4.0E-04	PHYSPROP	9.6E+01	PHYSPROP	1.6E+00	CR89	1.6E+00	2.2E-02	5.7E-06	EPA WATER	4.1E+04	EPI	6.1E+00	PHYSPROP	1.8E-01	PHYSPROP	1.1E+00	1.3E+01	5.0E+01	1.4E-01	EPI		
Heptachlor Epoxide	1024-57-3	3.9E+02	PHYSPROP	8.6E-04	2.1E-05	PHYSPROP	2.0E-05	PHYSPROP	1.6E+02	PHYSPROP	1.9E+00	LookChem	1.9E+00	2.4E-02	6.2E-06	EPA WATER	1.0E+04	EPI	5.0E+00	PHYSPROP	2.0E-01	PHYSPROP	1.6E+01	1.6E+01	3.8E+01	2.1E-02	EPI		
Hexabromobenzene	87-82-1	5.5E+02	PHYSPROP	1.1E-03	2.8E-05	PHYSPROP	1.6E-08	PHYSPROP	3.3E+02	PHYSPROP	3.0E+00	LookChem	3.0E+00	2.5E-02	6.6E-06	EPA WATER	2.8E+03	EPI	6.1E+00	PHYSPROP	1.6E-04	PHYSPROP	1.2E-01	1.3E+02	3.1E+02	1.4E-02	EPI		
Hexabromodiphenyl ether, 2,2',4,4',5,5'-(BDE-153)	68631-49-2	6.4E+02	OTHER				5.8E-06	IRIS					2.5E-02	3.0E-06	EPA WATER					9.0E-04	IRIS			4.2E+02	1.0E+03				
Hexachlorobenzene	118-74-1	2.8E+02	PHYSPROP	7.0E-02	1.7E-03	PHYSPROP	1.8E-05	PHYSPROP	2.3E+02	PHYSPROP	2.0E+00	CR89	2.0E+00	4.3E-02	7.8E-06	EPA WATER	6.2E+03	EPI	5.7E+00	PHYSPROP	6.2E-03	PHYSPROP	1.6E+00	4.1E+00	1.7E+01	2.5E-01	EPI		
Hexachlorobutadiene	87-68-3	2.6E+02	PHYSPROP	4.2E-01	1.0E-02	PHYSPROP	2.2E-01	PHYSPROP	2.1E+01	PHYSPROP	1.6E+00	CR89	1.6E+00	2.7E-02	7.0E-06	EPA WATER	8.5E+02	EPI	4.8E+00	PHYSPROP	3.2E+00	PHYSPROP	5.0E-01	3.0E+00	7.3E+00	8.1E-02	EPI		
Hexachlorocyclohexane, Alpha-	319-84-6	2.9E+02	PHYSPROP	2.7E-04	6.7E-06	PHYSPROP	3.5E-05	EPI	1.6E+02	PHYSPROP			2.7E-02	5.1E-06	EPA WATER	2.8E+03	EPI	3.8E+00	PHYSPROP	2.0E+00	PHYSPROP	1.4E-01	4.5E+00	1.1E+01	2.1E-02	EPI			
Hexachlorocyclohexane, Beta-	319-85-7	2.9E+02	PHYSPROP	1.8E-05	4.4E-07	PHYSPROP	3.6E-07	PHYSPROP	3.1E+02	PHYSPROP	1.9E+00	CR89	1.9E+00	2.8E-02	7.4E-06	EPA WATER	2.8E+03	EPI	3.8E+00	PHYSPROP	2.4E-01	PHYSPROP	1.4E-01	4.5E+00	1.1E+01	2.1E-02	EPI		
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	2.9E+02	PHYSPROP	2.1E-04	5.1E-06	PHYSPROP	4.2E-05	PHYSPROP	1.1E+02	PHYSPROP			4.3E-02	5.1E-06	EPA WATER	2.8E+03	EPI	3.7E+00	PHYSPROP	7.3E+00	PHYSPROP	1.4E-01	4.5E+00	1.1E+01	2.1E-02	EPI			
Hexachlorocyclohexane, Technical	608-73-1	2.9E+02	PHYSPROP	2.1E-04	5.1E-06	EPI	3.5E-05	EPI	1.1E+02	EPI			4.3E-02	5.1E-06	EPA WATER	2.8E+03	EPI	4.1E+00	EPI	8.0E+00	PHYSPROP	1.4E-01	4.5E+00	1.1E+01	2.1E-02	EPI			
Hexachlorocyclopentadiene	77-47-4	2.7E+02	PHYSPROP	1.1E+00	2.7E-02	PHYSPROP	6.0E-02	PHYSPROP	-9.0E+00	PHYSPROP	1.7E+00	CR89	1.7E+00	2.7E-02	7.2E-06	EPA WATER	1.4E+03	EPI	5.0E+00	PHYSPROP	1.8E+00	PHYSPROP	6.5E-01	3.5E+00	1.4E+01	1.0E-01	EPI		
Hexachloroethane	67-72-1	2.4E+02	PHYSPROP	1.6E-01	3.9E-03	PHYSPROP	2.1E-01	PHYSPROP	1.9E+02	PHYSPROP	2.1E+00	CR89	2.1E+00	3.2E-02	8.9E-06	EPA WATER	2.0E+02	EPI	4.1E+00	PHYSPROP	5.0E+01	PHYSPROP	2.5E+00	2.2E+00	5.9E+00	4.2E-02	EPI		
Hexachlorophene	70-30-4	4.1E+02	PHYSPROP	2.2E-11	5.5E-13	PHYSPROP	1.0E-10	PHYSPROP	1.7E+02	PHYSPROP			3.5E-02	4.0E-06	EPA WATER	6.7E+05	EPI	7.5E+00	PHYSPROP	1.4E+02	PHYSPROP	6.5E+00	2.0E+01	8.3E+01	8.4E-01	EPI			
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	2.2E+02	PHYSPROP	8.2E-10	2.0E-11	EPI	4.1E-09	EPI	2.1E+02	PHYSPROP	1.8E+00	CR89	1.8E+00	3.1E-02	8.5E-06	EPA WATER	8.9E+01	EPI	8.7E-01	PHYSPROP	6.0E+01	PHYSPROP	1.9E-03	1.8E+00	4.4E+00	3.4E-04	EPI		
Hexamethylene Disiscyanate, 1,6-	822-00-6	1.7E+02	PHYSPROP	2.0E-03	4.8E-05	PHYSPROP	2.0E-02	PHYSPROP	-6.7E+01	PHYSPROP	1.1E+00	CR89	1.1E+00	4.0E-02	7.2E-06	EPA WATER	4.8E+03	EPI	3.2E+00	PHYSPROP	1.2E+02	PHYSPROP	1.2E-01	9.2E-01	2.2E+00	2.4E-02	EPI		
Hexamethylphosphoramide	680-31-9	1.8E+02	PHYSPROP	8.2E-07	2.0E-08	PHYSPROP	4.6E-02	PHYSPROP	7.2E+00	PHYSPROP	1.0E+00	CR89	1.0E+00	3.5E-02	6.9E-06	EPA WATER	1.0E+01	EPI	2.8E-01	PHYSPROP	1.0E+06	PHYSPROP	1.2E-03	1.1E+00	2.5E+00	2.4E-04	EPI		
Hexane, N	110-54-3	8.6E+01	PHYSPROP	7.4E-01	1.8E-00	EPI	1.5E+02	PHYSPROP	-9.5E+01	PHYSPROP	6.6E-01	CR89	6.6E-01	7.3E-02	8.2E-06	EPA WATER	1.3E+02	EPI	3.9E+00	PHYSPROP	9.5E+00	PHYSPROP	7.2E-01	3.2E-01	1.2E+00	2.0E-01	EPI		
Hexanedioic Acid	124-04-9	1.5E+02	PHYSPROP	1.9E-10	4.7E-12	EPI	3.2E-07	EPI	1.5E+02	PHYSPROP	1.4E+00	CR89	1.4E+00	5.8E-02	9.2E-06	EPA WATER	2.4E+01	EPI	8.0E-02	PHYSPROP	3.1E+04	PHYSPROP	1.2E-03	6.9E-01	1.7E+00	2.7E-04	EPI		
Hexanone, 2-	591-78-6	1.0E+02	PHYSPROP	3.8E-03	9.3E-05	EPI	1.2E-01	PHYSPROP	-5.6E+01	PHYSPROP	8.1E-01	CR89	8.1E-01	7.0E-02	8.4E-06	EPA WATER	1.5E+01	EPI	1.4E+00	PHYSPROP	1.7E+04	PHYSPROP	1.4E-02	3.8E-01	9.2E-01	3.6E-03	EPI		
Hexazone	51235-04-2	2.5E+02	PHYSPROP	9.2E-07	2.3E-12	EPI	2.3E-07	EPI	1.2E+02	PHYSPROP	1.3E+00	CR89	1.3E+00	2.5E-02	6.3E-06	EPA WATER	1.3E+02	EPI	1.9E+00	PHYSPROP	3.3E+04	PHYSPROP	6.2E-03	2.7E+00	6.5E+00	1.0E-03	EPI		
Hexythiazox	78587-05-0	3.5E+02	PHYSPROP	9.7E-07	2.4E-08	EPI	2.6E-08	PHYSPROP	1.1E+02	PHYSPROP			3.8E-02	4.4E-06	EPA WATER	2.1E+03	EPI	5.6E+00	PHYSPROP	5.0E-01	PHYSPROP	6.0E-01	1.0E+01	2.4E+01	8.3E-02	EPI			
Hydramethylnon	67485-29-4	4.9E+02	PHYSPROP	9.0E-05	2.2E-06	EPI	2.0E-08	PHYSPROP	1.9E+02	PHYSPROP			3.0E-02	3.6E-06	EPA WATER	1.8E+08	EPI	2.3E+00	PHYSPROP	6.0E-03	PHYSPROP	7.6E-04	6.2E+01	1.5E+02	9.0E-05	EPI			
Hydrazine	302-01-2	3.2E+01	PHYSPROP	2.5E-05	6.1E-07	PubChem	1.4E+01	PHYSPROP	2.0E+00	PHYSPROP	1.0E+00	CR89	1.0E+00	1.7E-01	1.9E-05	EPA WATER			2.1E+00	PHYSPROP	1.0E+06	PHYSPROP	9.5E-05	1.6E-01	3.8E-01	4.4E-05	RAGSE		
Hydrazine Sulfate	10034-93-2	1.3E+02	EPI						2.5E+02	CR89	1.4E+00	CR89	1.4E+00						3.1E+04	PERRY			4.4E-03	5.5E-01	3.8E+01	1.0E-03	RAGSE		
Hydrogen Chloride	7647-01-0	3.5E+01	EPI	8.3E-07	2.0E-06	Toxnet HSDB	3.5E+04	PubChem	-1.1E+02	CR89	1.5E+00	CR89	1.5E+00	1.9E-01	2.3E-05	EPA WATER			6.7E+05	Toxnet HSDB	2.3E-03	1.7E-01	4.0E-01	1.0E-03	RAGSE				
Hydrogen Fluoride	7664-39-3	2.0E+01	PHYSPROP	4.3E-03	1.0E-04	PHYSPROP	9.2E-02	PHYSPROP	-8.4E+01	PHYSPROP	8.2E-01	CR89	8.2E-01	2.2E-01	2.2E-05	EPA WATER			1.0E+06	PHYSPROP	3.7E+03	PHYSPROP	1.7E-03	1.4E-01	3.3E-01	1.0E-03	RAGSE		
Hydrogen Sulfide	7783-06-4	3.4E+01	PHYSPROP	3.5E-01	8.6E-03	PhysProp	1.6E+04	PHYSPROP	-8.5E+01	PHYSPROP	1.4E+00	CR89	1.4E+00	1.9E-01	2.2E-05	EPA WATER			3.7E+03	PHYSPROP	2.2E-03	1.6E-01	3.9E-01	1.0E-03	RAGSE				
Hydroquinone	123-31-9	1.1E+02	PHYSPROP	1.9E-09	4.7E-11	EPI	2.4E-05	EPI	1.7E+02	PHYSPROP	1.3E+00	CR89	1.3E+00	8.0E-02	1.1E-05	EPA WATER	2.4E+02	EPI	5.9E-01	PHYSPROP	7.2E+04	PHYSPROP	3.8E-03	4.3E-01	1.0E+00	9.3E-04	EPI		
Imazali	35554-44-0	3.0E+02	PHYSPROP	1.1E-07	2.6E-09	EPI	1.2E-06	PHYSPROP	5.																				

Contaminant		Molecular Weight		Volatility Parameters				Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients			Water Partition		Water Solubility		Tapwater Dermal Parameters							
Analyte	CAS No.	MW	MW Ref	H ¹ (unitless)	HLC (atm·m ³ /mole)	H ¹ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀₀ (cm ² /s)	D ₁₀₀₀ (cm ² /s)	K _{oc} (L/kg)	K _{oc} Ref	K _{oc} (L/kg)	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	t _{1/2} (hr)	t [†] (hr)	K _p (cm/hr)	KPREF		
Methyl Acetate	79-20-9	74.08	PHYSPROP	4.7E-03	1.2E-04	PHYSPROP	2.2E+02	PHYSPROP	-9.8E+01	PHYSPROP	9.3E-01	CRCB9	9.6E-02	1.1E-05	EPA WATER9	3.1E+00	EPI	1.8E-01	PHYSPROP	2.4E+05	PHYSPROP	2.6E-03	2.7E-01	6.6E-01	7.9E-04	EPI				
Methyl Acrylate	96-33-3	86.09	PHYSPROP	8.7E-01	2.0E-04	EPI	8.7E+01	PHYSPROP	-7.7E+01	PHYSPROP	9.5E-01	CRCB9	8.6E-02	1.0E-05	EPA WATER9	5.8E+00	EPI	8.0E-01	PHYSPROP	4.9E+04	PHYSPROP	6.2E-03	3.2E-01	7.7E-01	1.8E-03	EPI				
Methyl Ethyl Ketone (2-Butanone)	78-93-3	72.10	PHYSPROP	2.3E-03	5.7E-05	PHYSPROP	9.1E+01	PHYSPROP	-8.7E+01	PHYSPROP	8.0E-01	CRCB9	9.1E-02	1.0E-05	EPA WATER9	4.5E+00	EPI	2.9E-01	PHYSPROP	2.2E+05	PHYSPROP	3.1E-03	2.7E-01	6.4E-01	9.6E-04	EPI				
Methyl Hydrazine	60-34-4	46.08	PHYSPROP	1.2E-04	3.0E-06	PHYSPROP	5.0E+01	PHYSPROP	-5.2E+01	PHYSPROP	8.7E-01	LANGE	1.3E-01	1.4E-05	EPA WATER9	1.3E+01	EPI	1.1E+00	PHYSPROP	1.0E+06	PHYSPROP	4.5E-04	1.9E-01	6.4E-01	1.7E-04	EPI				
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	102.15	PHYSPROP	5.6E-03	1.4E-04	EPI	2.0E+01	PHYSPROP	-8.4E+01	PHYSPROP	8.0E-01	CRCB9	7.0E-02	8.3E-06	EPA WATER9	1.3E+01	EPI	1.3E+00	PHYSPROP	1.9E+04	PHYSPROP	1.2E-02	3.8E-01	9.2E-01	3.2E-03	EPI				
Methyl Isocyanate	624-83-9	57.07	PHYSPROP	3.8E-02	9.3E-04	PHYSPROP	3.5E+02	PHYSPROP	-4.5E+01	PHYSPROP	9.6E-01	CRCB9	1.2E-01	1.3E-05	EPA WATER9	4.0E+01	EPI	7.9E-01	PHYSPROP	2.9E+04	PHYSPROP	7.3E-03	2.2E-01	5.3E-01	2.5E-03	EPI				
Methyl Methacrylate	96-62-6	100.12	PHYSPROP	1.3E-02	3.2E-04	EPI	3.9E+01	PHYSPROP	-4.8E+01	PHYSPROP	9.4E-01	CRCB9	7.5E-02	9.2E-06	EPA WATER9	9.1E+00	EPI	1.4E+00	PHYSPROP	1.5E+04	PHYSPROP	1.4E-02	3.8E-01	9.2E-01	3.6E-03	EPI				
Methyl Parathion	298-00-0	265.54	PHYSPROP	4.1E-06	1.0E-07	PHYSPROP	3.5E+06	PHYSPROP	3.6E+01	PHYSPROP	1.4E+00	CRCB9	2.5E-02	6.4E-06	EPA WATER9	7.3E+02	EPI	2.9E+00	PHYSPROP	3.8E+01	PHYSPROP	2.6E-02	3.1E+00	7.5E+00	4.2E-03	EPI				
Methyl Phosphonic Acid	993-13-5	96.04	PHYSPROP	5.0E-03	1.2E-11	PHYSPROP	3.3E-04	EPI	1.1E+02	PHYSPROP	1.1E-02	PHYSPROP	1.1E-02	1.1E-05	EPA WATER9	1.4E+00	EPI	7.0E-01	PHYSPROP	2.0E+04	PHYSPROP	3.7E-04	3.6E-01	8.7E-01	9.8E-05	EPI				
Methyl Styrene (Mixed Isomers)	25013-15-4	3.5E+02	PHYSPROP	1.1E-01	2.6E-03	PHYSPROP	1.5E+00	PHYSPROP	-8.6E+01	EPI	8.9E-01	HSDB	1.7E-02	4.2E-06	EPA WATER9	7.2E+02	EPI	3.4E+00	PHYSPROP	8.9E+01	PHYSPROP	4.8E-01	1.0E+01	2.4E+01	6.6E-02	EPI				
Methyl methanesulfonate	66-27-3	1.1E+02	PHYSPROP	1.6E-04	4.0E-06	PHYSPROP	3.1E-01	PHYSPROP	2.0E+01	PHYSPROP	1.3E+00	CRCB9	7.9E-02	1.1E-05	EPA WATER9	4.3E+00	EPI	-6.6E-01	PHYSPROP	2.0E+05	LANGE	5.6E-04	4.4E-01	1.0E+00	1.4E-04	EPI				
Methyl tert-Butyl Ether (MTBE)	1634-04-4	8.8E+01	PHYSPROP	2.4E-02	5.9E-04	PHYSPROP	2.5E+02	PHYSPROP	-1.1E+02	PHYSPROP	7.4E-01	CRCB9	7.5E-02	8.6E-06	EPA WATER9	1.2E+01	EPI	9.4E-01	PHYSPROP	5.1E+04	PHYSPROP	2.9E-03	3.3E-01	7.9E-01	2.1E-03	EPI				
Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	2.0E+02	PHYSPROP	2.6E-16	6.4E-18	PHYSPROP	4.1E-12	PHYSPROP	2.4E+02	EPI			5.6E-02	6.6E-06	EPA WATER9	2.0E+02	EPI	2.1E+00	PHYSPROP	1.0E+06	PHYSPROP	7.6E-05	1.3E+00	3.1E+00	5.4E-06	EPI				
Methyl-5-Nitroaniline, 2-	99-55-8	1.5E+02	PHYSPROP	3.4E-07	8.3E-09	PHYSPROP	9.8E-04	PHYSPROP	1.1E+02	PHYSPROP			6.7E-02	7.8E-06	EPA WATER9	1.8E+02	EPI	1.9E+00	PHYSPROP	1.0E+04	PHYSPROP	1.8E-02	7.5E-01	1.8E+00	3.8E-03	EPI				
Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	1.5E+02	PHYSPROP	5.0E-11	1.2E-12	PHYSPROP	1.2E-04	PHYSPROP	1.2E+02	EPI			6.8E-02	8.0E-06	EPA WATER9	7.2E+01	EPI	9.2E-01	PHYSPROP	2.7E+05	PHYSPROP	7.4E-04	7.0E-01	1.7E+00	5.7E-05	EPI				
Methylaniline Hydrochloride, 2-	636-21-5	1.4E+02	PHYSPROP	8.6E-05	2.1E-06	PHYSPROP	2.9E-01	PHYSPROP	2.2E+02	PHYSPROP			6.9E-02	8.1E-06	EPA WATER9	1.2E+02	EPI	1.6E+00	PHYSPROP	8.3E+03	PHYSPROP	4.8E-05	6.7E-01	1.6E+00	1.1E-05	EPI				
Methylarsonic acid	124-58-3	1.4E+02	PHYSPROP				1.6E-03	PHYSPROP	1.6E+02	PHYSPROP			7.0E-02	8.2E-06	EPA WATER9	4.4E+01	EPI	-1.2E+00	PHYSPROP	2.6E+05	PHYSPROP	1.9E-04	6.4E-01	1.5E+00	4.2E-05	EPI				
Methylbenzene, 1,4-diamine monohydrochloride, 2-	74612-12-7	1.6E+02	OTHER										6.5E-02	7.6E-06	EPA WATER9									8.1E-01	2.0E+00					
Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	2.2E+02	OTHER										5.2E-02	6.1E-06	EPA WATER9									1.8E+00	4.3E+00					
Methylcholanthrene, 3-	56-49-5	2.7E+02	PHYSPROP	2.1E-04	5.2E-06	EPI	4.3E-08	EPI	1.8E+02	PHYSPROP	1.3E+00	CRCB9	2.4E-02	6.1E-06	EPA WATER9	9.6E+05	EPI	6.4E+00	PHYSPROP	2.9E-03	PHYSPROP	5.7E+00	3.3E+00	1.5E+01	9.0E-01	EPI				
Methylene Chloride	75-09-2	85.49	PHYSPROP	1.3E-01	3.3E-03	PHYSPROP	4.4E+02	PHYSPROP	-9.5E+01	PHYSPROP	1.3E+00	CRCB9	1.0E-01	1.3E-05	EPA WATER9	2.2E+01	EPI	1.3E+00	PHYSPROP	1.3E+04	PHYSPROP	1.3E-02	3.1E-01	7.5E-01	3.5E-03	EPI				
Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	2.7E+02	PHYSPROP	1.7E-09	4.1E-11	PHYSPROP	2.9E-07	PHYSPROP	1.1E+02	PHYSPROP			4.6E-02	5.4E-06	EPA WATER9	5.7E+03	EPI	3.9E+00	PHYSPROP	1.4E-01	PHYSPROP	1.2E-01	3.8E-01	7.9E+00	2.0E-02	EPI				
Methylene-bis(N,N-dimethyl) Aniline, 4,4'	101-61-1	2.5E+02	PHYSPROP	4.4E-08	1.1E-09	PHYSPROP	1.8E-05	PHYSPROP	9.2E+01	PHYSPROP			4.7E-02	5.5E-06	EPA WATER9	2.7E+03	EPI	4.4E+00	PHYSPROP	4.1E+00	PHYSPROP	5.2E-01	2.8E+00	6.7E+00	8.4E-02	RAGSE				
Methylenedisbenzennamine, 4,4'-	101-77-9	2.0E+02	PHYSPROP	2.2E-09	5.3E-11	PHYSPROP	2.0E-07	PHYSPROP	9.3E+01	PHYSPROP			5.6E-02	6.5E-06	EPA WATER9	2.1E+03	EPI	1.6E+00	PHYSPROP	1.0E+03	PHYSPROP	7.3E-03	1.4E+00	3.3E+00	1.4E-03	EPI				
Methylenediphenyl Diisocyanate	101-68-8	2.5E+02	PHYSPROP	3.7E-05	9.0E-07	PHYSPROP	5.0E-06	PHYSPROP	3.8E+01	PHYSPROP	1.2E+00	CRCB9	2.4E-02	6.2E-06	EPA WATER9	2.8E+05	EPI	5.2E+00	PHYSPROP	8.3E-01	PHYSPROP	1.1E+00	2.7E+00	1.0E+01	1.8E-01	EPI				
Methylstyrene, Alpha	98-83-9	1.2E+02	PHYSPROP	1.0E-01	2.6E-03	EPI	1.9E+00	EPI	-2.3E+01	PHYSPROP	9.1E-01	CRCB9	6.3E-02	8.2E-06	EPA WATER9	7.0E+02	EPI	3.5E+00	PHYSPROP	1.2E+02	PHYSPROP	2.9E-01	4.8E+00	1.2E+00	7.0E-02	EPI				
Metolachlor	51218-45-2	2.8E+02	PHYSPROP	3.7E-07	9.0E-09	PHYSPROP	3.1E-05	PHYSPROP	-6.2E+01	PHYSPROP	1.1E+00	CRCB9	2.2E-02	5.5E-06	EPA WATER9	4.9E+02	EPI	3.1E+00	PHYSPROP	5.3E+02	PHYSPROP	2.2E-02	4.1E+00	9.8E+00	3.4E-03	EPI				
Metribuzin	21087-64-6	2.1E+02	PHYSPROP	4.8E-09	1.2E-10	EPI	4.4E-07	PHYSPROP	1.3E+02	PHYSPROP	1.3E+00	CRCB9	2.7E-02	7.1E-06	EPA WATER9	5.3E+01	EPI	1.7E+00	PHYSPROP	1.1E+03	PHYSPROP	2.7E-04	1.7E+00	4.0E+00	1.3E-03	EPI				
Methylfuron-methyl	74223-64-6	3.8E+02	PHYSPROP	5.4E-15	1.3E-16	EPI	2.5E-12	PHYSPROP	1.6E+02	PHYSPROP			3.6E-02	4.2E-06	EPA WATER9	9.3E+01	EPI	2.2E+00	PHYSPROP	9.5E+03	PHYSPROP	2.5E-03	1.4E+01	3.4E+01	3.3E-04	EPI				
Mineral oils	80021-95-1	1.7E+02	EPI	3.3E+02	8.2E+00	EPI	1.4E-01	EPI	-9.6E+00	EPI	8.8E-01	ChemNet	3.6E-02	6.4E-06	EPA WATER9	4.8E+03	EPI	6.1E+00	EPI	3.7E-03	EPI	9.8E+00	9.5E-01	4.3E+00	2.0E+00	EPI				
Mirex	2385-85-5	5.5E+02	PHYSPROP	3.3E-02	8.1E-04	PHYSPROP	8.0E-07	PHYSPROP	4.9E+02	CRCB9	2.3E+00	ChemNet	2.2E-02	5.6E-06	EPA WATER9	3.6E+05	EPI	6.9E+00	PHYSPROP	8.5E-02	PHYSPROP	4.6E-01	1.2E+02	2.9E+02	5.2E-02	EPI				
Molinate	2212-67-1	1.9E+02	PHYSPROP	1.7E-04	4.1E-06	PHYSPROP	5.6E-03	PHYSPROP	7.0E+01	EPI	1.1E+00	CRCB9	3.2E-02	6.8E-06	EPA WATER9	1.8E+02	EPI	3.2E+00	PHYSPROP	9.7E+02	PHYSPROP	9.9E-02	1.2E+00	2.8E+00	1.9E-02	EPI				
Molybdenum	7439-98-7	9.6E+01	EPI				0.0E+00	NIOSH	2.6E+03	PHYSPROP	1.0E+01	CRCB9				2.0E+01	BAES							3.8						

Contaminant		Molecular Weight		Volatility Parameters				Melting Point		Density		Diffusivity in Air and Water		Soil Partition Coefficients		Water Partition		Water Solubility		Tapwater Dermal Parameters									
Analyte	CAS No.	MW	MW Ref	H ¹ (unitless)	HLC (atm-m ³ /mole)	H ¹ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀ (cm ² /s)	D ₁₀ and D ₁₀ Ref	K ₀ (L/kg)	K ₀ Ref	K _{oc} (L/kg)	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	T _{event} (hr/event)	t ¹ (hr)	K _p	KPEF	
Oxyfluorfen	42874-03-3	3.6E+02	PHYSPROP	3.4E-05	8.2E-07	EPI	2.0E-07	PHYSPROP	8.4E+01	PHYSPROP	1.4E+00	CRCB9	2.1E-02	5.3E-06	EPA WATER9			4.0E+04	EPI	4.7E+00	PHYSPROP	1.2E-01	PHYSPROP	1.5E-01	1.1E+01	2.7E+01	2.0E-02	EPI	
Paclobutrazol	76738-62-0	2.9E+02	PHYSPROP	3.4E-09	8.3E-11	EPI	7.5E-09	PHYSPROP	1.7E+02	PHYSPROP	1.2E+00	CRCB9	2.2E-02	5.7E-06	EPA WATER9			9.2E+02	EPI	3.2E+00	PHYSPROP	2.6E+01	PHYSPROP	3.1E-02	4.6E+00	1.1E+01	4.7E-03	EPI	
Paraquat Dichloride	1910-42-5	2.6E+02	PHYSPROP	1.3E-11	3.2E-13	PHYSPROP	7.5E-08	PHYSPROP	3.0E+02	EPI	1.3E+00	CRCB9	4.7E-02	5.5E-06	EPA WATER9			6.8E+03	EPI	4.5E+00	PHYSPROP	6.2E+05	PHYSPROP	3.6E-07	2.9E+00	7.0E+00	5.8E-08	EPI	
Parathion	56-38-2	2.9E+02	PHYSPROP	1.2E-05	3.0E-07	PHYSPROP	6.7E-06	PHYSPROP	6.1E+00	PHYSPROP	1.3E+00	CRCB9	2.3E-02	5.8E-06	EPA WATER9			2.4E+03	EPI	3.8E+00	PHYSPROP	1.1E+01	PHYSPROP	8.4E-02	4.5E+00	1.1E+01	1.3E-02	EPI	
Pebutate	1114-71-2	2.0E+02	PHYSPROP	9.7E-03	2.4E-04	EPI	8.9E-02	PHYSPROP	7.1E+01	EPI	9.5E-01	CRCB9	2.4E-02	6.1E-06	EPA WATER9			3.0E+02	EPI	3.8E+00	PHYSPROP	1.0E+02	PHYSPROP	2.2E-01	1.4E+00	3.5E+00	4.0E-02	EPI	
Pendimethalin	40487-42-1	2.8E+02	PHYSPROP	3.5E-05	8.6E-07	EPI	1.5E-05	PHYSPROP	5.6E+01	PHYSPROP	1.2E+00	CRCB9	2.3E-02	5.7E-06	EPA WATER9			5.6E+03	EPI	5.2E+00	PHYSPROP	3.3E+01	PHYSPROP	7.4E-01	4.0E+00	1.5E+01	1.2E-01	EPI	
Pentabromodiphenyl Ether	32534-81-9	5.6E+02	PHYSPROP	4.4E-03	1.1E-04	PHYSPROP	3.1E-08	EPI	5.0E+00	PHYSPROP	2.3E+00	IRIS	2.8E-02	3.2E-06	EPA WATER9			2.2E+04	EPI	6.8E+00	PHYSPROP	2.4E-03	PHYSPROP	3.4E-01	1.5E+02	3.7E+02	3.7E-02	EPI	
Pentabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-99)	60348-60-9	5.6E+02	PHYSPROP	4.4E-03	1.2E-06	PHYSPROP	3.1E-08	EPI	5.0E+00	EPI	2.3E+00	IRIS	2.2E-02	5.6E-06	EPA WATER9			2.2E+04	EPI	7.7E+00	PHYSPROP	7.9E-05	PHYSPROP	3.4E-01	1.5E+02	3.7E+02	3.7E-02	EPI	
Pentachlorobenzene	608-93-5	2.5E+02	PHYSPROP	2.9E-02	7.0E-04	PHYSPROP	1.0E-03	EPI	8.6E+01	PHYSPROP	1.8E+00	CRCB9	2.9E-02	7.9E-06	EPA WATER9			3.7E+03	EPI	5.2E+00	PHYSPROP	8.3E-01	PHYSPROP	1.0E+00	2.7E+00	1.0E+01	1.7E-01	EPI	
Pentachloroethane	76-01-7	2.0E+02	PHYSPROP	7.9E-02	1.9E-03	EPI	3.5E+00	PHYSPROP	2.9E+01	PHYSPROP	1.7E+00	CRCB9	3.2E-02	8.6E-06	EPA WATER9			1.4E+02	EPI	3.2E+00	PHYSPROP	4.9E+02	PHYSPROP	8.6E-02	1.4E+00	3.4E+00	1.6E-02	EPI	
Pentachloronitrobenzene	82-68-8	3.0E+02	PHYSPROP	1.8E-03	4.4E-05	EPI	5.0E-05	PHYSPROP	1.4E+02	PHYSPROP	1.7E+00	CRCB9	2.6E-02	6.9E-06	EPA WATER9			6.0E+03	EPI	4.6E+00	PHYSPROP	4.4E-01	PHYSPROP	2.8E-01	4.7E+00	1.1E+01	4.2E-02	EPI	
Pentachlorophenol	87-86-5	2.7E+02	PHYSPROP	1.0E-06	2.5E-08	PHYSPROP	1.1E-04	PHYSPROP	1.7E+02	PHYSPROP	2.0E+00	CRCB9	3.0E-02	8.0E-06	EPA WATER9			5.0E+03	EPI	5.1E+00	PHYSPROP	1.4E+01	PHYSPROP	8.0E-01	3.2E+00	1.3E+01	1.3E-01	EPI	
Pentaerythritol tetranitrate (PETN)	78-11-5	3.2E+02	PHYSPROP	5.4E-08	1.3E-09	PHYSPROP	5.5E-09	EPI	1.4E+02	PHYSPROP	1.8E+00	CRCB9	2.6E-02	6.8E-06	EPA WATER9			6.5E+02	EPI	2.4E+00	PHYSPROP	4.3E+01	PHYSPROP	6.9E-03	6.3E+00	1.5E+01	1.0E-03	EPI	
Pentane, n-	109-66-0	7.2E+01	PHYSPROP	5.1E+01	1.3E+00	PHYSPROP	5.1E+02	PHYSPROP	-1.3E+02	PHYSPROP	6.3E-01	CRCB9	8.2E-02	8.8E-06	EPA WATER9			7.2E+01	EPI	3.4E+00	PHYSPROP	3.8E+01	PHYSPROP	3.6E-01	2.7E-01	6.4E-01	1.1E-01	EPI	
Perchlorates																													
~Ammonium Perchlorate	7790-98-9	1.2E+02	PHYSPROP								2.0E+00	CRCB9																	
~Lithium Perchlorate	7791-03-9	1.1E+02	CRCB9								2.4E+00	CRCB9																	
~Perchlorate and Perchlorate Salts	14797-73-0	1.2E+02	CRCB9								2.4E+02	CRCB9																	
~Potassium Perchlorate	7778-74-7	1.4E+02	PHYSPROP								5.3E+02	PHYSPROP																	
~Sodium Perchlorate	7601-89-0	1.2E+02	PHYSPROP								4.8E+02	EPI																	
~Perfluorobutane Sulfonate	373-73-5	3.0E+02	PHYSPROP	5.9E-04	1.4E-05	PHYSPROP	5.2E-02	PHYSPROP	3.7E+01	EPI	1.8E+00	LookChem	2.7E-02	7.2E-06	EPA WATER9			1.8E+02	EPI	2.4E+00	PHYSPROP	2.1E+06	PHYSPROP	4.3E-03	5.1E-01	1.2E+00	1.0E-03	RAGSE	
Permethrin	52645-53-1	3.9E+02	PHYSPROP	7.7E-05	1.9E-06	EPI	2.2E-08	PHYSPROP	3.4E+01	EPI	1.2E+00	CRCB9	1.9E-02	4.8E-06	EPA WATER9			1.2E+05	EPI	6.5E+00	PHYSPROP	6.0E-03	PHYSPROP	1.6E+00	5.0E+01	6.5E+01	2.1E-01	EPI	
Phenacetin	62-44-2	1.8E+02	PHYSPROP	8.7E-09	2.1E-10	EPI	6.9E-07	PHYSPROP	1.4E+02	PHYSPROP	1.2E+00	CRCB9	6.0E-02	7.0E-06	EPA WATER9			4.1E+01	EPI	1.6E+00	PHYSPROP	7.7E+02	PHYSPROP	8.9E-03	1.1E+00	2.5E+00	1.7E-03	EPI	
Phenmedipham	13684-63-4	3.0E+02	PHYSPROP	3.4E-11	8.4E-13	EPI	1.0E-11	PHYSPROP	1.4E+02	PHYSPROP	1.8E+00	CRCB9	4.2E-02	5.0E-06	EPA WATER9			2.6E+03	EPI	3.6E+00	PHYSPROP	4.7E+00	PHYSPROP	5.2E-02	5.1E+00	1.2E+01	7.9E-03	EPI	
Phenol	108-95-2	9.4E+01	PHYSPROP	1.4E-05	3.3E-07	PHYSPROP	3.5E-01	PHYSPROP	4.1E+01	PHYSPROP	1.1E+00	CRCB9	8.3E-02	1.0E-05	EPA WATER9			1.9E+02	EPI	1.5E+00	PHYSPROP	8.3E+04	PHYSPROP	1.6E-02	3.5E-01	8.5E-01	4.3E-03	EPI	
Phenothiazine	92-84-2	2.0E+02	PHYSPROP	1.1E-06	2.8E-08	PHYSPROP	8.9E-07	PHYSPROP	1.9E+02	PHYSPROP	1.3E+00	PubChem	2.9E-02	7.5E-06	EPA WATER9			1.5E+03	EPI	4.2E+00	PHYSPROP	1.6E+00	PHYSPROP	3.7E-01	1.4E+00	3.3E+00	6.8E-02	EPI	
Phenylenediamine, m-	108-45-2	1.1E+02	PHYSPROP	5.1E-08	1.3E-09	EPI	2.1E-03	EPI	6.4E+01	PHYSPROP	1.0E+00	CRCB9	7.2E-02	9.2E-06	EPA WATER9			3.4E+01	EPI	3.3E-01	PHYSPROP	2.4E+05	PHYSPROP	9.4E-04	4.2E-01	1.0E+00	2.3E-04	EPI	
Phenylenediamine, o-	95-54-5	1.1E+02	PHYSPROP	2.9E-07	7.2E-09	EPI	2.1E-03	EPI	1.0E+02	PHYSPROP	1.8E+00	CRCB9	8.4E-02	9.8E-06	EPA WATER9			3.5E+01	EPI	1.5E-01	PHYSPROP	4.0E+04	PHYSPROP	1.9E-02	4.2E-01	1.0E+00	4.9E-04	EPI	
Phenylenediamine, p-	106-50-3	1.1E+02	PHYSPROP	2.8E-08	6.7E-10	PHYSPROP	5.0E-03	PHYSPROP	1.5E+02	PHYSPROP	1.2E+00	CRCB9	8.4E-02	9.8E-06	EPA WATER9			3.4E+01	EPI	3.0E-01	PHYSPROP	3.7E+04	PHYSPROP	9.8E-04	9.4E-01	1.0E+00	2.5E-04	EPI	
Phenylphenol, 2-	90-43-7	1.7E+02	PHYSPROP	4.3E-05	1.1E-06	EPI	2.0E-03	EPI	5.9E+01	PHYSPROP	1.2E+00	CRCB9	4.2E-02	7.8E-06	EPA WATER9			6.7E+03	EPI	3.1E+00	PHYSPROP	7.0E+02	PHYSPROP	9.8E-02	4.2E-01	2.3E+00	2.0E-02	EPI	
Phorate	298-02-2	2.6E+02	PHYSPROP	1.8E-04	4.4E-06	EPI	6.4E-04	PHYSPROP	-1.5E+01	CRCB9	1.2E+00	CRCB9	2.3E-02	5.9E-06	EPA WATER9			4.6E+02	EPI	3.6E+00	PHYSPROP	5.0E+01	PHYSPROP	7.8E-02	3.0E+00	7.2E+00	1.3E-02	EPI	
Phosgene	75-44-5	9.9E+01	PHYSPROP	6.8E-01	1.7E-02	PHYSPROP	1.4E-03	PHYSPROP	-1.2E+02	PHYSPROP	1.4E+00	CRCB9	8.9E-02	1.2E-05	EPA WATER9			1.0E+00	EPI	7.1E-01	PHYSPROP	9.8E+03	YAWS	5.6E-04	3.8E+01	9.0E-01	1.5E-04	EPI	
Phosmet	732-11-6	3.2E+02	PHYSPROP	3.4E-07	8.4E-09	EPI	4.9E-07	PHYSPROP	7.2E+01	PHYSPROP	1.4E+00	CRCB9	4.1E-02	4.8E-06	EPA WATER9			1.0E+01	EPI	2.8E+00	PHYSPROP	2.4E+01	PHYSPROP	1.3E-02	6.3E+00	1.5E+01	1.8E-03	EPI	
Phosphates, Inorganic																													
~Aluminum metaphosphate	13776-88-0	2.6E+02	CRCB9								2.8E+00	CRCB9																	
~Ammonium polyphosphate	68333-79-9																												
~Calcium pyrophosphate	7790-76-3	2.5E+02	CRCB9								1.2E+03	CRCB9																	

Contaminant	CAS No.	Molecular Weight		Volatility Parameters				Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients				Water Partition		Water Solubility		Tapwater Dermal Parameters								
		MW	MW Ref	H ¹ (unitless)	HLC (atm-m ³ /mole)	H ¹ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀ (cm ² /s)	D ₁₀ and D ₁₀ Ref	K _{oc} (L/kg)	K _{oc} Ref	K _{oc} (L/kg)	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	t _{1/2} (hr)	t [†] (hr)	K _p	KPREF				
*Aroclor 1242	53469-21-9	2.9E+02	PHYSPROP	1.4E-02	3.4E-04	PHYSPROP	8.6E-05	EPI	1.2E+02	EPI	1.4E+00	ATSDR Profile	1.4E+00	ATSDR Profile	2.4E-02	6.1E-06	EPA WATER9	7.8E+04	EPI	6.3E+00	PHYSPROP	2.8E-01	PHYSPROP	3.6E+00	4.5E+00	1.9E+01	5.5E-01	EPI				
*Aroclor 1248	12672-29-6	6.2E+02	PHYSPROP	1.8E-02	4.4E-04	PHYSPROP	4.9E-04	PHYSPROP	1.2E+02	EPI	1.4E+00	HSDB	1.4E+00	HSDB	1.6E-02	3.9E-06	EPA WATER9	7.7E+04	EPI	6.2E+00	PHYSPROP	1.0E-01	PHYSPROP	4.5E+00	3.1E+02	1.3E+03	4.8E-01	EPI				
*Aroclor 1254	11097-69-1	3.3E+02	PHYSPROP	1.2E-02	2.8E-04	PHYSPROP	7.7E-05	PHYSPROP	1.3E+02	EPI	1.5E+00	ATSDR Profile	1.5E+00	ATSDR Profile	2.4E-02	6.1E-06	EPA WATER9	1.3E+05	EPI	6.5E+00	PHYSPROP	4.3E-02	PHYSPROP	5.2E+00	7.1E+00	3.1E+01	7.5E-01	EPI				
*Aroclor 1260	11096-82-1	4.0E+02	PHYSPROP	1.4E-02	3.4E-04	PHYSPROP	4.1E-05	PHYSPROP	1.6E+02	EPI	1.6E+00	ATSDR Profile	1.6E+00	ATSDR Profile	2.2E-02	5.6E-06	EPA WATER9	3.5E+05	EPI	7.6E+00	PHYSPROP	1.4E-02	PHYSPROP	7.5E+00	1.4E+01	7.7E+01	9.9E-01	EPI				
*Aroclor 5460	11126-42-4	2.9E+02	PHYSPROP	5.1E-03	1.3E-04	PHYSPROP	8.5E-06	PHYSPROP	1.2E+02	EPI	1.6E+00	LookChem	1.6E+00	LookChem	2.6E-02	6.8E-06	EPA WATER9	8.1E+04	EPI	6.3E+00	PHYSPROP	5.3E-02	PHYSPROP	3.8E+00	4.5E+00	2.0E+01	5.8E-01	EPI				
*Heptachlorobiphenyl, 2,3,3',4,4',5,5' (PCB 189)	39635-31-9	4.0E+02	PHYSPROP	2.1E-03	5.1E-05	PHYSPROP	1.3E-07	PHYSPROP	1.6E+02	EPI	1.7E+00	LookChem	1.7E+00	LookChem	2.2E-02	5.7E-06	EPA WATER9	3.5E+05	EPI	8.3E+00	PHYSPROP	7.5E-04	PHYSPROP	2.3E+01	1.7E+01	8.0E+01	3.0E+00	EPI				
*Hexachlorobiphenyl, 2,3,3',4,4',5,5' (PCB 167)	52663-72-6	3.6E+02	PHYSPROP	2.8E-03	6.9E-05	PHYSPROP	5.8E-07	PHYSPROP	1.5E+02	EPI	1.6E+00	LookChem	1.6E+00	LookChem	2.3E-02	5.9E-06	EPA WATER9	2.1E+05	EPI	7.5E+00	PHYSPROP	2.2E-03	PHYSPROP	1.0E+01	1.1E+01	5.0E+01	1.4E+00	EPI				
*Hexachlorobiphenyl, 2,3,3',4,4',5' (PCB 157)	69782-90-7	3.6E+02	PHYSPROP	6.6E-03	1.6E-04	EPI	5.8E-07	EPI	1.5E+02	EPI	1.6E+00	I	1.6E+00	I	2.3E-02	5.9E-06	EPA WATER9	2.1E+05	EPI	7.6E+00	PHYSPROP	1.6E-03	EPI	1.2E+01	1.1E+01	5.0E+01	1.7E+00	EPI				
*Hexachlorobiphenyl, 2,3,3',4,4',5' (PCB 156)	38380-08-4	3.6E+02	PHYSPROP	5.8E-03	1.4E-04	EPI	1.6E-06	PHYSPROP	1.5E+02	EPI	1.6E+00	LookChem	1.6E+00	LookChem	2.3E-02	5.9E-06	EPA WATER9	2.1E+05	EPI	7.6E+00	PHYSPROP	5.3E-03	PHYSPROP	9.1E+00	1.1E+01	5.0E+01	1.2E+00	EPI				
*Hexachlorobiphenyl, 3,3',4,4',5,5' (PCB 169)	32774-16-6	3.6E+02	PHYSPROP	2.8E-03	6.9E-05	PHYSPROP	5.8E-07	PHYSPROP	1.5E+02	EPI	1.6E+00	LookChem	1.6E+00	LookChem	2.3E-02	5.9E-06	EPA WATER9	2.1E+05	EPI	7.4E+00	PHYSPROP	5.1E-04	PHYSPROP	9.1E+00	1.1E+01	5.0E+01	1.2E+00	EPI				
*Pentachlorobiphenyl, 2',3,4,4',5' (PCB 123)	65510-44-3	3.3E+02	EPI	7.8E-03	1.9E-04	EPI	5.5E-06	EPI	9.8E+01	EPI	1.5E+00	LookChem	1.5E+00	LookChem	2.4E-02	6.1E-06	EPA WATER9	1.3E+05	EPI	7.0E+00	EPI	1.6E-02	EPI	6.9E+00	7.1E+00	3.2E+01	1.0E+00	EPI				
*Pentachlorobiphenyl, 2',3,4,4',5' (PCB 118)	31508-00-6	3.3E+02	PHYSPROP	1.2E-02	2.9E-04	EPI	9.0E-06	PHYSPROP	1.3E+02	EPI	1.5E+00	LookChem	1.5E+00	LookChem	2.4E-02	6.1E-06	EPA WATER9	1.3E+05	EPI	7.1E+00	PHYSPROP	1.3E-02	PHYSPROP	8.6E+00	7.1E+00	3.2E+01	1.2E+00	EPI				
*Pentachlorobiphenyl, 2,3,3',4,4',5' (PCB 105)	32598-14-4	3.3E+02	PHYSPROP	1.2E-02	2.8E-04	EPI	6.5E-06	PHYSPROP	1.3E+02	EPI	1.5E+00	LookChem	1.5E+00	LookChem	2.4E-02	6.1E-06	EPA WATER9	1.3E+05	EPI	6.8E+00	PHYSPROP	3.4E-03	PHYSPROP	5.2E+00	7.1E+00	3.2E+01	7.5E-01	EPI				
*Pentachlorobiphenyl, 2,3,4,4',5' (PCB 114)	74472-37-0	3.3E+02	PHYSPROP	3.8E-03	9.2E-05	PHYSPROP	5.5E-06	PHYSPROP	9.8E+01	PHYSPROP	1.5E+00	LookChem	1.5E+00	LookChem	2.4E-02	6.1E-06	EPA WATER9	1.3E+05	EPI	7.0E+00	PHYSPROP	1.6E-02	PHYSPROP	6.9E+00	7.1E+00	3.2E+01	1.0E+00	EPI				
*Pentachlorobiphenyl, 3,3',4,4',5' (PCB 126)	57465-28-8	3.3E+02	EPI	7.8E-03	1.9E-04	EPI	2.2E-06	EPI	1.3E+02	EPI	1.5E+00	LookChem	1.5E+00	LookChem	2.4E-02	6.1E-06	EPA WATER9	1.3E+05	EPI	7.0E+00	EPI	7.3E-03	EPI	6.9E+00	7.1E+00	3.2E+01	1.0E+00	EPI				
*Polychlorinated Biphenyls (high risk)	1336-36-3	2.9E+02	PHYSPROP	1.7E-02	4.2E-04	PHYSPROP	4.9E-04	PHYSPROP	1.2E+02	EPI	1.4E+00	HSDB	1.4E+00	HSDB	2.4E-02	6.3E-06	EPA WATER9	7.8E+04	EPI	7.1E+00	PHYSPROP	7.0E-01	PHYSPROP	3.6E+00	4.5E+00	1.9E+01	5.5E-01	EPI				
*Polychlorinated Biphenyls (low risk)	1336-36-3	2.9E+02	PHYSPROP	1.7E-02	4.2E-04	PHYSPROP	4.9E-04	PHYSPROP	1.2E+02	EPI	1.4E+00	HSDB	1.4E+00	HSDB	2.4E-02	6.3E-06	EPA WATER9	7.8E+04	EPI	7.1E+00	PHYSPROP	7.0E-01	PHYSPROP	3.6E+00	4.5E+00	1.9E+01	5.5E-01	EPI				
*Polychlorinated Biphenyls (lowest risk)	1336-36-3	2.9E+02	PHYSPROP	1.7E-02	4.2E-04	PHYSPROP	4.9E-04	PHYSPROP	1.2E+02	EPI	1.4E+00	HSDB	1.4E+00	HSDB	2.4E-02	6.3E-06	EPA WATER9	7.8E+04	EPI	7.1E+00	PHYSPROP	7.0E-01	PHYSPROP	3.6E+00	4.5E+00	1.9E+01	5.5E-01	EPI				
*Tetrachlorobiphenyl, 3,3',4,4' (PCB 77)	32598-13-3	2.9E+02	PHYSPROP	3.8E-04	9.4E-06	PHYSPROP	1.6E-05	PHYSPROP	1.8E+02	CRCB9	1.4E+00	LookChem	1.4E+00	LookChem	4.3E-02	5.0E-06	EPA WATER9	7.8E+04	EPI	6.6E+00	PHYSPROP	5.7E-04	PHYSPROP	6.0E+00	4.5E+00	2.0E+01	9.2E-01	EPI				
*Tetrachlorobiphenyl, 3,4,4',5' (PCB 81)	76032-50-4	2.9E+02	EPI	9.1E-03	2.2E-04	EPI	8.5E-06	EPI	1.2E+02	EPI	1.4E+00	LookChem	1.4E+00	LookChem	2.4E-02	6.3E-06	EPA WATER9	7.8E+04	EPI	6.3E+00	EPI	3.2E-02	EPI	3.8E+00	4.5E+00	2.0E+01	5.8E-01	EPI				
Polymeric Methylene Diphenyl Disocyanate (PMDI)	9016-87-9	5.1E+02	EPI	5.4E-10	1.3E-11	EPI	5.4E-13	EPI	2.5E+02	EPI	1.4E+00	LookChem	1.4E+00	LookChem	3.0E-02	3.5E-06	EPA WATER9	1.0E+10	EPI	1.0E+01	EPI	1.8E-06	EPI	1.6E+02	7.8E+01	3.7E+02	1.9E+01	EPI				
Polynuclear Aromatic Hydrocarbons (PAHs)																																
*Acenaphthene	83-32-9	1.5E+02	PHYSPROP	7.5E-03	1.8E-04	PHYSPROP	2.2E-03	PHYSPROP	9.3E+01	PHYSPROP	1.2E+00	CRCB9	1.2E+00	CRCB9	5.1E-02	8.3E-06	EPA WATER9	5.0E+03	EPI	3.9E+00	PHYSPROP	3.9E+00	PHYSPROP	4.1E+01	7.7E-01	1.8E+00	8.6E-02	EPI				
*Anthracene	120-12-7	1.8E+02	PHYSPROP	2.3E-03	5.6E-05	PHYSPROP	6.5E-06	EPI	2.2E+02	PHYSPROP	1.3E+00	CRCB9	1.3E+00	CRCB9	3.9E-02	7.9E-06	EPA WATER9	1.6E+04	EPI	4.5E+00	PHYSPROP	4.3E-02	PHYSPROP	4.3E+00	1.0E+00	4.1E+00	1.4E-01	EPI				
*Benz[a]anthracene	56-55-3	2.3E+02	PHYSPROP	4.9E-04	1.2E-05	PHYSPROP	2.1E-07	PHYSPROP	8.4E+01	PHYSPROP	1.3E+00	PubChem	1.3E+00	PubChem	2.6E-02	6.7E-06	EPA WATER9	1.8E+05	EPI	5.8E+00	PHYSPROP	9.4E-03	PHYSPROP	3.2E+00	2.0E+00	8.5E+00	5.5E-01	EPI				
*Benzo[b]fluoranthene	205-82-3	2.5E+02	PHYSPROP	8.3E-06	2.0E-07	PHYSPROP	2.6E-08	PHYSPROP	1.7E+02	PHYSPROP	1.7E+00	PHYSPROP	1.7E+00	PHYSPROP	4.8E-02	5.6E-06	EPA WATER9	6.9E+05	EPI	6.1E+00	PHYSPROP	2.5E-03	PHYSPROP	4.2E+00	2.7E+00	1.2E+01	6.9E-01	EPI				
*Benzo[a]pyrene	50-32-8	2.5E+02	PHYSPROP	1.9E-05	4.6E-07	PHYSPROP	5.5E-09	EPI	1.8E+02	PHYSPROP	1.8E+00	PHYSPROP	1.8E+00	PHYSPROP	4.8E-02	5.6E-06	EPA WATER9	5.9E+05	EPI	6.1E+00	PHYSPROP	1.6E-03	PHYSPROP	4.4E+00	2.7E+00	1.2E+01	7.1E-01	EPI				
*Benzo[b]fluoranthene	205-99-2	2.5E+02	PHYSPROP	2.7E-05	6.6E-07	PHYSPROP	5.0E-07	PHYSPROP	1.7E+02	PHYSPROP	1.7E+00	PHYSPROP	1.7E+00	PHYSPROP	4.8E-02	5.6E-06	EPA WATER9	6.0E+05	EPI	5.8E+00	PHYSPROP	1.5E-03	PHYSPROP	2.5E+00	2.7E+00	1.1E+01	4.2E-01	EPI				
*Benzo[k]fluoranthene	207-08-9	2.5E+02	PHYSPROP	2.4E-05	5.8E-07	PHYSPROP	9.7E-10	EPI	2.2E+02	PHYSPROP	2.2E+00	PHYSPROP	2.2E+00	PHYSPROP	4.8E-02	5.6E-06	EPA WATER9	5.9E+05	EPI	6.1E+00	PHYSPROP	8.0E-04	PHYSPROP	4.2E+00	2.7E+00	1.2E+01	6.9E-01	EPI				
*Chloronaphthalene, Beta-	91-58-7	1.6E+02	PHYSPROP	1.3E-02	3.2E-04	PHYSPROP	1.2E-02	EPI	6.1E+01	PHYSPROP	1.1E+00	CRCB9	1.1E+00	CRCB9	4.5E-02	7.7E-06	EPA WATER9	2.5E+														

Contaminant	CAS No.	Molecular Weight		Volatility Parameters				Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients				Water Partition		Water Solubility		Tapwater Dermal Parameters					
		MW	MW Ref	H ⁺ (unitless)	HLC (atm-m ³ /mole)	H ⁺ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	D ₁₀ (cm ² /s)	D ₁₀ Ref	D ₁₀ and D ₁₀ Ref	K _d (L/kg)	K _d Ref	K _{oc} (L/kg)	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	B ₁₀ (unitless)	t* (hr)	K _p	KPREF	
Sodium Tungstate	13472-45-2	2.9E+02	CRC89						7.0E+02	CRC89	4.2E+00	CRC89											7.4E+05	CRC89	6.6E+03	4.6E+00	1.1E+01	1.0E+03	RAGSE
Sodium Tungstate Dihydrate	10213-10-2	3.3E+02	CRC89						1.0E+02	CRC89	3.3E+00	CRC89											7.4E+05	CRC89	7.0E+03	7.4E+00	1.8E+01	1.0E+03	RAGSE
Stirofos (Tetrachlorovinophos)	961-11-5	3.7E+02	PHYSPROP	7.5E-08	1.8E-09	EPI	4.2E-08	PHYSPROP	9.8E+01	PHYSPROP	3.9E+00	CRC89	3.7E-02	4.3E-06	EPA WATER9			1.4E+03	EPI	3.5E+00	PHYSPROP	1.1E+01	PHYSPROP	2.3E+02	1.2E+01	2.8E+01	3.1E+03	EPI	
Strontium Chromate	7789-06-2	2.0E+02	CRC89								3.9E+00	CRC89											1.1E+03	CRC89	5.5E+03	1.5E+00	3.5E+00	1.0E+03	RAGSE
Strontium, Stable	7440-24-6	8.8E+01	PHYSPROP						7.8E+02	PHYSPROP	2.6E+00	CRC89				3.5E+01	BAES					3.6E+03	3.3E+01	7.8E+01	1.0E+03	RAGSE			
Strychnine	57-24-9	3.3E+02	PHYSPROP	3.1E-12	7.6E-14	PHYSPROP	2.9E-09	PHYSPROP	2.9E+02	PHYSPROP	1.4E+00	CRC89	2.2E-02	5.6E-06	EPA WATER9			5.4E+03	EPI	1.9E+00	PHYSPROP	1.6E+02	PHYSPROP	3.8E+03	7.8E+00	1.9E+01	4.0E+04	EPI	
Styrene	100-42-5	1.0E+02	PHYSPROP	1.1E-01	2.8E-03	PHYSPROP	6.4E+00	PHYSPROP	-3.1E+01	PHYSPROP	0.9E+01	CRC89	2.1E-02	4.8E-06	EPA WATER9			4.5E+02	EPI	3.0E+00	PHYSPROP	3.1E+02	PHYSPROP	1.5E+01	4.0E+01	9.7E+01	3.7E+02	EPI	
Styrene-Acrylonitrile (SAN) Trimer	NA	2.1E+02	OTHER								1.1E+00	PPRTV	2.6E-02	6.5E-06	EPA WATER9					3.1E+00	OTHER	8.5E+01	PPRTV	6.6E+02	1.6E+00	3.8E+00	1.2E+02	RAGSE	
Sulfone	126-33-0	1.2E+02	PHYSPROP	2.0E-04	4.9E-06	PHYSPROP	4.1E-03	EPI	2.8E+01	PHYSPROP	1.3E+00	CRC89	7.7E-02	9.9E-06	EPA WATER9			9.1E+00	EPI	7.7E+01	PHYSPROP	1.0E+06	PHYSPROP	4.3E+04	5.0E+01	1.2E+00	1.0E+04	EPI	
Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	2.9E+02	PHYSPROP	5.6E-06	1.4E-07	PHYSPROP	8.1E-07	PHYSPROP	1.5E+02	PHYSPROP	1.3E+00	CRC89	4.4E-02	5.1E-06	EPA WATER9			2.9E+03	EPI	3.9E+00	PHYSPROP	2.4E+00	PHYSPROP	9.7E+02	4.3E+00	1.0E+01	1.5E+02	EPI	
Sulfur Trioxide	7446-11-9	8.0E+01	PHYSPROP						2.6E+02	PHYSPROP	1.7E+01	PHYSPROP	1.9E+00	CRC89	1.2E-01	1.6E-05	EPA WATER9					3.4E+03	3.0E+01	7.1E+01	1.0E+03	RAGSE			
Sulfuric Acid	7664-93-9	9.8E+01	PHYSPROP						5.9E-05	PHYSPROP	1.0E+01	PHYSPROP	1.8E+00	CRC89					1.0E+06	PHYSPROP			3.8E+03	3.7E+01	8.9E+01	1.0E+03	RAGSE		
Sulfurous acid, 2-chloroethyl 2-[4-[1,1-dimethylethyl]phenoxy]-1-methylethyl ester	140-57-8	3.3E+02	PHYSPROP	7.8E-06	1.9E-07	PHYSPROP	2.2E-07	PHYSPROP	-3.2E+01	PHYSPROP	1.1E+00	CRC89	2.0E-02	5.0E-06	EPA WATER9			5.6E+03	EPI	4.8E+00	PHYSPROP	5.9E+01	PHYSPROP	2.3E+01	7.9E+00	1.9E+01	3.3E+02	EPI	
TCMTB	21564-17-0	2.4E+02	PHYSPROP	2.7E-10	6.5E-12	PHYSPROP	3.1E-07	PHYSPROP	1.5E+02	EPI			4.9E-02	5.8E-06	EPA WATER9			3.4E+03	EPI	3.3E+00	PHYSPROP	1.3E+02	PHYSPROP	6.7E+02	2.3E+00	5.5E+00	1.1E+02	EPI	
Tebuthiuron	34014-18-1	2.3E+02	PHYSPROP	4.9E-09	1.2E-10	PHYSPROP	3.0E-07	PHYSPROP	1.6E+02	PHYSPROP	1.3E+00	CRC89	5.1E-02	5.9E-06	EPA WATER9			4.2E+01	EPI	1.8E+00	PHYSPROP	2.5E+03	PHYSPROP	7.4E+02	2.0E+00	4.8E+00	1.3E+03	EPI	
Temephos	3383-96-8	4.7E+02	PHYSPROP	8.0E-08	2.0E-09	PHYSPROP	7.9E-08	PHYSPROP	3.0E+01	PHYSPROP	1.3E+00	CRC89	1.8E-02	4.5E-06	EPA WATER9			9.5E+04	EPI	6.0E+00	PHYSPROP	2.7E+01	PHYSPROP	2.9E+01	4.3E+01	1.0E+02	3.5E+02	EPI	
Terbacil	5902-51-2	2.2E+02	PHYSPROP	4.9E-08	1.2E-10	EPI	4.7E-07	PHYSPROP	1.8E+02	PHYSPROP	1.3E+00	CRC89	2.7E-02	7.2E-06	EPA WATER9			5.0E+01	EPI	1.9E+00	PHYSPROP	7.1E+02	PHYSPROP	9.7E+01	1.7E+00	4.1E+00	1.7E+03	EPI	
Terbufos	13071-79-9	2.9E+02	PHYSPROP	9.8E-04	2.4E-05	EPI	3.2E-04	PHYSPROP	-2.9E+01	PHYSPROP	1.1E+00	CRC89	2.2E-02	5.4E-06	EPA WATER9			1.0E+03	EPI	4.5E+00	PHYSPROP	5.1E+00	PHYSPROP	2.3E+01	4.3E+00	1.0E+01	3.6E+02	EPI	
Terbutryn	886-50-0	2.4E+02	PHYSPROP	8.8E-07	2.2E-08	EPI	1.7E-06	PHYSPROP	1.0E+02	PHYSPROP	1.1E+00	CRC89	2.4E-02	6.0E-06	EPA WATER9			6.1E+02	EPI	3.7E+00	PHYSPROP	2.5E+01	PHYSPROP	1.3E+01	2.4E+00	5.0E+00	2.1E+02	EPI	
Tetrabromodiphenyl ether, 2,2',4,4'-(BDE-47)	5436-43-1	4.9E+02	PHYSPROP	1.2E-04	3.0E-06	PHYSPROP	7.0E-08	EPI	1.6E+02	EPI			3.1E-02	3.6E-06	EPA WATER9			1.3E+04	EPI	6.8E+00	PHYSPROP	1.5E+03	PHYSPROP	7.9E+01	5.5E+01	2.1E+02	9.3E+02	EPI	
Tetrachlorobenzene, 1,2,4,5-	95-94-3	2.2E+02	PHYSPROP	4.1E-02	1.0E-03	PHYSPROP	5.4E-03	EPI	1.4E+02	PHYSPROP	1.9E+00	CRC89	3.2E-02	8.8E-06	EPA WATER9			2.2E+03	EPI	4.6E+00	PHYSPROP	6.0E+01	PHYSPROP	6.6E+01	1.7E+00	6.7E+00	1.2E+01	EPI	
Tetrachlorobenzene, 1,1,1,2-	630-20-6	1.7E+02	PHYSPROP	1.0E-01	2.5E-03	PHYSPROP	1.2E+01	PHYSPROP	-7.0E+01	PHYSPROP	1.5E+00	CRC89	4.8E-02	9.1E-06	EPA WATER9			8.6E+01	EPI	2.9E+00	PHYSPROP	1.1E+03	PHYSPROP	7.9E+02	9.2E+01	2.2E+00	1.6E+02	EPI	
Tetrachloroethane, 1,1,2,2-	79-34-5	1.7E+02	PHYSPROP	1.5E-02	3.7E-04	PHYSPROP	4.6E+00	PHYSPROP	-4.4E+01	PHYSPROP	1.6E+00	CRC89	4.9E-02	9.3E-06	EPA WATER9			9.5E+01	EPI	2.4E+00	PHYSPROP	2.8E+03	PHYSPROP	1.5E+02	9.2E+01	2.2E+00	6.9E+03	EPI	
Tetrachloroethylene	127-18-4	1.7E+02	PHYSPROP	1.7E-01	1.8E-02	PHYSPROP	1.1E+01	PHYSPROP	-2.2E+01	PHYSPROP	1.6E+00	CRC89	5.0E-02	5.9E-06	EPA WATER9			9.5E+01	EPI	3.4E+00	PHYSPROP	2.1E+02	PHYSPROP	1.7E+01	8.9E+01	2.1E+00	3.3E+02	EPI	
Tetrachlorophenol, 2,3,4,6-	58-90-2	2.3E+02	PHYSPROP	3.6E-04	8.8E-06	EPI	6.7E-04	EPI	7.0E+01	PHYSPROP	1.6E+00	CRC89	5.0E-02	5.9E-06	EPA WATER9			3.0E+03	EPI	4.5E+00	PHYSPROP	2.3E+01	PHYSPROP	4.2E+01	2.1E+00	5.0E+00	7.1E+02	EPI	
Tetrachlorotoluene, p-alpha, alpha, alpha-	5216-25-1	2.3E+02	PHYSPROP	7.9E-03	1.9E-04	PHYSPROP	3.8E-02	PHYSPROP	4.0E+01	EPI	1.4E+00	CRC89	2.8E-02	7.3E-06	EPA WATER9			1.6E+03	EPI	4.5E+00	PHYSPROP	4.0E+00	PHYSPROP	4.9E+01	2.0E+00	4.9E+00	8.4E+02	EPI	
Tetraethyl Dithiopyrophosphate	3689-24-5	3.2E+02	PHYSPROP	1.8E-04	4.5E-06	EPI	1.1E-04	PHYSPROP	-3.2E+01	EPI	1.2E+00	CRC89	2.1E-02	5.3E-06	EPA WATER9			2.7E+02	EPI	4.0E+00	PHYSPROP	3.0E+01	PHYSPROP	7.5E+02	6.7E+00	1.6E+01	1.1E+02	EPI	
Tetrafluoroethane, 1,1,1,2-	811-97-2	1.0E+02	PHYSPROP	2.0E+00	5.0E-02	PHYSPROP	5.0E+03	PHYSPROP	-1.0E+02	PHYSPROP	1.2E+00	CRC89	8.2E-02	1.1E-05	EPA WATER9			8.6E+01	EPI	1.7E+00	PHYSPROP	2.0E+03	PHYSPROP	2.1E+02	3.9E+01	9.4E+01	5.5E+03	EPI	
Tetryl (Trinitrophenylmethylnitramine)	479-45-8	2.9E+02	PHYSPROP	1.1E-07	2.7E-09	PHYSPROP	5.7E-08	PHYSPROP	1.3E+02	PHYSPROP	1.6E+00	CRC89	2.6E-02	6.7E-06	EPA WATER9			4.6E+03	EPI	1.6E+00	PHYSPROP	7.4E+01	PHYSPROP	6.1E+03	4.3E+00	1.0E+01	4.7E+04	EPI	
Thallium (I) Nitrate	10102-45-1	2.7E+02	PHYSPROP						2.1E+02	PHYSPROP	5.6E+00	CRC89				7.1E+01	SSL					9.6E+04	PHYSPROP	3.3E+03	3.3E+00	7.9E+00	1.0E+03	RAGSE	
Thallium (Soluble Salts)	7440-28-0	2.1E+02	PHYSPROP						3.0E+02	PHYSPROP	1.2E+01	CRC89											5.5E+03	1.5E+00	3.6E+00	1.0E+03	RAGSE		
Thallium Acetate	563-68-8	2.6E+02	PHYSPROP				1.5E+01	PHYSPROP	1.3E+02	CRC89	3.7E+00	CRC89	3.9E-02	1.2E-05	EPA WATER9					-1.7E-01	PHYSPROP	2.8E+04	PHYSPROP	2.5E+04	3.1E+00	7.5E+00	4.0E+05	EPI	
Thallium Carbonate	6533-73-9	4.7E+02	PHYSPROP				5.8E+00	PHYSPROP	2.7E+02	PHYSPROP	7.1E+00	CRC89	3.9E-02	1.2E-05	EPA WATER9					-8.6E-01	PHYSPROP	5.2E+04	PHYSPROP	8.2E+06	4.4E+01	1.1E+02	9.8E+07	EPI	
Thallium Chloride	7791-12-0	2.4E+02	PHYSPROP						4.3E+02	PHYSPROP	7.0E+00	CRC89	5.2E-02	1.8E-05	EPA WATER9							2.9E+03	PHYSPROP	6.0E+06	2.3E+00	5.6E+00	1.0E+03	RAGSE	
Thallium Sulfate	7446-18-6	5.0E+02	PHYSPROP						6.3E+02	PHYSPROP	6.8E+00	CRC89											5.5E+04	CRC89	8.6E+03	7.1E+01	1.7E+02	1.0E+03	RAGSE
Thiessulfuron-methyl	79277-27-3	3.9E+02	PHYSPROP																										

Contaminant		Molecular Weight		Volatility Parameters					Melting Point		Density		Diffusivity in Air and Water				Soil Partition Coefficients			Water Partition		Water Solubility		Tapwater Dermal Parameters				
Analyte	CAS No.	MW	MW Ref	H ⁺ (unitless)	HLC (atm-m ³ /mole)	H ⁺ and HLC Ref	VP	VP Ref	MP	MP Ref	Density (g/cm ³)	Density Ref	Dia (cm ² /s)	Diw (cm ² /s)	D ₁₀ and D ₁₀₀ Ref	K _d (L/kg)	K _{oc} Ref	K _{oc} (L/kg)	K _{oc} Ref	log K _{ow} (unitless)	log K _{ow} Ref	S (mg/L)	S Ref	B (unitless)	t _{event} (hr/event)	t [*] (hr)	K _p (cm/hr)	KPREF
Trifluralin	1582-09-8	3.4E+02	PHYSPROP	4.2E-03	1.0E-04	PHYSPROP	4.6E-05	PHYSPROP	4.9E+01	PHYSPROP	1.4E+00	PubChem	2.2E-02	5.6E-06	EPA WATER9		1.6E+04	EPI	5.3E+00	PHYSPROP	1.8E-01	PHYSPROP	5.1E-01	7.9E+00	1.9E+01	7.3E-02	EPI	
Trimethyl Phosphate	512-56-1	1.4E+02	PHYSPROP	2.9E-07	7.2E-09	PHYSPROP	8.5E-01	EPI	-4.6E+01	PHYSPROP	1.2E+00	CRC89	5.8E-02	8.8E-06	EPA WATER9		1.1E+01	EPI	-6.5E-01	PHYSPROP	5.0E+05	PHYSPROP	4.3E-04	6.4E-01	1.5E+00	9.5E-05	EPI	
Trimethylbenzene, 1,2,3	526-73-8	1.2E+02	PHYSPROP	1.8E-01	4.4E-03	PHYSPROP	1.7E+00	PHYSPROP	-2.5E+01	PHYSPROP	8.9E-01	CRC89	6.1E-02	8.0E-06	EPA WATER9		6.3E+02	EPI	3.7E+00	PHYSPROP	7.5E+01	PHYSPROP	3.8E-01	5.0E-01	1.2E+00	9.0E-02	EPI	
Trimethylbenzene, 1,2,4	95-63-6	1.2E+02	PHYSPROP	2.5E-01	6.2E-03	PHYSPROP	2.1E+00	PHYSPROP	-4.4E+01	PHYSPROP	8.8E-01	CRC89	6.1E-02	7.9E-06	EPA WATER9		6.1E+02	EPI	3.6E+00	PHYSPROP	5.7E+01	PHYSPROP	3.6E-01	5.0E-01	1.2E+00	8.6E-02	EPI	
Trimethylbenzene, 1,3,5	108-67-8	1.2E+02	PHYSPROP	3.6E-01	8.8E-03	PHYSPROP	2.5E+00	PHYSPROP	-4.5E+01	PHYSPROP	8.6E-01	CRC89	6.0E-02	7.8E-06	EPA WATER9		6.0E+02	EPI	3.4E+00	PHYSPROP	4.8E+01	PHYSPROP	2.6E-01	5.0E-01	1.2E+00	6.2E-02	EPI	
Trimethylpentene, 2,4,4	25167-70-8	1.1E+02	PHYSPROP	3.0E+01	7.5E-01	PHYSPROP	7.1E+01	PHYSPROP	-8.4E+01	EPI	7.2E-01	PubChem	6.0E-02	7.3E-06	EPA WATER9		2.4E+02	EPI	4.1E+00	PHYSPROP	4.0E+00	PHYSPROP	7.7E-01	4.5E-01	1.7E+00	1.9E-01	RAGSE	
Trinitrobenzene, 1,3,5	99-35-4	2.1E+02	PHYSPROP	2.7E-07	6.5E-09	EPI	6.4E-06	EPI	1.2E+02	PHYSPROP	1.5E+00	CRC89	2.9E-02	7.7E-06	EPA WATER9		1.7E+03	EPI	1.2E+00	PHYSPROP	2.8E-02	PHYSPROP	3.4E-03	1.6E+00	3.9E+00	6.1E-04	EPI	
Trinitrotoluene, 2,4,6	118-96-7	2.3E+02	PHYSPROP	8.5E-07	2.1E-08	EPI	8.0E-06	PHYSPROP	8.0E+01	PHYSPROP	1.7E+00	CRC89	3.0E-02	7.9E-06	EPA WATER9		2.8E+03	EPI	1.6E+00	PHYSPROP	1.2E+02	PHYSPROP	5.6E-03	2.0E+00	4.7E+00	9.6E-04	EPI	
Triphenylphosphine Oxide	791-28-6	2.8E+02	PHYSPROP	2.2E-08	5.3E-10	PHYSPROP	2.6E-09	EPI	1.6E+02	PHYSPROP	1.2E+00	CRC89	2.3E-02	5.8E-06	EPA WATER9		2.0E+03	EPI	2.8E+00	PHYSPROP	6.3E+01	PHYSPROP	2.1E-02	3.8E+00	9.1E+00	3.3E-03	EPI	
Tris[1,3-Dichloro-2-propyl] Phosphate	13674-87-8	4.3E+02	PHYSPROP	1.1E-07	2.6E-09	PHYSPROP	7.4E-08	PHYSPROP	2.7E+01	PHYSPROP	1.4E+00	CRC89	3.3E-02	3.9E-06	EPA WATER9		1.1E+04	EPI	3.7E+00	PHYSPROP	7.0E+00	PHYSPROP	1.3E-02	2.7E+01	6.5E+01	1.6E-03	EPI	
Tris(1-chloro-2-propyl)phosphate	13674-84-5	3.3E+02	PHYSPROP	2.4E-06	6.0E-08	PHYSPROP	2.0E-05	PHYSPROP	-4.0E+01	PHYSPROP	1.4E+00	CRC89	4.0E-02	4.7E-06	EPA WATER9		1.6E+03	EPI	2.6E+00	PHYSPROP	1.2E+03	PHYSPROP	8.4E-03	7.2E+00	1.7E+01	1.2E-03	EPI	
Tris(2,3-dibromopropyl)phosphate	126-72-7	7.0E+02	PHYSPROP	8.9E-04	2.2E-05	EPI	1.9E-04	PHYSPROP	5.5E+00	PHYSPROP	2.3E+00	PubChem	1.9E-02	4.9E-06	EPA WATER9		9.7E+03	EPI	4.3E+00	PHYSPROP	8.0E+00	PHYSPROP	1.4E-03	8.5E+02	2.0E+03	1.4E-04	EPI	
Tris(2-chloroethyl)phosphate	115-96-8	2.9E+02	PHYSPROP	1.3E-04	3.3E-06	EPI	6.1E-02	PHYSPROP	-5.5E+01	PHYSPROP	1.4E+00	CRC89	2.4E-02	6.2E-06	EPA WATER9		3.9E+02	EPI	1.4E+00	PHYSPROP	7.0E+03	PHYSPROP	2.3E-03	4.2E+00	1.0E+01	3.6E-04	EPI	
Tris(2-ethylhexyl)phosphate	78-42-2	4.3E+02	PHYSPROP	3.2E-06	7.9E-08	EPI	8.3E-08	PHYSPROP	-7.4E+01	PHYSPROP	9.9E-01	CRC89	1.6E-02	3.9E-06	EPA WATER9		2.5E+06	EPI	9.5E+00	PHYSPROP	6.0E-01	PHYSPROP	9.3E+01	2.9E+01	1.3E+02	1.2E+01	EPI	
Tungsten	7440-33-7	1.8E+02	PHYSPROP				0.0E+00	NIOSH	3.4E+03	PHYSPROP	1.9E+01	CRC89				1.5E+02	BAES					5.2E-03	1.1E+00	2.7E+00	1.0E-03	RAGSE		
Uranium (Soluble Salts)	NA	2.4E+02	CRC89				0.0E+00	NIOSH	1.1E+03	CRC89	1.9E+01	CRC89				4.5E+02	BAES					5.9E-03	2.3E+00	5.4E+00	1.0E-03	RAGSE		
Urethane	51-79-6	8.9E+01	PHYSPROP	2.6E-06	6.4E-08	EPI	2.6E-01	EPI	4.9E+01	PHYSPROP	9.9E-01	CRC89	8.5E-02	1.0E-05	EPA WATER9		1.2E+01	EPI	-1.5E-01	PHYSPROP	4.8E+05	PHYSPROP	1.4E-03	3.3E-01	8.0E-01	3.9E-04	EPI	
Vanadium Pentoxide	1314-62-1	1.8E+02	EPI				0.0E+00	NIOSH	6.8E+02	CRC89	3.4E+00	CRC89									7.0E+02	CRC89	5.2E-03	1.1E+00	2.6E+00	1.0E-03	RAGSE	
Vanadium and Compounds	7440-62-2	5.1E+01	EPI						1.9E+03	CRC89	6.0E+00	CRC89				1.0E+03	SSL					2.7E-03	2.0E-01	4.9E-01	1.0E-03	RAGSE		
Vernolate	1929-77-7	2.0E+02	PHYSPROP	1.3E-03	3.1E-05	EPI	1.0E-02	PHYSPROP	7.1E+01	EPI	9.5E-01	CRC89	2.4E-02	6.1E-06	EPA WATER9		3.0E+02	EPI	3.8E+00	PHYSPROP	9.0E+01	PHYSPROP	2.2E-01	1.4E+00	3.5E+00	4.0E-02	EPI	
Vinclozolin	50471-44-8	2.9E+02	PHYSPROP	7.1E-07	1.7E-08	EPI	1.2E-07	PHYSPROP	1.1E+02	PHYSPROP	1.5E+00	CRC89	2.5E-02	6.5E-06	EPA WATER9		2.8E+02	EPI	3.1E+00	PHYSPROP	2.6E+00	PHYSPROP	2.9E-02	4.2E+00	1.0E+01	4.5E-03	EPI	
Vinyl Acetate	108-05-4	8.6E+01	PHYSPROP	2.1E-02	5.1E-04	EPI	9.0E+01	PHYSPROP	-9.3E+01	PHYSPROP	9.3E-01	CRC89	8.5E-02	1.0E-05	EPA WATER9		5.6E+00	EPI	7.3E-01	PHYSPROP	2.0E-04	PHYSPROP	5.6E-03	3.2E-01	7.7E-01	1.6E-03	EPI	
Vinyl Bromide	593-60-2	1.1E+02	PHYSPROP	5.0E-01	1.2E-02	PHYSPROP	1.0E+03	PHYSPROP	1.4E+02	PHYSPROP	1.5E+00	CRC89	8.6E-02	1.2E-05	EPA WATER9		2.2E+01	EPI	1.6E+00	PHYSPROP	7.6E+03	PHYSPROP	1.7E-02	4.2E-01	1.0E+00	4.4E-03	EPI	
Vinyl Chloride	75-01-4	6.2E+01	PHYSPROP	1.1E+00	2.8E-02	PHYSPROP	3.0E+03	EPI	-1.5E+02	PHYSPROP	9.1E-01	CRC89	1.1E-01	1.2E-05	EPA WATER9		2.2E+01	EPI	1.6E+00	PHYSPROP	8.8E+03	PHYSPROP	2.5E-02	2.4E-01	5.7E-01	8.4E-03	EPI	
Warfarin	81-81-2	3.1E+02	PHYSPROP	1.1E-07	2.8E-09	EPI	1.2E-07	PHYSPROP	1.6E+02	PHYSPROP			4.2E-02	4.9E-06	EPA WATER9		4.3E+02	EPI	2.7E+00	PHYSPROP	1.7E+01	PHYSPROP	1.2E-02	5.6E+00	1.3E+01	1.8E-03	EPI	
Xylene, p-	106-42-3	1.1E+02	PHYSPROP	2.8E-01	6.9E-03	PHYSPROP	8.8E+00	PHYSPROP	1.3E+01	PHYSPROP	8.6E-01	CRC89	6.8E-02	8.4E-06	EPA WATER9		3.8E+02	EPI	3.2E+00	PHYSPROP	1.6E+02	PHYSPROP	2.0E-01	4.1E-01	9.9E-01	4.9E-02	EPI	
Xylene, m-	108-38-3	1.1E+02	PHYSPROP	2.9E-01	7.2E-03	PHYSPROP	8.3E+00	PHYSPROP	-4.8E+01	PHYSPROP	8.6E-01	CRC89	6.8E-02	8.4E-06	EPA WATER9		3.8E+02	EPI	3.2E+00	PHYSPROP	1.6E+02	PHYSPROP	2.1E-01	4.1E-01	9.9E-01	5.3E-02	EPI	
Xylene, o-	95-47-6	1.1E+02	PHYSPROP	2.1E-01	5.2E-03	PHYSPROP	6.6E+00	PHYSPROP	-2.5E+01	PHYSPROP	8.8E-01	CRC89	6.9E-02	8.5E-06	EPA WATER9		3.8E+02	EPI	3.1E+00	PHYSPROP	1.8E+02	PHYSPROP	1.9E-01	4.1E-01	9.9E-01	4.7E-02	EPI	
Xylenes	1330-20-7	1.1E+02	PHYSPROP	2.7E-01	6.6E-03	PHYSPROP	8.0E+00	PHYSPROP	-2.5E+01	EPI	8.6E-01	ATSDR Profile	6.9E-02	8.5E-06	EPA WATER9		3.8E+02	EPI	3.2E+00	PHYSPROP	1.1E+02	PHYSPROP	2.0E-01	4.1E-01	9.9E-01	5.0E-02	EPI	
Zinc Phosphide	1314-84-7	2.6E+02	CRC89						1.2E+03	CRC89	4.6E+00	CRC89											3.7E-03	2.9E+00	7.0E+00	6.0E-04	RAGSE	
Zinc and Compounds	7440-66-6	6.5E+01	PHYSPROP						4.2E+02	PHYSPROP	7.1E+00	CRC89				6.2E+01	SSL					1.9E-03	2.4E-01	5.9E-01	6.0E-04	RAGSE		
Zineb	12122-67-7	2.8E+02	PHYSPROP	1.1E-07	2.7E-09	PHYSPROP	7.5E-08	PHYSPROP	1.6E+02	EPI			4.5E-02	5.2E-06	EPA WATER9		1.3E+03	EPI	1.3E+00	PHYSPROP	1.0E+01	PHYSPROP	2.1E-03	3.7E+00	8.8E+00	3.3E-04	EPI	
Zirconium	7440-67-7	9.1E+01	EPI				0.0E+00	NIOSH	1.9E+03	CRC89	6.5E+00	CRC89				3.0E+03	BAES					3.7E-03	3.4E-01	8.2E-01	1.0E-03	RAGSE		

APPENDIX B
SCS QUALITY MANAGEMENT SYSTEM



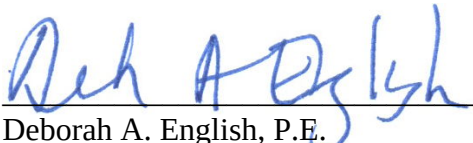
Quality Management System

SCS Engineers and Affiliated Companies

September 25, 2009
Revised October 21, 2010
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Revised January 5, 2015

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Reviewer:

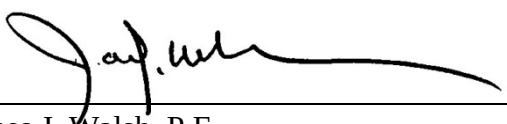


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1/5/15

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Attachments

A	Design Checklist
B	Quality Management System Audit Checklist

1.0 MANAGEMENT AND ORGANIZATION

1.1 APPROVAL PAGE

An approval page signed by the primary author and reviewer is included prior to the Table of Contents. The 2009 SCS Quality Management System was prepared by a committee consisting of Bob Gardner, Tom Nichols, Mark Tumlin, Bob Westly, John Picone, Dave Fisher, Tom Barham, Deborah English, Dave Laney, Jim Walsh, Tom Conrad and Mike McLaughlin. This update was prepared by Mike McLaughlin and Deborah English.

1.2 STATEMENT OF POLICY

To be the environmental firm of choice to clients, SCS must provide quality solutions to environmental problems in an ethical manner. We will treat our clients' environmental problems as if they were our own, making sure that SCS staff and our subcontractors have the necessary training and skills, use the proper tools, and employ sound procedures to address each client's needs. We will continuously seek to improve the quality of the services we deliver by checking our work, considering new technologies and work processes, and documenting compliance with the SCS Quality Management System.

Compliance with this policy and the SCS Quality Management System are required of all employees. In consideration of such compliance, SCS will provide a legal defense to employees who have signed, sealed, or initialed SCS work products.

The SCS Quality Assurance and Quality Control Program was first adopted by resolution of the Board of Directors on January 19, 1985 and amended and re-affirmed by the Board on the following dates:

- February 3, 1989
- July 15, 1992
- February 5, 1994
- May 29, 1998
- February 1, 2003

The SCS Quality Management System was first adopted by resolution of the Board of Directors on May 30, 2009 and amended and re-affirmed by the Board on the following dates:

- November 30, 2012
- January 5, 2015

This Quality Management System follows guidelines established in the most recent US Environmental Protection Agency (EPA) guidance for Quality Management Plans (Ref. 1).

1.3 ORGANIZATION CHART

Within SCS, everyone plays a role in delivering quality work. If you see a problem or mistake, fix it if you can, or bring it to the responsible person's or your supervisor's attention.

Certain individuals have specific roles and responsibilities as described elsewhere in this document. **Figure 1** is an organization chart showing roles for quality management at SCS. It shows the reporting relationships for corporate-wide support (National Partners, executives, corporate staff), Project Managers, Project Directors, Office Directors, Office Services Managers, office staff, and field staff.

The National Partner for Quality Management reports to the President with respect to quality management, and serves as the national leader and focal point for quality management at SCS. The National Partner is supported by Office Quality Management Coordinators designated by the Office Directors.

1.4 DISCUSSION OF AUTHORITY

This Quality Management System document has been adopted and may be revised by the Board of Directors, which also appoints executive officers of the firm. Executive officers of the firm are charged with the responsibility for its implementation under the direction of the President.

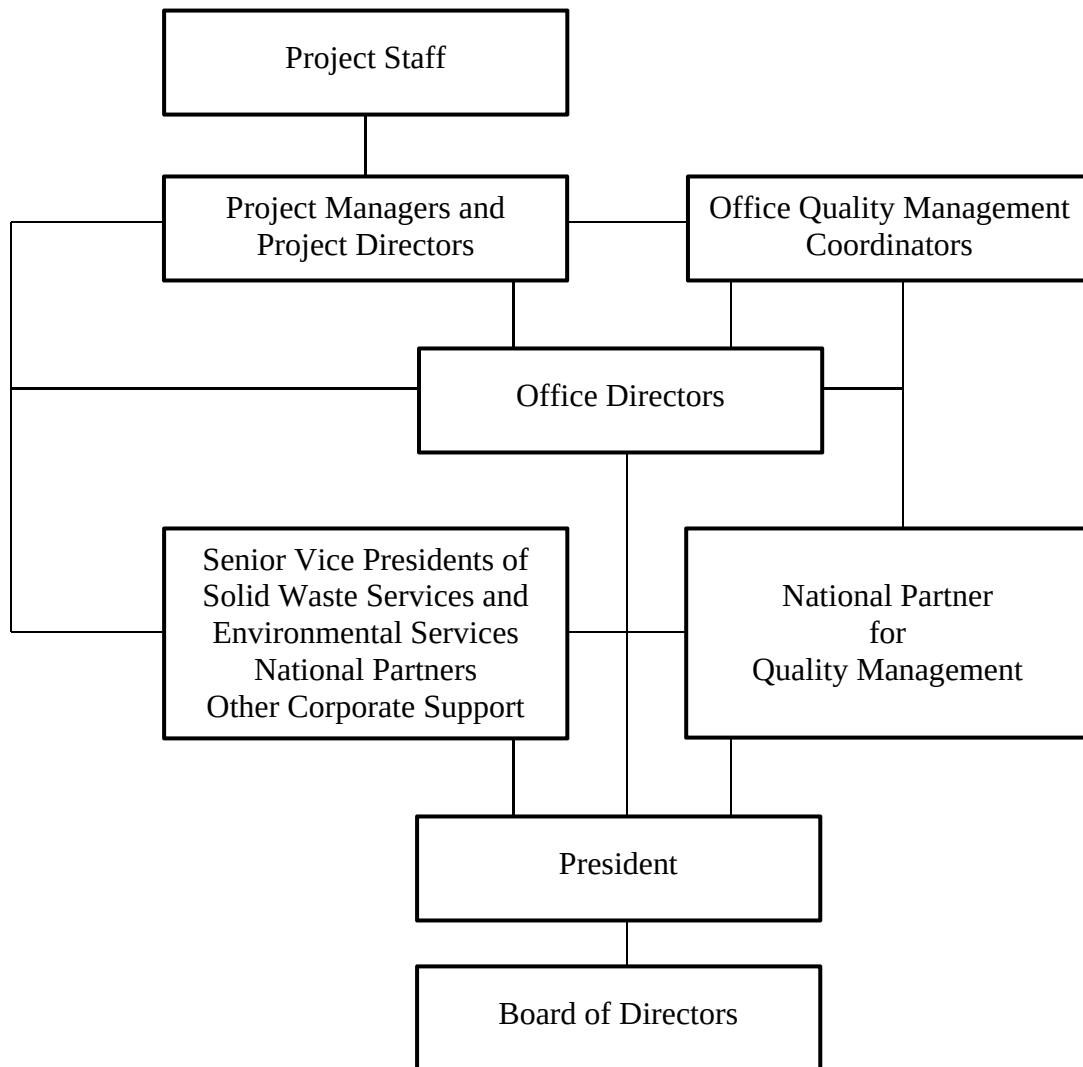
The National Partner for Quality Management is appointed by and reports to the President. This professional leads quality management at SCS, providing guidance, developing tools, and conducting training to his or her colleagues for quality management. The National Partner for Quality Management reports at least once a year to the Board of Directors, which provides access to senior management to plan, assess, and improve the Quality Management System.

Each Office Director or designated Office Quality Management Coordinator is responsible for the implementation of the Quality Management System within the Office, including reviewing office procedures for conformance with the Quality Management System, following up on findings from annual audits, communicating quality management issues and developments to Office staff, making sure annual training is conducted, and communicating possible quality management issues to the National Partner for Quality Management.

The Executive Vice President and Senior Vice Presidents may designate National Partners and SCS Certified Leaders who have firm-wide leadership of their areas of expertise.

1.5 DISCUSSION OF TECHNICAL ACTIVITIES SUPPORTED BY THE QUALITY SYSTEM

SCS performs a variety of services. These include, but are not limited to, engineering and scientific studies, geotechnical and hydrogeological investigations, engineering designs, feasibility studies, field inspections, field sampling, construction, and operation, monitoring, and maintenance of environmental protection systems.

Figure 1. Organization Chart for Quality Management

Key:

- Direct Reporting Relationship
- - - Relationship Involving Support and Assistance

Most services performed by SCS result in some form of documentation of the work, whether the work was conducted in the field or in the office. This Quality Management System applies to external documents (such as reports, draft reports, proposals, engineering plans and specifications, as-built drawings, conference papers, articles, and similar materials which are circulated outside the firm) and critical internal documents (such as work plans, inter-office assignments, and quality assurance project plans).

This Quality Management System includes procedures and checklists for use in conducting quality assurance reviews of external and internal documents.

1.6 HOW MANAGEMENT ASSURES PROGRAM IS UNDERSTOOD AND IMPLEMENTED

The current version of this Quality Management System document is maintained and available on the firm's Intranet. References to the firm's Quality Management System are included in the *SCS Employee Handbook* (Ref. 2) and the *SCS Project Manager's Manual* (Ref. 3). Periodic quality management training is provided to technical and support staff. In addition, quality management policies, issues, and suggested improvements are discussed during periodic Office Quality Management Coordinator conference calls chaired by the National Partner for Quality Management.

1.7 PROCESS FOR RESOLVING DISPUTES REGARDING THE QUALITY SYSTEM

If a dispute arises over quality system requirements, quality assurance and quality control procedures, assessments, or corrective actions that cannot be resolved through normal communication channels, the National Partner will be notified. The National Partner will investigate the matter as necessary, consult with appropriate technical experts as necessary, and resolve the dispute if possible. If the National Partner cannot resolve the dispute, it will be referred to the President.

2.0 QUALITY SYSTEM COMPONENTS

2.1 DESCRIPTION OF PRINCIPAL COMPONENTS

SCS is an environmental consulting and contracting firm. We provide quality solutions to environmental problems in an ethical manner. To achieve this, work performed by the firm is subject to a quality control process and a quality assurance review. Quality control includes the day-to-day steps we follow to make sure the work we do is correct. For example, we double-check our own calculations, read the meter twice, and proofread our own writing to make sure mistakes are fixed before anyone else sees the work.

For many of the types of work we do, the firm has adopted or published standard operating procedures that provide a consistent quality control process. In addition, certain projects and tasks may only be performed by SCS Certified staff. Additional information on the quality

control process, standard operating procedures, and SCS Certified are available on the SCS Intranet.

SCS plans, specifications, reports, work plans, and related materials (called “documents” below) shall be reviewed internally by a second qualified person (a person other than the primary author) prior to release. When feasible, proposals shall also be reviewed internally by a second qualified person. The internal review will be conducted by the Project Director or by an individual designated by the Project Director. If a qualified person cannot be identified within SCS, an external party (designated or approved by the Project Director) with the appropriate expertise may be contracted to perform the review. Whether or not the seal of a licensed professional is required on a given document, internal review is required to help assure the quality of SCS documents. Normally, internal review is reflected by the signatures of the primary author and the reviewer on the transmittal letter. In the event of transmittal by email, the quality assurance reviewer should be copied on the email, and a copy of the email saved to the project file.

At SCS, quality assurance/quality control is not just a final review before the document is delivered to a client. It is inefficient to “add quality” to a report or engineering design at or near the end of a project. While a necessary step, the end-of-project review, plan check, and/or final edit does not substitute for an overall project program that incorporates regular reviews of in-progress work, interaction with clients to confirm their needs, and frequent communication between project team members to verify assumptions. Quality work products are created when all team members focus throughout the project on the achievement of quality in each task.

Also related to the subjects of quality assurance and quality control is our commitment to ethical conduct and to protecting public health and safety. It would be wrong (and unacceptable) to write down field measurements that were not taken, or to state that something was observed when it was not observed. As a firm, we depend on our colleagues to be careful, honest, and professional in the work they perform, and we can accept no less. We provide annual ethics training to all employees. Additional information on SCS Standards of Business Ethics and Conduct are contained in SCS’s *Employee Handbook* and *Project Managers Manual* (both of which can be found on the SCS Intranet).

2.2 ROLES AND RESPONSIBILITIES OF STAFF

2.2.1 Project Manager

The SCS Project Manager is the person identified as such for a given project or task in Vision, the software used by SCS to plan and track project performance. The Project Manager is responsible for the quality of project work and external and internal documents associated with that work. Responsibilities include making sure that:

- Contracts are reviewed and executed in accordance with SCS policies.
- Project work and reporting documents are of professional quality, correct, accurate (i.e., no errors), and consistent.

- The work and deliverables satisfy the contract, reflect industry standards, and comply with regulatory requirements.
- Client expectations and requirements are met or surpassed.
- Review has been completed before deliverables are sent to the client or others outside SCS.
- Work performed by subcontractors meets subcontract and client specifications.
- Deliverables are understandable to the intended audience, not just to those intimately familiar with the subject matter.
- Findings, results, and conclusions are presented in a manner appropriate to client needs, and are supported by the deliverable.
- Applicable SCS and client procedures are followed, including the latest *SCS Health and Safety Injury and Illness Prevention Program* (Ref. 4), SCS standard operating procedures, and standards for writing style, format, and similar standards. These referenced SCS documents are posted on the Intranet.
- Operations, monitoring, and maintenance by SCS are performed in accordance with contract documents, applicable regulatory requirements, and available operation and maintenance manuals and standard operating procedures.
- Construction by SCS is performed in accordance with construction documents (design drawings, specifications, etc.), applicable regulatory requirements (including local building permits), and under proper State contracting licenses.
- Project file documentation is complete, organized, and accurate.

2.2.2 Project Director

The SCS Project Director is the person identified as such for a given project in Vision. The Project Director normally provides quality assurance review of the work products and deliverables (prior to transmittal to the client in the case of external documents). Where the Project Director also serves as the Project Manager, he or she will perform the quality control responsibilities of the Project Manager, and obtain a quality assurance review by another qualified senior professional.

In some situations, Project Directors may designate others to be responsible for quality assurance reviews. For example, on complex multidisciplinary projects, appropriately qualified persons, regardless of title, should be designated by the Project Director to conduct quality assurance reviews of specific project elements.

2.2.3 Office Director and Office Quality Management Coordinators

The Office Director of the office performing the work is ultimately responsible for assuring that this Quality Management System is followed within his or her office. If the Office Director does not serve as the Office Quality Management Coordinator, he or she will designate one or more Office Quality Management Coordinators. Office Quality Management Coordinator responsibilities include reviewing Office procedures for conformance with the Quality Management System, following up on annual audits, communicating quality management issues and developments to Office staff, making sure periodic training is conducted, and communicating possible quality management issues to the National Partner for Quality Management.

2.2.4 Officers of the Firm (Vice Presidents and Above)

Officers of the firm are appointed by the Board of Directors and are authorized by the Board to sign proposals and contracts in accordance with Board policy. Often this means that an officer of the firm serves as Project Manager, Project Director, or Office Director as described above.

In addition, officers are required to complete and document at least one Quality Management System audit each year for a project or activity in which they are not otherwise directly involved, as described in Section 9.1.

2.2.5 National Partners

National Partners are appointed by Senior Vice Presidents and confirmed by the Board to serve as the leader of a topic or practice area nationwide. As such, National Partners are responsible for developing standard technical approaches to our work and identifying , identifying staff with the expertise to perform certain tasks, answering questions and providing technical guidance, and reviewing or identifying reviewers of high risk deliverables (i.e., those in which an error could represent significant potential liability to SCS) .

2.2.6 National Partner for Quality Management

As noted in Section 0 above, the National Partner for Quality Management is appointed by the President and confirmed by the Board of Directors. This professional leads quality management at SCS, providing guidance, developing tools, conducting training for quality management, recommending and following up on audits, tracking quality management performance and improvements, and reporting to the Board of Directors. In addition, the National Partner for Quality Management may conduct audits, investigate deviations from this Quality Management System and impose corrective actions, subject only to review by the President.

2.2.7 SCS Certified Leaders

The leaders of the SCS Certified projects or tasks are identified by the Senior Vice Presidents. These leaders are responsible for identifying the criteria for certification, providing training (if appropriate), approving certification, and maintaining current lists of certified individuals on the Intranet.

2.3 TOOLS AVAILABLE FOR IMPLEMENTING QUALITY MANAGEMENT SYSTEM

2.3.1 SCS Intranet

The SCS Intranet provides a variety of tools, references, and links to support SCS personnel in performing their work. It includes accounting reports, corporate policies, legal guidelines and standard contracts, resources associated with specific practice areas, computer information and resources, and the health and safety program requirements and standard operating procedures. Quality Assurance is located under corporate policies and includes the Quality Management System, tools and references, review and documentation checklists, standard operating procedures and audit documentation. Additional tools are available within the practice area sections of the Intranet.

2.3.2 Deltek Vision

Deltek Vision is a project-based enterprise resource planning software that can be used to monitor project budgets, costs, schedules, and time allocation. The firm's Vision database identifies the persons serving as Project Director and Project Manager, and it documents staff who charge time to the project. In addition, the Vision database summarizes education, experience, and selected training and competencies for SCS personnel.

2.3.3 Learning Management System

The Learning Management System is a software application for the administration, documentation, tracking, and reporting of training programs, classroom and online events, e-learning programs, and training content. Use of the Learning Management System facilitates making sure that all staff required to complete certain training have in fact accomplished it.

2.4 SPECIFIC GROUPS AT SCS WHO DEVELOP QUALITY ASSURANCE PLANS

Each profit center at SCS develops quality assurance plans as required to perform work properly for specific projects. If it is anticipated that a specific project requires a departure from an existing SCS standard operating procedure due to client requirements or the unusual nature of the project, the Project Manager will provide details to the appropriate SCS National Partner, SCS Certified Leader or staff, or Senior Vice President, and a copy of the resulting project-specific standard operating procedure will be given to the National Partner for Quality Management.

3.0 PERSONNEL QUALIFICATIONS AND TRAINING

3.1 POLICY STATEMENT

SCS work will be performed or supervised by staff who are qualified by virtue of training or experience. Evidence of such training or experience will be documented (e.g., in Vision, in the SCS Learning Management System, on an individual resume, and/or in a personnel file).

3.2 DESCRIPTION OF THE PROCESS USED TO IDENTIFY, ENSURE AND DOCUMENT THAT PERSONNEL HAVE AND MAINTAIN THE APPROPRIATE KNOWLEDGE, SKILL AND CREDENTIALS NEEDED TO PERFORM THEIR JOBS

First and foremost, Project Managers and Project Directors select staff whom they know from experience have the appropriate background and skills to make up the project team. As described in the *SCS Project Managers Manual*, the proposed SCS team credentials are evaluated with respect to those needed for the project, and summarized in the proposal to the client or at the start of a new project. If needed, the proposed project team will be strengthened through additional training, assistance from other SCS personnel, or assistance from outside contractors. The need for strengthening the project team will be determined by the Project Manager and Project Director.

SCS positions have training requirements that must be completed and documented. For example, new employees must receive orientation, while others require human resources training, health and safety training, technical training, etc. Other training requirements may be specified in SCS Certified (Section 3.3) and SCS standard operating procedures (Section 8). Supervisors are responsible for identifying training requirements for those they supervise. SCS Certified training and expertise are specified by the With respect to professional licenses and similar credentials, the professional is responsible for maintaining these (e.g., obtaining continuing education or similar credits), with support from his or her supervisor.

Employee training requirements and renewal dates may be tracked using software such as the Intranet or the SCS Learning Management System. The Learning Management System or another system may also notify both the employee and supervisor of upcoming license and certification (internal and external) renewal dates, but the employee is responsible to maintain his or her own credentials. As part of annual performance reviews, training and credentials are addressed, needed training is identified, and new skills or credentials may be added as goals to complete. Individuals may also record their training on their SCS professional resumes.

3.3 SCS CERTIFIED STAFF

Special SCS certifications are required to perform some kinds of projects and tasks. To perform such projects/tasks, an individual's name must appear on the list of those certified as having completed the appropriate training and/or as having the necessary experience as determined by the designated leader of the applicable SCS Certified programs. The projects/tasks for which such internal SCS Certifications are required appear below; details (including the designated leader, definitions, training information, and lists of names of those certified) appear on the Intranet:

- Landfill gas modeling
- Drilling atop lined landfills
- Geotechnical analysis
- Dangerous goods shipping
- Environmental due diligence

4.0 PROCUREMENT OF ITEMS AND SERVICES

Quality is an important criterion when SCS purchases goods or services from third parties. We require subcontractors to provide certain basic information (evidence of insurance, tax identification, evidence of special certifications required to perform the work, small or disadvantaged status, etc.), and we require purchase orders, service orders, or subcontracts as provided in the *SCS Contract Guide* (Ref. 5). We normally are not required to accept the “low bid” for subcontract services, and this Quality Management System and our longstanding practices require that we select subcontractors and vendors who we believe offer the best value for the work required.

4.1 REVIEW AND APPROVAL OF PROCUREMENT DOCUMENTS

The SCS Project Manager (or designee) is responsible for review and approval of procurement documents. Often all that is needed is to assure that the procurement documents (e.g., scope of work and associated specifications) meet the needs of the project. This could be as simple as specifying laboratory methods for samples to be collected by SCS, together with associated quality assurance/quality control requirements. Or it could be more complicated (e.g., detailed performance specifications for a control system). In any event, it is the SCS Project Manager’s (or designee’s) job to make sure we are buying what is needed for the project.

For repetitive procurement items, we follow an informal “vendor approval” process. A vendor who has delivered responsive service with good value to SCS and our clients in the past is considered approved for similar services. Where we do not have experience with a prospective vendor, the approval process is more formal. Questions the Project Manager (or designee) will consider include the extent to which the prospective vendor:

- Demonstrates appropriate qualifications and experience.
- Demonstrates appropriate attention to quality (e.g., through a written quality assurance/quality control program, certifications, etc.).
- Provides technical details of their products or services.
- Provides business and technical references for their work.

Vendor records are maintained in the Vision database. Vendors who have established national accounts and/or Master Services Agreements with SCS are posted on the SCS Intranet; as appropriate, copies of (or links to) qualifications materials and similar documents also are posted.

4.2 ENSURING PROCURED ITEMS AND SERVICES ARE OF ACCEPTABLE QUALITY

Purchased goods and services will be evaluated by the SCS Project Manager (or designee) upon receipt, if possible, or before acceptance and payment in any case. Briefly summarized, at a minimum the Project Manager (or designee) will confirm that the items or services appear to meet the requirements contained in the procurement documents.

In some cases, it may be necessary to conduct additional investigation to confirm items and services are of acceptable quality. For example, it may be prudent to visit the facilities of a fabricator or laboratory to become familiar with their work at that facility. As another example, it may be necessary to confirm the items or services are of acceptable quality through independent validation (e.g., for laboratory data) or material testing.

The need for and results of additional investigation or testing will be documented by the Project Manager (or designee).

5.0 DOCUMENTS AND RECORDS

This section addresses the following topics:

- Quality-Related Documents and Records Requiring Retention and Review.
- Preparing and Reviewing Documents for Conformance with Requirements.
- Ensuring Accuracy of Documents and Records.
- Maintaining Documents and Retention Policy.
- Ensuring Compliance with Regulatory Requirements for Records.
- Chain-Of-Custody and Confidentiality Provisions.

We use Job Numbers to track and control documents. For jobs, the Job Number is a number in the following format:

$\overline{A} \quad \overline{A} \quad \overline{B} \quad \overline{C} \quad \overline{C} \quad \overline{D} \quad \overline{D} \quad \overline{D} \quad \cdot \quad \overline{E} \quad \overline{E}$

where AA corresponds to the Profit Center code, B is the century (2 for years between 2000 and 2099), CC is the fiscal year (11 for projects between 1/1/11 and 12/31/11), DDD is a sequential number generally starting with 001 for the first project of the year (although some profit centers allocate these numbers in different blocks for different satellite offices), and EE is a suffix (often not used; thus “00” is the default). For example, 01215059.00 would be the 59th project for Office 01 in the year 2015.

Some Job Numbers are further divided into Project Tasks (Task 1, Task 2, etc.) to facilitate tracking portions of a given project that are managed and invoiced separately.

For proposals, the positions of BCC and DDD are reversed; an extra number is available to designate the proposal; e.g., 010074210; and no suffix is included

$\overline{A} \quad \overline{A} \quad \overline{D} \quad \overline{D} \quad \overline{D} \quad \overline{D} \quad \overline{B} \quad \overline{C} \quad \overline{C}$

Documents and records (including emails) should contain the appropriate Job Number as provided in the *SCS Style Manual* (Ref. 6). Emails sent by SCS normally should include the Job Number or Proposal Number in the Subject line. If the email is originated by SCS, the Job Number or Proposal Number should be included. It may be included anywhere in the subject line, but the end of the subject line is preferred. The Job Number or Proposal Number should be

added to the subject line in responses to client-generated emails, if this procedure does not conflict with client preferences.

5.1 QUALITY-RELATED DOCUMENTS AND RECORDS REQUIRING RETENTION AND REVIEW

We generate many documents and records in the course of our work, and all of them are a reflection of the quality of our work to one degree or another. However, the following documents and records require retention and review as provided in this Quality Management System:

- Technical Reports
- Engineering Plans, Specifications, Basis of Design Documents, and Cost Estimates
- Proposals and Contracts
- Conference Papers and Articles
- Internal Project Documents (General)
- Correspondence and Emails
- Diary, Daily Logs, or Log Book
- Record Copies (Final Client Deliverables)
- Internal Documents (Controlled)
- Special Documentation Requirements
 - Project Health and Safety Plans
 - Sampling and Analysis Plans
 - Quality Assurance Project Plans
 - Calculations

Document and data controls include:

- Review and approval by Project Manager and Project Director or other professional providing quality assurance review prior to issue and use. For documents that are externally transmitted, this will be documented by the signatures of the primary author and the quality assurance reviewer on the transmittal letter or, in the event of email transmittal, by copying the quality assurance reviewer on the transmittal email. The transmittal document should be saved to the project file.
- Where multiple versions of a document have been issued, version numbers or similar are used in the file name (e.g., v0.x for draft documents, v1.x for deliverables, v2.x for subsequent generation of deliverable following regulatory review, etc., where x is the version number).
- Making documents available where needed. File them in accordance with this Quality Management System on a common network drive.
- Removal or suitable marking of obsolete documents to prevent inadvertent use.

Materials and data provided by a client for use on a project are evaluated for suitability before use, and handled and stored to protect usability. Such materials or data that become lost or damaged or are found unsuitable are reported to the client and recorded in the project files. Special requirements for handling, storage, or control of client supplied materials or data, if any, are documented within the project files.

5.2 PREPARING AND REVIEWING DOCUMENTS FOR CONFORMANCE WITH REQUIREMENTS

5.2.1 Technical Reports

Proposals as well as draft, draft final, and final reports prepared by SCS will be reviewed by a Project Director (or designee) for quality assurance to confirm that the following questions have been answered in the affirmative (or are being documented as inapplicable):

- Have the scope and purpose been identified?
- Have the documents and other necessary supporting data been identified and cross-checked, including:
 - Regulatory requirements (federal, state, and local).
 - References to industry standards (National Fire Protection Association, American Society of Testing Materials, etc.).
 - References to technical literature and related reports.
 - Field testing results, laboratory analysis, calculations, and in-house analyses.
 - Special features, qualifications, and/or limitations of the data.
- Was the work done in conformance with industry standards, contract specifications, and regulatory requirements?
- Was the scope of data collection appropriate, given the project scope and purpose?
- Were the analytical techniques used appropriate, considering client requirements, regulatory requirements, industry and professional standards of practice, and available data?
- Are deviations from standard practice justified and explained?
- Are tables and figures of consistent format, easily understood, and adequate in number and content?
- Are mathematical expressions developed logically? Are calculations correct?
- Are assumptions clearly identified, together with an appropriate explanation or rationale?
- Are the coverage and explanation of previous work sufficient (but not unduly duplicative) to place the report in context?

- Have findings, conclusions, and recommendations been stated clearly? Are the findings, conclusions and recommendations supported by the data collected and analyses performed, as presented in the text?
- Are the findings and conclusions correct and well founded?
- Are the findings and conclusions consistent with similar work performed by SCS or others? If not, is a sufficient technical basis presented to explain the difference?

5.2.2 Engineering Plans and Specifications

In addition to transmittal documentation, final or near-final (e.g., 95 percent) drawing title blocks will be initialed to reflect the appropriate reviews.

For final submittals, the appropriate professional seals will be placed on each drawing by the primary designer (if registered) or the Project Manager if he or she provided detailed review, and the cover sheet will be signed and sealed by the professional having primary responsibility and authority for the project (the Project Director, the Office Director, or the Reviewing Principal), as well as the primary designer or Project Manager (if they hold the appropriate professional license). All submittals will be signed, sealed, and otherwise marked (e.g., with firm certificate of authorization number, phraseology, etc.) in accordance with state regulatory requirements.

A Design Checklist should be completed for each review and a copy saved with the deliverable in the project file. The standard Design Checklist is included in Attachment A, but may be modified to meet Office- or project-specific requirements. During each review, the professionals conducting the review will assure and document that the following questions have been answered in the affirmative (or are documented as being not applicable):

- Was the design prepared in conformance with contract requirements?
- Have relevant building codes and other standards been obtained and reviewed by the designer? Is the design consistent with applicable codes?
- Is the basis for design adequately documented? Were the formulae used appropriate? Are calculations correct and have they been independently checked?
- Are the title blocks, referencing, and drafting consistent throughout the drawings with *SCS Computer Aided Design and Drafting Standards Manual* (Ref. 7) or those of the client?
- Are dimensions clearly shown, or readily computed?
- Are details clearly shown, properly referenced, and adequate in number and quality?
- Are notes clear, specific, and complete?
- Are materials and products adequately specified in the specifications or drawings? Are applicable Construction Specifications Institute (or similar) divisions covered?

Is the specification terminology consistent with the design drawings? Are materials and specifications properly incorporated by reference? Are the specified materials or products readily available and at a reasonable, cost effective price?

- Is the design practical? Can it be constructed? Once built, can it be properly operated and maintained?
- Is the construction cost estimate complete? Are the prime contractor's and subcontractors' mark-ups identified and properly applied?
- Are operation and maintenance manuals included? If so, are they understandable and complete? Are manuals required to be complete prior to start up and operation of the system? Do they contain performance or operation goals, sample data sheets, and manufacturers' specifications?

5.2.3 Proposals and Contracts

Before a proposal is prepared, a Go/No-Go Decision should be made by a person authorized to execute a contract of the anticipated value of the proposed project, as provided in the SCS *Contract Guide*. Proposals will be transmitted over the signature of the person so authorized. In general, the highest-ranking officer of the firm involved in the proposal effort should sign it, along with the preparer of the proposal. Normally, the person signing the transmittal letter should provide a quality assurance review of the proposal before signing the transmittal letter. In those cases in which the person signing the transmittal letter is also the primary author of the proposal, a quality assurance review should be performed by another qualified professional in the office or another office, who should also sign the transmittal letter. The review typically should include at least a comparison of the proposal with the request for proposal (if any) and verification of the cost estimate.

Contracts may only be signed by authorized SCS personnel as provided in the current version of the SCS Contract Guide (available on the Intranet). If the contract used is not an SCS standard contract or if modifications to an SCS standard contract are requested by a client or subcontractor, the contract must be reviewed by the SCS legal department. The legal department keeps a record of all contract reviews. Client contracts and subcontracts must be fully executed before work is performed, and a copy provided to the Office Services Manager. The Office Services Managers save contracts on laser fiche in a central filing system. Copies of contract documents shall also be maintained in the project file.

5.2.4 Conference Papers and Articles

Conference papers and articles should include a second SCS professional as co-author or be reviewed by a second qualified SCS professional before transmittal. In cases in which the co-author is not an SCS professional (e.g., a client or subcontractor), a second SCS professional should still perform an independent quality assurance review of the paper.

5.2.5 Internal Documents (General)

Internal documents, such as telephone conversation notes, meeting notes, trip reports, and work plans, will be kept in a central filing system established by the SCS Project Manager in accordance with standard office filing procedures. The person who prepares an internal document will route one copy to the Project Manager (or, for large jobs, to his or her designee). Under no circumstances may such an internal document be distributed outside the firm without the approval of the Project Manager. The person providing the quality assurance review for the project periodically should audit project files to assure that adequate records are being maintained.

5.2.6 Correspondence and Emails

Project-related correspondence, such as letters, memoranda, and emails, must be routed to the Project Manager. At the discretion of the Project Manager, such correspondence may require his or her approval prior to distribution outside the firm. Letter reports and similar deliverables will be subject to quality assurance review in accordance with the requirements for Technical Reports provided in Section 5.2.1. Significant correspondence, including emails (e.g., documenting transmittal of deliverables, client approval of deliverables and scope and schedule changes, comments on or approval of subcontractor deliverables, etc.) will also be saved in the project files.

5.2.7 Diary, Daily Logs, or Log Book

On construction projects where SCS is providing either on-site inspection or periodic observations, the Project Manager will assure that a diary or log book is kept with notes recorded for each day (or observation). On other projects with field activities, the Project Manager will assure that a diary (or daily log) is maintained to note work performed, problems, solutions, conclusions, conversations, and other relevant matters, all recorded in a businesslike and professional manner (e.g., factual in tone, without personal or editorial comments). Copies of field documents will be retained in the project file.

5.2.8 Record Copies

Following completion of a project, the Project Manager will assure that job files are purged of duplicate information and generally arranged in chronological order to facilitate future access and review. A record copy of final project documents (drawings, specifications, reports, etc.) shall be provided for the project file. A complete set of files must be retained in some combination of electronic and hard copies. See Section 5.4 for additional guidance on preparing project files for closure and the SCS records retention policy.

5.2.9 Internal Documents (Controlled)

Internal Documents (Controlled) are documents relating to company policies and procedures that are maintained and updated using a controlled procedure. Examples include this Quality Management System and the *Health and Safety Injury and Illness Prevention Program*. Controlled documents are formally approved by the President and the Board of Directors

following development or modification by the person or committee with responsibility for the document.

Company policy and procedure documents are maintained in read-only versions on the SCS Intranet to ensure that the current versions are always available to all employees.

5.2.10 Special Documentation Requirements

5.2.10.1 Project Health and Safety Plans

Prior to the conduct of field assignments, the Project Manager will identify and evaluate the potential hazards, if any, to employees who may work at the job site. The Project Manager will prepare, or request that the Office Health and Safety Coordinator or others prepare, a site-specific health and safety plan for the project. The site-specific health and safety plan will conform to SCS's *Health and Safety Injury and Illness Prevention Program* requirements (SOP 2), client specifications, and applicable local, state, and federal guidelines.

The site-specific health and safety plan will be reviewed by the Project Manager and, if not prepared by the Office Health and Safety Coordinator, also by the Office Health and Safety Coordinator or the Corporate Health and Safety Director, as applicable. Evidence of this review and approval will be placed in the project files. The plan will be provided to and signed by employees and subcontractors working on the job prior to the initiation of field activities. The site-specific health and safety plan including a copy of the signed Acknowledgement page will be retained in the project file.

See Section 7.7.3 for additional guidance on Project Health and Safety Plans.

5.2.10.2 Sampling and Analysis Plans

Prior to the conduct of a sampling and analysis assignment, the Project Manager will evaluate the sampling and analysis requirements after considering the physical characteristics of the site, the material to be sampled, and standard references that are relevant to the assignment. If warranted or required (e.g., the assignment is complex or a regulatory agency requires it), a written sampling and analysis plan will be prepared.

The sampling and analysis plan will describe the sampling methods to be used and their rationale, documentation standards (including chain-of-custody considerations), analyses selected and their rationale, and analytical procedures to be used and their rationale (including method detection and reporting limits). It must take into consideration the quality assurance/quality control program followed by whatever laboratory will be used to analyze the samples. The sampling and analysis plan will be reviewed and approved by the Project Manager and the person providing quality assurance review (i.e., the Project Director or designee), with evidence of these approvals maintained in the project files.

See Section 7.7.1 for additional guidance on preparing field sampling plans.

5.2.10.3 Quality Assurance Project Plans

This Quality Management System provides general guidance and policy with respect to quality assurance and quality control. For some projects, the client may require SCS to provide as a deliverable a separate quality assurance/quality control plan for the specific program or project. This Quality Management System can serve as a reference for such a project-specific plan. Project Managers are responsible for preparing the quality assurance/quality control project plan, and it must be reviewed and approved by the Project Director or designee, with approvals noted as a part of the document (e.g., a signature block on the title page).

Section 7.7.2 provides additional guidance on preparation of quality assurance project plans.

5.3 ENSURING ACCURACY OF DOCUMENTS AND RECORDS

SCS processes are implemented under controlled conditions by means of standard practices and project-specific controls, as follows:

- Objectives, scope of services, and technical approach for each project are documented and referenced to contract documents.
- Suitable equipment and techniques are utilized in accordance with applicable standard practices or separately specified client-specific requirements as appropriate.
- Referenced standards and practices are followed.
- Construction contractor proposed variances from the drawings and specifications are documented, and change orders are negotiated as necessary.
- To the extent necessary, workmanship requirements are defined in the specifications, contract documents, or by standard practices.
- Special requirements that cannot be readily verified are identified and controlled as specified by personnel having the appropriate educational backgrounds and relevant experience.

The Project Manager manages the production processes and preparation of work results and services, supported by other staff and subcontractors as required. The following activities typically are included:

- Plan the work.
- Hold project kick-off meeting with the project team to review the project requirements and quality control/quality assurance procedures (Section 7.5).
- Use standard operating procedures (including activity-specific forms and logs for documentation) appropriate to the work to be performed (Section 8.0).
- Obtain permits and similar approval documents as required by our scope.

- Review results.
- Re-plan work or activities as necessitated by data and results obtained.
- Coordinate client reviews as appropriate.
- Prepare written work results including appropriate quality control reviews and assurance verifications.
- Submit written work results to the client in an appropriate form (e.g., letter, formal bound report, technical memo, design plans and specifications, “as-built” documentation for constructed systems, etc.).

5.4 MAINTAINING DOCUMENTS AND RETENTION POLICY

Documents and records are maintained in a central filing system. Electronic records associated with a given project are filed in a subdirectory having the Job Number as its name. If Project Tasks are used, they will appear as the next file directory level within the project directory. Within each project or task directory, the following folders or subdirectories should be used:

- Background Documents (existing information obtained from other sources, including the client)
- Contract and Invoices (contract, change orders, subcontracts, insurance certificates, invoices)
- Correspondence (emails, letters, progress reports, etc.).
- Deliverables (draft and final reports, drawings, etc.).
- Data and Calculations (database reports, spreadsheets, laboratory reports, chain-of-custody forms, scanned handwritten calculations, field notes, logs, etc.).

The Project Manager or designee is responsible for maintaining project documents and records while the project is active and for organizing project files for retention when the project is closed. There is no need to maintain or retain paper copies when electronic copies have been made, and there is no need to maintain or retain superseded draft documents, insignificant correspondence, or duplicate copies. Draft documents should be discarded unless there is a specific need to retain them (e.g., to document client changes or to retain information that may be used for other purposes or in other deliverables). Significant correspondence (including emails) should be saved to the project Correspondence folder or subdirectory instead of or in addition to other locations.

Provided there are no unusual circumstances requiring that the records be retained (which may include project-specific requirements), project records may be discarded as indicated below. All destruction of documents is suspended when a lawsuit, claim, or investigation is pending, threatened, or foreseeable. Appropriate precautions shall be taken when destroying records

subject to confidentiality obligations. For example, in some cases, it may be appropriate to shred confidential information or return it to our client. Questions regarding document retention or destruction should be directed to corporate legal counsel.

Except for items that are to be retained in our permanent records, project documents and records may be discarded 10 years after the project is closed. However, if future work at or near the project site is anticipated, and/or if the project contains elements that may be useful as a future reference (e.g., an unusual project element that could serve as a model for future projects or proposals), the files may be retained indefinitely.

The following records are permanent records and should not be discarded:

- Contracts and subcontracts.
- Insurance certificates.
- Final reports.
- Final plans and specifications.
- Other documents signed and sealed by an SCS professional engineer or professional geologist.

5.5 ENSURING COMPLIANCE WITH REGULATORY REQUIREMENTS FOR RECORDS

Environmental laws and requirements as well as projects with an obvious potential for litigation may supersede the SCS records retention policy. Similarly, when our work is the subject of a court or administrative order, those requirements for records retention should be followed in lieu of the guidance provided in Section 5.4.

If you are unclear or concerned that special requirements should be considered, consult with corporate legal counsel.

5.6 CHAIN-OF-CUSTODY AND CONFIDENTIALITY PROVISIONS

SCS will maintain security procedures internal to each office to safeguard information, limit access, and prevent unauthorized disclosure of information or records. Specific chain-of-custody procedures will be identified in the contractual and project documentation requirements for the project as necessary to withstand scrutiny during litigation.

In some cases, SCS employees will sign separate confidentiality agreements governing their work. In such cases, or where other considerations merit their use, related documents and other evidence generated in the performance of the work will be inventoried, cataloged, and stored in a separate secure area. SCS employees subject to such separate confidentiality agreements shall not disclose, either in whole or in part, to any entity external to the Client any information or data that is the subject of the agreements (e.g., site-specific cost information, or strategy) without first obtaining written permission from the Client.

6.0 COMPUTER HARDWARE AND SOFTWARE

6.1 COMPUTER HARDWARE AND SOFTWARE

SCS standardizes computer hardware and software across all offices. With numerous offices across the country and some international presence, SCS realizes the need for standardization in order to foster transparent interaction among colleagues. The goal is to create an SCS computer and network environment where workers from one office can travel to another office and find a familiar computer and network environment with access to the same files and file system rights as they enjoyed in their home office.

The SCS Information Systems Committee meets periodically to discuss information technology issues and to set policies, including policies on company standards for computer hardware and software. The committee reports to the SCS Board of Directors, and the most recent Board package or the Intranet should be consulted to determine any changes in standards (e.g., the specific software versions now considered standard at SCS).

At present, SCS uses Autodesk's AutoCAD, Microsoft Office (Word, Excel, PowerPoint), Microsoft Internet Explorer, and Microsoft Outlook software throughout the firm. To help SCS maintain standards for both software and hardware SCS has established purchasing agreements with Dell and Microsoft. Standard models are set up on the Dell website specific to SCS. For software purchases, employees should contact information technology support staff to make sure the correct versions are purchased. For security purposes, all users should lock or turn off their computers when not in use and when they leave for the day. It is also recommended that computers have a screen saver enabled that requires a password to be entered when the computer wakes up.

Where particular software is required for specific problems and applications, this software is procured, and information regarding the use of such niche software is tracked by SCS information technology support staff. As new software and solutions are proven reliable (and determined to be compatible with other SCS standard software), this information is made available to the entire firm.

Computer hardware standards have been established to increase effectiveness in acquiring and administering computer resources by promoting consistency in configurations and compatibility. Additional benefits include volume-based purchasing discounts, better inventory management, and better support by system administrators.

SCS's information technology group maintains and tests security patches and software updates to be sure they will work within the SCS environment. Updates and patches are pushed to SCS-owned computers to keep them on the same versions of updates and patches.

6.2 ASSESSING AND DOCUMENTING IMPACT OF CHANGES TO USER REQUIREMENTS

Prospective changes to computer hardware or software policies for SCS are the responsibility of the SCS Information Systems Committee, which is made up of senior executives, power users, and information technology professionals. The primary purpose of the committee is to make sure SCS is using the right technologies to meet the needs of our various users.

At least once each year (normally in the months before a meeting of the Board), the Information Systems Committee meets to discuss the status of information technology at SCS. If changes are planned, the committee will describe them in a written report to the Board that assesses and documents the impact of changes in computer technology (software and hardware) to users.

Users at SCS have access to a number of tools to help document challenges in using the computer systems available. We use web pages and a list server (netnews@scsengineers.com) to document SCS procedures and solutions with respect to computer systems.

6.3 EVALUATING HARDWARE AND SOFTWARE PURCHASES

The SCS Information Systems Committee evaluates hardware and software purchases based on feedback received from users. As noted above, a specific email list server is used to circulate questions, comments, problems, and solutions among SCS power users and others. The netnews messages provide a constant stream of feedback for evaluation.

6.4 ENSURING DATA AND INFORMATION THAT ARE AUTOMATED MEET MANAGEMENT REQUIREMENTS AND STANDARDS

The SCS Information Systems Committee is responsible to assure that the data and information automated by our various information systems are automated in ways that meet SCS requirements and standards. Of particular interest are approaches to automation that reduce the potential for inadvertent error, and that incorporate independent means of verifying some kinds of data.

7.0 PLANNING

7.1 PLANNING ENVIRONMENTAL DATA OPERATIONS CONSIDERING DATA QUALITY OBJECTIVES

This section has been prepared to conform to the guidelines presented in the most recent EPA requirements for quality management plans (Ref. 1), which states that the purpose of this section is “to document how individual data operations will be planned within the organization to ensure that data or information collected are of the needed and expected quality for their desired use.”

This section describes the processes by which SCS plans environmental data operations using a systematic planning process, develops quality assurance project plans, and evaluates and qualifies data from SCS activities and other sources.

Planning is a dynamic function that begins with scoping at the proposal stage and evolves throughout the project through interaction between the client, regulatory agencies, SCS managers and staff, and subcontractors. The key to planning is communication on all levels throughout the project to ensure that all parties understand the project objectives and deadlines, as well as the agreed upon procedures to meet those goals.

Project planning is to some extent a function of the complexity of the project, and SCS personnel understand how to plan both quick turnaround due diligence investigations and complex, multi-phased projects requiring detailed work plans and schedules with critical path timelines utilizing project management programs such as Microsoft Project or Primavera. This section focuses on the planning process for more complex projects, but an abbreviated process will be followed for less complex projects. The basic elements of the planning process include scoping at the proposal level; identification of the project team; review of background information; definition of project objectives, schedule, and milestones; development of data quality objectives; work plan preparation, including the quality assurance project plan; and dynamic communication and planning during project implementation.

7.2 PROPOSAL LEVEL SCOPING

A successful project requires a clear understanding of the client's objectives, schedule, and budget at the proposal stage. Failure to adequately scope and budget the project at this stage may result in misunderstandings and dissatisfaction with work products and project costs at a later date. In addition, for small projects, the proposal scope of work may serve as the project work plan. Therefore, the proposal should clearly define:

- The project understanding, including available background information and regulatory requirements.
- The proposed scope of work, including any assumptions or limitations associated with site access, site conditions, data quality requirements, etc.
- The schedule, including assumptions that could affect the schedule such as access, laboratory turnaround, weather conditions, client or regulatory review times, etc.
- Pricing (the level of detail will depend on the type of quote. Time and materials should specify labor hours and rates, as well as expense and subcontractor markups).

Internally, staff and schedule constraints should be evaluated at the time the proposal is prepared to avoid conflicts with existing projects or other proposed work. The Project Director, Project Manager, and key technical staff will typically be identified at the proposal stage.

7.3 IDENTIFICATION OF THE PROJECT TEAM

Once the work has been awarded, the Project Director and Project Manager will work with the client to define the Project Team. This will include identifying client and regulatory personnel roles, as well as key SCS and subcontractor personnel. Key personnel in each entity participating in the project will be identified, and the lines of communication will be defined.

Once the external relationships and responsibilities are defined, the Project Manager will identify other internal staff requirements and roles. For a complex project this may involve development of critical path timelines and resource requirements using appropriate software. For less complex projects, the proposal schedule and pricing spreadsheet may be used.

7.4 REVIEW OF BACKGROUND INFORMATION AND OTHER INFORMATION SOURCES

If background information was not available for proposal scoping or if other sources of information have been identified, they will be reviewed if possible before the kickoff meeting so that issues that may affect performance of the work can be identified. Examples of such issues include:

- Data gaps.
- Data quality issues that could affect the usability of existing data.
- Unanticipated site conditions.

These information and data will be subject to a more intensive review during work plan preparation.

7.5 PROJECT TEAM REVIEW OF OBJECTIVES, SCHEDULE, AND MILESTONES (KICKOFF MEETING)

A kickoff meeting will be held with the client by telephone or in person to review the project objectives, schedule, and milestones. At a minimum, the client and key SCS personnel will attend this meeting. In some instances regulatory and subcontractor personnel may also be involved.

Issues to be addressed at the kickoff meeting include:

- Overall project objectives, schedule, and budget.
- Personnel roles and lines of communication, including regulatory agencies and subcontractors.
- Project milestones and deliverables.
- Technical and/or administrative constraints identified in the proposal or during review of background information (limiting physical conditions, access limitations, etc.).
- Site field activities, including subcontractors, equipment, and supplies.
- Health and safety requirements.
- Preliminary data quality objectives (as specified in the proposal).

7.6 DEVELOPMENT OF DATA QUALITY OBJECTIVES

Data Quality Objectives are qualitative and quantitative statements developed by data users to specify the quality of data from field and laboratory data collection activities to support decisions or regulatory actions. The complete Data Quality Objectives process involves seven steps to ensure that the data obtained meets the objectives of the investigation. This is not required for every project, but is a useful tool and may be a regulatory requirement. For simple projects, Data Quality Objectives may be limited to assumptions stated in the scope of work with reference to analytical methods and guidance documents or standards (for example, state and federal guidance documents and American Society of Testing and Materials standards).

However, for most complex projects the first step in work planning will be the development of Data Quality Objectives following the seven step Data Quality Objectives process, in accordance with the most recent EPA guidance (Ref. 8 and 9) or applicable state requirements.

The seven-step Data Quality Objectives process involves the following:

1. State the problem.
2. Identify the goals of the study.
3. Identify the information inputs.
4. Define the boundaries of the study.
5. Develop the analytic approach.
6. Specify performance or acceptance criteria.
7. Develop the plan for obtaining data.

The Data Quality Objectives provide the basis for the type and quantity of data that will be collected, the types of field testing and laboratory analyses that will be performed, the quality assurance/quality control requirements that will be specified for field and laboratory data, and the level of quality assurance review or validation that will be used to evaluate the collected data. These, in turn, will be specified in the project work plan. The Data Quality Objectives may be presented in a separate document or incorporated into the work plan.

7.7 WORK PLAN PREPARATION

For large, complex projects, a site specific work plan typically will be developed that will encompass the field sampling plan, quality assurance project plan, and health and safety plan. Small projects may be implemented directly from the proposal scope of work.

7.7.1 Field Sampling Plan

Where prepared, the field sampling plan will present the project background, investigation objectives, rationale, sample types and locations, and sampling procedures. The sampling design will be developed in accordance with the Data Quality Objectives by qualified personnel.

Sampling standard operating procedures identified in the field sampling plan may be site-specific, SCS internal, commercial (e.g., Geoprobe[®] hydraulic probing), or publicly available [e.g., EPA Region IV (<http://www.epa.gov/region4/sesd/fbqstp/>)]. Site-specific and SCS

standard operating procedures will be presented in the field sampling plan, while commercial and publicly available standard operating procedures will only be referenced. Site-specific and SCS standard operating procedures will be developed in accordance with the most recent EPA guidance for preparing standard operating procedures (Ref. 10). Additional guidance on standard operating procedures is provided in Section 8.0.

7.7.2 Quality Assurance Project Plan

The quality assurance project plan presents quality assurance/quality control requirements for field sample collection, laboratory analytical procedures, and data review/validation required to achieve the project Data Quality Objectives. In some instances, a standardized quality assurance project plan may be prepared and used for multiple investigation projects, but a site-specific quality assurance project plan will typically be used for complex projects. Quality assurance project plans will be prepared in accordance with the most recent EPA requirements and guidance for quality assurance project plans (Refs. 11 and 12) and will address the following elements (some may be cross-referenced to the field sampling plan):

- Title and Approval Sheet
- Table of Contents
- Distribution List
- Project/Task Organization
- Problem Definition/Background
- Project/Task Description
- Quality Objectives and Criteria
- Special Training/Certification
- Documents and Records
- Sampling Process Design
- Sampling Methods
- Sample Handling and Custody
- Analytical Methods
- Quality Control
- Instrument/Equipment Testing, Inspection, and Maintenance
- Instrument/Equipment Calibration and Frequency
- Inspection/Acceptance of Supplies and Consumables
- Non-direct Measurements
- Data Management
- Assessments and Response Actions
- Reports to Management
- Data Review, Verification, and Validation
- Verification and Validation Methods
- Reconciliation with User Requirements

The specified level of data quality documentation and data review will depend on the project type and Data Quality Objectives. For some projects, data review may be limited to an assessment of precision, accuracy, completeness, representativeness, and comparability, combined with a review of method-specific quality control documentation, in accordance with

EPA guidance documents (Ref. 13). If formal data validation is required, it will be performed in accordance with EPA Contract Laboratory Program guidelines (Refs. 14 and 15).

7.7.3 Site-Specific Health and Safety Plan

When required, a project site-specific health and safety plan will be prepared to provide site-specific health and safety information and guidance. The site-specific health and safety plan will be prepared consistent with the processes and procedures defined in *SCS Health and Safety Injury and Illness Prevention Program* Standard Operating Procedure 2 (Site and Project Health and Safety Plans). SCS's health and safety program complies with applicable federal and state regulations including the Occupational Health and Safety Act requirements at 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926. The site-specific health and safety plan template has been developed for projects requiring varying levels of health and safety protection.

7.8 ONGOING COMMUNICATION AND DYNAMIC PLANNING

SCS recognizes that communication within the project team, including representatives of the client and regulatory agency, if applicable, is critical throughout the project and that project planning is a dynamic process that continues through project implementation. Successful communication relies on both informal and formal processes. For large projects, formal status reports and project team meetings will be scheduled by the Project Manager to keep team members informed of project developments. The frequency of such activities will be determined by the overall length of the project and the intensity of project activities.

During field activities, the Field Team Leader will consult with the Project Manager regarding any major deviations from the work plan. The Project Manager will decide whether consultation with other team members is appropriate at the time of such deviations, or whether they may be reported during regularly scheduled communications.

Informal communication will typically continue at all levels during project implementation. This will include interactions between the subcontractors and SCS field staff, as well as communication at different levels between SCS staff and client representatives. If the client approves, communication by SCS with regulatory personnel will typically be through the Project Manager.

7.9 EVALUATING AND QUALIFYING DATA COLLECTED FOR OTHER PURPOSES AND/OR FROM OTHER SOURCES, INCLUDING USE OF STATISTICS

For many SCS projects, there is a wealth of existing data and other information that has been collected by others for various purposes. To the extent these data and other information are reliable and meet Data Quality Objectives for the project, they should be used.

Data from other sources will be evaluated to determine usability for site characterization, risk assessment, or other uses in accordance with EPA guidelines (Ref. 11.) Usability of site-specific existing data will be assessed on the basis of:

- Date of collection.
- Documentation of field quality assurance.
- Acceptability and comparability of analytical method.
- Adequacy of detection limits with respect to regulatory limits or risk-based standards.
- Availability of raw data.
- Documentation of analytical quality assurance.

Acceptability of existing data will be based on professional judgment in evaluating the overall precision, accuracy, completeness, representativeness, and comparability of that data with respect to standards to be applied to data from the current investigation.

8.0 IMPLEMENTATION OF WORK PROCESSES

This section has been prepared to conform to EPA guidelines (Ref. 1), which states that the purpose of this section is “to document how work processes will be implemented within the organization to ensure that data or information collected are of the needed and expected quality for their desired use.” The process starts with the preparation of a proposal by SCS personnel and acceptance of a task order or signed contract from the client. These documents at a minimum identify the project scope of work, cost, and schedule, and, in some instances, specify the details of how the work will be performed. In addition to performing work in accordance with these documents, SCS employees are responsible for performing required work in accordance with approved planning and technical documents including standard operating procedures. Standard operating procedures represent a set of written procedures that serve to impose standardization on the performance of similar work processes in different geographical locations or offices by different SCS personnel.

8.1 ENSURING WORK IS PERFORMED IN ACCORDANCE WITH DOCUMENTS

To ensure that work is performed in accordance with the approved planning and technical documents, the Project Manager or his or her designee is responsible for reviewing project work on a frequent and ongoing basis. The objectives of the review will be to address the following questions:

- Does project work conform to appropriate contractual documents including the SCS proposal, the contract, task order, etc.?
- Does the project work conform to applicable planning documents, such as the work plan, field sampling plan, and quality assurance project plan?
- Does project work conform to current, relevant, and site- or project-specific standard operating procedures?
- If standard operating procedures are not available for the work performed, do they need to be developed?

It is expected that the Project Manager will ensure that the final project deliverables specify the documents with which our work conforms. If these documents are updated or superseded and replaced during the course of the project, the Project Manager will be responsible for placing a memo in the project file that documents the change.

It is also the responsibility of the Project Manager to bring to the attention of SCS's National Partner for Quality Management deficiencies that may exist in standard operating procedures currently accepted or approved by SCS, and inform him or her of standard operating procedures that may need to be adopted to improve the quality of project work that is performed.

8.2 IDENTIFYING OPERATIONS THAT NEED STANDARD OPERATING PROCEDURES

During performance of the project and review of work operations and processes as described in Section 8.1, the Project Manager will identify operations that need standard operating procedures. The identification of project related activities that need standard operating procedures, the identification of previously approved and applicable standard operating procedures, and/or the need to prepare new standard operating procedures can also be initiated by any employee.

Standard operating procedures provide employees guidance on policies and procedures associated with individual processes and operations. SCS employees are encouraged to use them whenever appropriate. Written standard operating procedures must be specific to the task to which they apply. However, they must not be so restrictive in nature that necessary and appropriate deviations that occur because of site- or project-specific conditions or requirements cannot be accommodated.

Some of the standard operating procedures used by SCS have been developed by a state or federal government (e.g., EPA). Some have been developed by SCS or SCS clients. The latest list of standard operating procedures appears on the Intranet.

Where available standard operating procedures are deficient or where SCS personnel require additional guidance, it is expected that SCS will develop company-specific or project-specific standard operating procedures. All company-specific standard operating procedures must follow a process for standard operating procedure development, review, formal approval/ adoption, revision, and withdrawal. Standard operating procedures that have been adopted by SCS will be posted on the company Intranet for use by all employees.

Any SCS employee who is unsure whether a standard operating procedure exists for performance of his or her work should contact his or her immediate supervisor and/or the Project Manager of any project to which s/he is assigned.

8.3 CONTROLLING AND DOCUMENTING CHANGES IN PROCEDURES

The Project Manager or designee will be responsible for documenting deviations from approved documents during performance of projects. Significant deviations by a project team member should be approved and documented by the Project Manager or their designee.

Deviations from standard operating procedures to collect environmental data must be reported to the National Partner for Chemical Data Quality, and deviations from standard operating procedures that affect health and safety must be reported to the Corporate Health and Safety Director. In the event of a disagreement or dispute regarding a deviation from a standard operating procedure, the procedure described in Section 1.7 will be followed.

Obsolete documentation should be removed from the work area (to avoid inadvertent use).

9.0 ASSESSMENT AND RESPONSE

In his book, *To Engineer Is Human: The Role of Failure in Successful Design*, Dr. Henry Petroski (Aleksandar S. Vesic professor of civil engineering at Duke University) makes the point that we do not learn so much from the bridge that stands as we do from the bridge that fails. By analyzing bridge failures, engineers learn how to make better bridges.

The same principle applies to the SCS Quality Management System. In the event that a mistake or failure is identified with respect to one of our projects, we will investigate and identify a root cause of the mistake or failure together with improvements to strengthen the system. The goal is to continuously improve our work and this Quality Management System.

Project quality problems identified by SCS personnel, clients, regulatory agencies or other entities with respect to a project will be reported to the Project Manager, Project Director, and to the appropriate Senior Vice President. The Senior Vice President will be responsible for investigation and corrective action. Major quality problems will be reported to the National Partner for Quality Management and to the Board of Directors by the Senior Vice President.

9.1 ASSESSING QUALITY MANAGEMENT SYSTEM (AT LEAST ANNUALLY)

At least once each year, every officer of the firm (Vice President and above) will complete at least one quality system audit using the audit form or checklist published by the National Partner for Quality Management. To be considered a quality system audit, the officer conducting the assessment must not be involved significantly in the project being audited.

In addition, Senior Vice President Practice Leaders for Environmental Services; Solid Waste; Construction; Operations, Maintenance, and Monitoring; and Energy; and the National Partner for Quality Management will annually select additional projects for auditing by a selected qualified professional or team of professionals.

9.2 FOLLOW-UP AND CORRECTIVE ACTION

Audit reports will be sent to the Project Manager, Project Director, National Partner for Quality Management, Senior Vice President Practice Leader, and Office Director/ Office Quality Management Coordinator for the project audited. The National Partner for Quality Management and the Office Quality Management Coordinator will follow-up, in consultation with the Practice Leader and Office Director, with the Project Manager and Project Director regarding any deficiencies noted in the audits.

Where problems associated with the quality of SCS performance are identified through the audit reports or during performance of the work, or where discrepancies are identified between SCS performance and the requirements of this Quality Management System, corrective actions will be taken and documented. Corrective actions will consider the root cause of the problem or discrepancy. Examples of corrective actions are shown on Table 1.

Table 1. Examples of Corrective Actions

Root Cause	Corrective Action
1. Lack of familiarity with Quality Management System (QMS) or Standard Operating Procedures (SOP)	Additional training in QMS or SOP
2. Omission or error in SOP	Modify SOP
3. Staff not competent for work assigned	Assign staff who are competent for work
4. Errors or sloppiness in deliverables	Auditor to review with Project Manager, Project Director, and/or project staff
5. Intentional departure from QMS or SOP requirements	Disciplinary action as appropriate
6. Fraudulent conduct	Dismissal

9.3 REPORTING ASSESSMENT RESULTS TO MANAGEMENT

At least once each year, the Senior Vice Presidents of our major practice groups and the National Partner for Quality Management will provide the SCS Board of Directors with a written assessment of the Quality Management System, together with any suggested changes. Summary quality system assessment reports presented to the Board of Directors, together with approved changes, will be posted to the Intranet and distributed to management via list servers as appropriate (ODsList, OHSCs, SWTelcon, ESLeaders, etc.).

The Board of Directors, in turn, will discuss and approve proposed changes as appropriate.

9.4 DETERMINING LEVEL OF COMPETENCE REQUIRED OF OUR STAFF

Ultimately, the Project Manager is responsible for determining the competencies needed for each project, and for assigning staff with the appropriate aptitude, education, background, experience and training to perform the work safely and properly. The Project Director is responsible for determining the competencies needed for the Project Manager, and the Office Director or ultimately the President is responsible for determining the competencies needed for the Project Director and/or Reviewing Principal. Competencies must be documented (e.g., in Vision, the Learning Management System, resumes, personnel files, and/or proposals).

Documented competencies are subject to quality system audit.

9.5 AUTHORITY OF THOSE CONDUCTING ASSESSMENTS

Officers of SCS are appointed by the Board of Directors and have the executive authority to review files associated with any project of the firm (subject only to specific confidentiality agreements that may limit access to information for some projects).

The National Partner for Quality Management is appointed by and reports directly to the President with respect to the Quality Management System and has the executive authority to review files associated with any project (subject to confidentiality agreements).

9.6 MANAGEMENT REVIEW

The National Partner for Quality Management will review audit reports and similar information as they are generated. These sources of information will be among those considered (along with changes in technology, feedback from clients and colleagues, and other sources of information bearing on this Quality Management System) as a part of the written assessments to be prepared under Section 9.3 for discussion by the SCS Board of Directors at least once each year.

9.7 DISPUTES

In the event that a quality system audit or proposed corrective action results in a dispute, the dispute will be resolved as discussed in Section 1.7 .

10.0 QUALITY IMPROVEMENT

SCS continuously strives to improve our work for clients and will use this Quality Management System to assist in that effort.

10.1 ELIMINATING CONDITIONS ADVERSE TO QUALITY

Conditions that adversely affect the quality of SCS work will be identified and eliminated. Such conditions will be addressed as they are identified and in any case during the annual assessments of the Quality Management System presented under Section 9.3 to the SCS Board of Directors.

10.2 TRAINING

SCS will provide staff with training to enhance professional performance. This includes training to improve technical proficiency, to communicate SCS policies, and to enhance managerial skills. Internal training topics include:

- Ethics and Business Standards of Conduct
- Project Management, including use of Vision, but also emphasizing the goal of client satisfaction and the importance of effective communication
- Contracts and Risk Management
- Health and Safety
- Quality Management
- Technical

10.3 IDENTIFYING PROCESS IMPROVEMENTS

This Quality Management System and its related components (standard operating procedures, Health and Safety requirements, documentation of staff competencies, etc.) will be improved as appropriate whenever changes are warranted. Such changes will be initiated by the National Partner for Quality Management and implemented as determined by the Board of Directors.

11.0 REFERENCES

1. *EPA Requirements for Quality Management Plans (QA/R-2)*, EPA/240/B-01/002, March 2001, reissued May 2006.
2. *SCS Employee Handbook*.
3. *SCS Project Manager's Manual*.
4. *SCS Health and Safety Injury and Illness Prevention Program*.
5. *SCS Contract Guide*.
6. *SCS Style Manual*.
7. *SCS Computer Aided Design and Drafting (CADD) Standards Manual*.
8. *Guidance on Systematic Planning using the Data Quality Objective Process*, EPAQA/G-4, EPA/240/B-06/001, February 2006.
9. *Systematic Planning: A Case Study for Hazardous Waste Site Investigations*, EPA/240/B-06/004, February 2006.
10. *Guidance for Preparing of Standard Operating Procedures*, EPA G-6, EPA/600/B-07/001, April 2007.

11. *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, EPA/240/B-01/003, March 2001, reissued May 2006.*
12. *Guidance for Quality Assurance Project Plans, EPA G-5, EPA/240/R-02/009, December 2002.*
13. *Guidance on Environmental Data Verification and Data Validation, G-8, EPA/240/R-02/004, November 2002, reissued January 2008.*
14. *USEPA National Functional Guidelines for Inorganic Superfund Data Review (ISM02.1), EPA/540/R-13/001, October 2013.*
15. *USEPA National Functional Guidelines for Superfund Organic Methods Data Review (SOM02.1), EPA/540/R-014/002, October 2013.*
16. *Guidance on Choosing a Sampling Design for Environmental Data Collection G-5S, EPA/240/R-02/005, December 2002.*

Attachment A
Design Checklist

SCS Design Quality Management Checklist v1a Feb 2014		Revision Dates:			Due Dates: (M/DD/YYYY)	
Project #:		Revision #s:				Design Start:
Proj Name:		Project Location:				35% Review:
Client:		SCS Team:				60% Review:
POC Name:						95% Review:
Title:		Project Designer	Design Lead	QA Review	Responsible Signatory	100% Complete:
Location:						Bid:
Phone #:						Award:
email:						Const Start:
Item #	Item	Project Designer	Design Lead	QA Review	Responsible Signatory	Comment:
		<i>Initial and Date Each Box at Completion</i>				
1	Does design conform with contract requirements?					
2	Have relevant building codes been obtained and reviewed by designer? (Design Lead should identify codes in comments.)					
3	Is design consistent with applicable codes?					
4	Is the basis for design documented (e.g., in a basis of design memo)?					
5	Are calculations documented and checked?					
6	Are drawings (including title blocks and profile and detail references) consistent with each other and with SCS CADD Standards Manual or client standards?					
7	Do drawings include dimensions or scale, north arrow, and source references?					
8	Are dimensions consistent and do they add up consistently?					
9	Are drawing notes spell-checked, consistent with cross references and specifications, clear, specific and complete?					

Item #	Item	Project Designer	Design Lead	QA Review	Responsible Signatory	Comment:
		Initial and Date Each Box at Completion				
10	Are materials and vendor sub-components adequately specified in drawings or specifications?					
11	Are applicable CSI divisions referenced?					
12	Are specifications consistent with drawings?					
13	Are specifications for materials incorporated by reference?					
14	Has engineers cost estimate been checked?					
15	Are sources of costs appropriately referenced (RS Means, contractor quotes)?					
16	Are specifiied materials costs effective and readily available?					
17	Is the design practical and constructable?					
18	Are the drawings adequately detailed for construction?					
19	Does the design facilitate proper operation and maintenance?					

Attachment B

Quality Management System Audit Checklist

QUALITY SYSTEM AUDIT CHECKLIST

Audited Project (# and title): _____

Project Manager/Director¹: _____

Office: _____

Auditor: _____

Audit Dates: _____

Brief Project Description: _____

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Yes	No	Not Applicable	
A. PLANNING				
1. Is scope of work adequately defined?				
2. Are SCS and subcontractor project staff qualified?				
3. Is the promised project schedule reasonable considering work to be performed and staff availability?				
4. Was the proposal reviewed by a second person and is the review documented by a dual signature?				
5. If a SCS standard contract was not used or was modified, was the contract reviewed by corporate legal staff?				
6. Were service orders and purchase orders executed before subcontracted work was performed?				
7. Are reviews of work planning documents (work plan, QAPP, etc.) documented?				
8. Was a Health and Safety Plan prepared and is a copy of the field signature page in the file?				
B. EXECUTION				
9. Does project work conform to the scope of work?				
10. Do the personnel working on the project have the appropriate aptitude, experience and training?				
11. If work includes SCS Certified scope, do personnel have the required certification?				
12. Are calculations documented as having been checked?				
13. Is work performed in accordance with regulatory requirements?				
14. Does the work appear to be correct (i.e. free of obvious errors)?				

¹ List both, even if they are the same. Do not audit a project you were involved in.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Yes	No	Not Applicable	
15. Is the work presented clearly and professionally?				
16. Are communications with client satisfactory and are they documented?				
17. Was the work delivered on time?				
18. Is work performed in accordance with the project-specific QAPP? ²				
19. Are reviews of subcontractor submittals documented?				
20. Are field records complete and in the project file (log books, daily CQA records, etc.)?				
21. Are deviations from the scope of work and/or planning documents documented?				
22. Do the deviations adversely affect the quality of the work?				
23. Is calibration of equipment documented and consistent with QAPP, SOP, or manufacturer's instructions?				
24. Are reviews of change orders documented?				
25. Are copies of project deliverables in the file?				
26. Have draft documents been removed from the file or, if kept, are versions properly identified?				
27. Are reviews of project deliverables documented (by dual signature, copying reviewer on email transmittal, or other method)?				
28. Do reviewers have experience and expertise appropriate to their reviews?				
29. Are the project files complete and organized?				
30. If problems were identified during execution, are corrective actions documented?				
C. EVALUATION				
31. How would you evaluate the overall quality of this work, based on your review of the above? Provide constructive suggestions, if any.				

Send pdf of completed audit checklist to Deborah English in Kansas City office, with copies to the PM, PD, and applicable Senior Vice President.

² If this is applicable, review of field documentation (log books, chain of custody, etc.) and laboratory analytical data reports will be required to answer this question.

APPENDIX C
XRF CALIBRATION MANUAL

INSTRUCTION MANUAL

INNOV-X SYSTEMS ALPHA SERIES™ X-RAY FLUORESCENCE SPECTROMETERS

**August 2005
Version 2.1**

**Innov-X Systems, Inc.
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Woburn, MA 01801**

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Chapter 1 Introduction

1.0 INSPECTING YOUR INNOV-X ANALYZER

Upon receipt:

1. Locate and remove the shipping papers and documentation from under the lid's foam padding.
2. Remove the Innov-X Analyzer and all of the components from the protective carrying case and identify each on the enclosed shipping list.
3. Connect the battery charger to an 110V-240V AC power source. Place one Li-ion battery on the charger and charge it for at least 2 hours. Charge the second battery.
4. Charge the HP iPAQ using the attached AC adaptor for at least ½ hour.
5. Read and review the "Quick Start" section of the User's Manual. Innov-X recommends that you read the entire manual.
6. Install the fully charged battery into the analyzer.
7. Press the ON/OFF button on the back of the analyzer and the power button on the iPAQ.
8. Select Innov-X from the start menu located in the upper left hand corner of iPAQ screen.
9. Select the desired analysis mode (i.e., Analytical, FastID, Pass/Fail or Soil). The instrument will undergo a one minute hardware initialization period.
10. Standardize the instrument with the 316 Stainless Steel mask. Standardize the instrument every 4 hours or as directed by the display.
11. Release the software trigger lock and analyze a sample of known composition, in order to verify the correct operation of the analyzer.
12. Analyze samples of unknown composition.

1.1 COMPONENTS INCLUDED WITH THE ANALYZER

Shown here are the various items which are included with the Innov-X portable XRF analyzer. Unless otherwise noted, all items are standard accessories.



Analyzer, with iPAQ attached.



Two, Li-ion batteries (one shown).



Battery charger and an AC adaptor. Battery shown mounted in charging system.



Standardization cap and weld mask (optional)

The standard standardization cap has no weld slit.



iPAQ cradle and AC adaptor. The cradle is used to connect the iPAQ to a PC for downloading data and reports.



Testing stand. This is the benchtop docking station for the analyzer. It is an optional accessory

1.2 QUICK START INSTRUCTIONS

The following section provides a quick overview to using the Innov-X portable XRF analyzer. This is intended to provide the basic startup and operational instruction needed to perform simple analyses. It is highly recommended that the user read the sections on Radiation Safety (Chapter 3) and the detailed description on operation (Chapter 4). The following Quick Start information is also provided as a separate, bound, laminated publication for quick reference.

1. Place a battery in the analyzer.
2. Power on the Analyzer (On/Off switch located on back of analyzer)
3. Power on the iPAQ (Button located in upper right hand corner of iPAQ)
4. Select Innov-X from the start menu located in the upper left hand corner of iPAQ screen.
5. Read the radiation safety notice and acknowledge that you are a certified user by pressing Start.
6. Select Desired Mode.
7. The analyzer will undergo a 60 second hardware initialization.
8. Place a standardization clip on the nose of the analyzer. Tap the button on the screen to standardize. (*Manual section 4.4 Standardization*)
9. When standardization is complete, remove the standardization clip.

10. Release the software trigger lock by tapping the locked icon on the iPAQ screen and tapping yes in response to the software prompt.
11. Test standard to verify instrument performance.
12. Results will display on screen. Subsequent tests may be started from either the Results or Analysis screens.

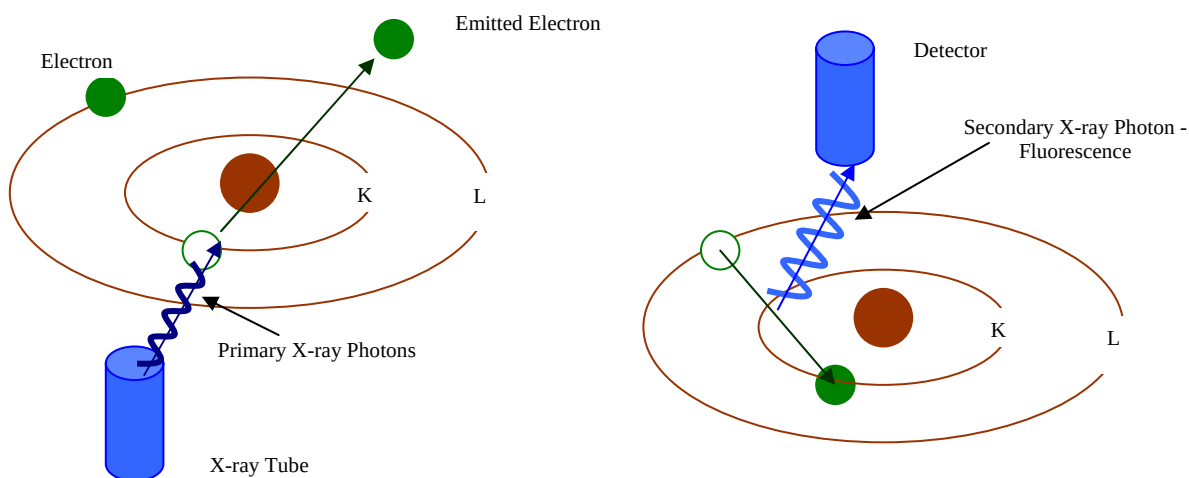
1.3 INTRODUCTION TO XRF: X-RAY FLUORESCENCE SPECTROMETRY OVERVIEW

Basic Theory

Although most commonly known for diagnostic use in the medical field, the use of x-rays forms the basis of many powerful analytical measurement techniques, including X-ray Fluorescence (XRF) Spectrometry.

XRF Spectrometry is used to identify elements in a substance and quantify the amount of those elements present. An element is identified by its characteristic X-ray emission wavelength (λ) or energy (E). The amount of an element present is quantified by measuring the intensity of its characteristic line. XRF Spectrometry ultimately determines the elemental composition of a material.

All atoms have a fixed number of electrons (negatively charged particles) arranged in orbitals around the nucleus. The number of electrons in a given atom is equal to the number of protons (positively charged particles) in the nucleus; and, the number of protons is indicated by the Atomic Number in the Periodic Table of Elements. Each Atomic Number is assigned an elemental name, such as Iron (Fe), with Atomic Number 26. Energy Dispersive (ED) XRF and Wavelength Dispersive (WD) XRF Spectrometry typically utilize activity in the first three electron orbitals, the K, L, and M lines, where K is closest to the nucleus. Each electron orbital corresponds to a specific and different energy level for a given element.



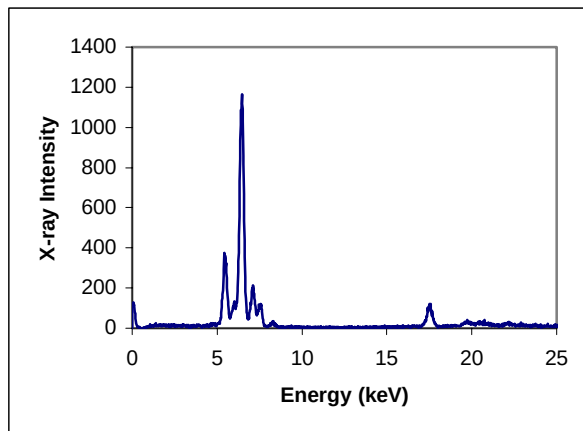
In XRF Spectrometry, high-energy primary X-ray photons are emitted from a source (X-ray tube) and strike the sample. The primary photons from the X-ray tube have enough energy to knock electrons out of the innermost, K or L, orbitals. When this occurs, the atoms become ions, which are unstable. Electrons seek stability; therefore, an electron from an outer orbital, L or M, will move into the newly vacant space at the inner orbital. As the electron from the outer orbital moves into the inner orbital space, it emits an energy known as a secondary X-ray photon. This phenomenon is called fluorescence. The secondary X-ray produced is characteristic of a specific element. The energy (E) of the emitted fluorescent X-ray photon is determined by the difference in energies between the initial and final orbitals of the individual transitions.

This is described by the formula

$$E=hc/\lambda$$

where h is Planck's constant; c is the velocity of light; and λ is the characteristic wavelength of the photon.

Wavelengths are inversely proportional to the energies; they are characteristic for each element. For example the $K\alpha$ energy for Iron (Fe) is about 6.4keV. The number of element-specific characteristic X-rays produced in a sample over a given period of time, or the intensity, can be measured to determine the quantity of a given element in a sample. Typical spectra for EDXRF Spectrometry appear as a plot of Energy (E) versus the Intensity (I).



History

Wilhelm Roentgen discovered X-rays in 1895. Methods for identifying and quantifying elements using XRF were first published by Henry Moseley in 1913. Much research and development of XRF continued after Moseley's pioneering work, especially during WWII when rapid developments in the aircraft, automotive, steel and other metals industries heightened the need to identify alloys quickly and reliably. However, the first commercial XRF Spectrometers weren't available until the early 1950's. Those systems were based on WDXRF technology and measured the characteristic wavelength of an element, one element at a time. Although the use of these systems was critical for elemental analyses, they were large, expensive, and required highly skilled operators to use and maintain them.

In the late 1960's, EDXRF technology, which measures the characteristic energy of an element, began to rival the use of WDXRF due to the development of Si (Li) solid state detectors, which offered better energy resolution of the signal. EDXRF systems offered the potential of collecting and displaying information on all of the elements in a sample at the same time, as opposed to one at a time with typical WDXRF systems. Many of the early EDXRF systems used radioisotopes for excitation instead of X-ray tubes, which could require changing sources to determine all the elements of interest. Some of those early EDXRF systems did not easily resolve multiple elements in a single analytical run.

As can be imagined, the equipment and applications of XRF Spectrometers have developed tremendously since the 1960's. Advancements in technology, electronics, computers, software and the use and modification of them for XRF Spectrometers by instrument manufacturers, research scientists & engineers, and industrial users alike have led to the current state of the art in XRF Spectrometers. Now a mature technology, XRF Spectrometry is routinely used for R&D, QC and analytical services in support of production.

Elemental Analysis

XRF Spectrometry is the choice of many analysts for elemental analysis when compared to the other techniques available. Wet chemistry instrument techniques for elemental analysis require destructive and time-consuming specimen preparation, often using concentrated acids or other hazardous materials. Not only is the sample destroyed, waste streams are generated during the analytical process that need to be disposed of, many of which are hazardous. These wet chemistry elemental analysis techniques often take twenty minutes to several hours for specimen preparation and analysis time. All of these factors lead to a relatively high cost per sample. However, if PPB and lower elemental concentrations are the primary measurement need, wet chemistry instrument elemental analysis techniques are necessary.

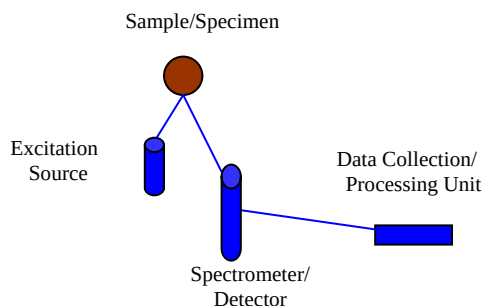
XRF Spectrometry easily and quickly identifies and quantifies elements over a wide dynamic concentration range, from PPM levels up to virtually 100% by weight. XRF Spectrometry does not destroy the sample and requires little, if any, specimen preparation. It has a very fast overall sample turnaround time. These factors lead to a significant reduction in the per sample analytical cost when compared to other elemental analysis techniques.

All elemental analysis techniques experience interferences, both chemical and physical in nature, and must be corrected or compensated for in order to achieve adequate analytical results. Most wet chemistry instrument techniques for elemental analysis suffer from interferences that are corrected for by both extensive and complex specimen preparation techniques, instrumentation advancements, and by mathematical corrections in the system's software. In XRF Spectrometry, the primary interference is from other specific elements in a substance that can influence (matrix effects) the analysis of the element(s) of interest. However, these interferences are well known and documented; and, instrumentation advancements and mathematical corrections in the system's software easily and quickly correct for them. In certain cases, the geometry of the sample can effect XRF analysis, but this is easily compensated for by grinding or polishing the sample, or by pressing a pellet or making glass beads.

Quantitative analysis for XRF Spectrometry is typically performed using Empirical Methods (calibration curves using standards similar in property to the unknown) or Fundamental Parameters (FP). FP is frequently preferred because it allows elemental analysis to be performed with no standards or calibration curves. This enables the analyst to use the system immediately, without having to spend additional time setting up individual calibration curves for the various elements and materials of interest. The capabilities of modern computers allow the use of this no-standard mathematical analysis, FP, accompanied by stored libraries of known materials, to determine not only the elemental composition of an unknown material quickly and easily, but even to identify the unknown material itself.

EDXRF Spectrometers

EDXRF Spectrometer systems are mechanically very simple; essentially there are no moving parts. An EDXRF system typically has three major components: an excitation source, a spectrometer/detector, and a data collection/processing unit. The ease of use, rapid analysis time, lower initial purchase price and substantially lower long-term maintenance costs of EDXRF Spectrometers have led to having more systems in use today worldwide than WDXRF Spectrometer systems.



EDXRF has been found most useful for scrap alloy sorting, forensic science, environmental analysis, archaeometry and a myriad of other elemental field-oriented analyses.

Handheld EDXRF Spectrometers for Field Analyses

It is clear that a future trend for elemental analysis is in rapid site investigation using techniques that are fast, inexpensive, reliable, and long-term cost effective. There is a need for immediate decisions to be made during the delivery of materials, industrial processing, and in the field for positive materials identification or environmental site assessment and remediation. It is also clear that EDXRF Spectrometry is the most suitable elemental analysis technique available for field analysis due to its simplicity, speed, precision, accuracy, reliability, and overall cost effectiveness.

Recent technological developments in cell phones, pocket PC's and other portable consumer electronics have led to the advancement of many high-performance, miniature components. X-ray equipment manufacturers began to take advantage of these developments in the late 1990's and developed Handheld EDXRF systems. An obvious advantage of Handheld EDXRF systems is that the analyzer is taken to the sample as opposed to bringing the sample to the analyzer and configuring it to fit in an analysis chamber. In addition to the per sample analytical cost savings, a key factor in using non-destructive EDXRF analysis, especially in the field, is the overall project cost savings due to improved and more timely decision making. The use of EDXRF for immediate positive materials identification or to guide an environmental site characterization will generally reduce the overall time required in the field due to the quick turnaround for the sample analysis; this invariably reduces the overall costs of analytical field work.

Of course, Handheld EDXRF technology has continued to evolve in concert with portable consumer electronic developments. Just like the early Benchtop EDXRF systems, early Handheld EDXRF systems used radioisotopes for excitation. There are several practical problems with the use of radioactive isotopes for handheld systems. The source decays and loses its testing speed over time. In addition to the loss in analytical capabilities, the sources have to be replaced incurring a cost. The use of radioactive isotopes also requires licensing (state-to-state in the US) and a radioactive materials control program; they are difficult to ship and transport, as they require hazardous materials declarations and/or permits. Consequently, the newest and most exciting development in Handheld EDXRF technology is the use of battery operated, miniature X-ray tubes, which was pioneered by the staff at Innov-X Systems.

Innov-X Systems Handheld EDXRF Spectrometers

Innov-X Systems specializes in Handheld EDXRF technology with the most advanced miniature components available for X-ray Tube sources, detectors, and PC 's. Innov-X Systems Handheld EDXRF Spectrometers are ideally suited for field analysis of alloys, lead-based paint, environmental soils, filters, dust wipes, forensics, archaeometry, and a variety of other elemental analyses in the field or around the plant. Innov-X Systems EDXRF Spectrometers are affordable, easy to use, reliable, and overall cost effective. The Innov-X Systems Handheld EDXRF units incorporate state-of the art components including a battery operated miniature X-ray tube, a high-resolution silicon pin detector, high speed data acquisition circuitry, and a Compaq IPAQ Pocket PC® handheld computer for calculations, results and operator interface.

Innov-X Systems EDXRF Spectrometers offer the following invaluable features:

- Portable
- Battery operated, rechargeable
- X-ray Tube-based (Ag or W anode, 10-40kV, 10-100uA)
- Si PIN diode detector.
- Integrated pocket PC
- Pistol-shaped design for difficult testing locations and welds
- Auto-compensation for irregular or small samples
- Fundamental Parameters for no-standard analyses
- Stored Grade Libraries for rapid Grade ID's
- Stored Fingerprint Libraries for rapid material ID's

- Docking station available for use as standard benchtop unit
- Results shown after a few seconds of testing time.

For more information on how to utilize your Innov-X Systems Handheld EDXRF Spectrometer optimally, please review this Instruction Manual or contact us directly.

Chapter 2. Usage and Assembly of Accessories

2.0 ACCESSORIES

This chapter describes the various accessories that are provided with an Innov-X XRF analysis system. Included are:

- Batteries
- Battery Charger
- iPAQ cradle and charger
- Testing Stand Assembly (not standard with all units)
- Standardization Clip or Standardization Clip/Welding mask.

2.1 ANALYZER BATTERY

The Innov-X Systems XRF Analyzer is powered by a replaceable, rechargeable Lithium ion battery. In addition, the iPAQ has its own internal battery.

Innov-X Systems Main Battery

The Innov-X Analyzer uses a rechargeable Lithium Ion Smart Battery. A picture of the battery is shown in Fig. 2.1. Two batteries are included with each analyzer. The batteries are charged on an external battery charger. Batteries typically function for 4 to 8 hours, depending on usage patterns. Heavier duty cycles deplete the battery more quickly. Therefore, users who do longer and more frequent tests will need to replace their batteries more often than users who take shorter or fewer tests.

Replacement batteries can be purchased directly by calling Innov-X Systems at 781-938-5005. (P/N A003)



Figure 2.1. Li-ion Battery for analyzer

Battery power indicators:

There are two ways of determining the charge remaining on a battery: the LED indicator on the battery and the battery status icon on the analyzer screen. The battery icon, when tapped, will indicate the percent charge remaining on a battery inside the analyzer. Additionally, the battery icon will change from green to yellow when the battery gets low, indicating it has about 15 minutes left of charge.

To use the battery LED, push the button below the indicator. The lighting will indicate the % of charge. If possible, try to use batteries with at least 50% of their full charge, according to the indicator.

2.2 CHANGING A BATTERY

To change a battery, perform the following steps:

1. Hold the instrument by the handle, upside down, so the bottom of the instrument base is pointing upward. Please refer to Fig. 2.2.
2. Hold the instrument so that the nose is pointing away from the operator.
3. Open the battery door on the bottom of the handle. The batteries have a small tab attached for ease of removal.

4. Pull out the existing battery, and replace with a new battery.
5. Insert the charged battery into the analyzer such that the connectors on the top of the battery are facing to the right. Note that the battery slot is keyed so that the battery can only be inserted one way.



Figure 2.2a. Instrument handle. Pull the rubber latch and lift door. Reach into opening and remove battery.



Figure 2.2b Insert new battery into opening.

2.3 BATTERY CHARGER

The battery charger is shown in Fig. 2.3. It takes about 2 hours to completely charge a battery. The status of the charger is shown by two lights on the power adaptor. Table 2.1 lists the information conveyed by the lights.



Figure 2.3. Battery charger.

Left Light	Right light	Status
On	Off	Battery is charging
On	On	Battery is 80% charged
Off	On	Battery is completely charged
Blink	Blink	Error. Remove battery and replace on charger. If error persists, call Innov-X Systems Technical support.
Off	Off	No battery is on charger

Table 2.1 Battery charger status lights

2.4 HP IPAQ POCKET PC BATTERY

The iPAQ has an internal rechargeable battery, which can be recharged by using the power adaptor that is included with the unit. This adaptor can be connected either to the iPAQ itself, or to the cradle. If it is connected to the cradle, and plugged in, the iPAQ will recharge whenever it is placed in the cradle. In addition, the iPAQ Battery will recharge whenever the iPAQ is mounted in an Innov-X analyzer which is powered, but not actively taking a test. The amber light on the top of the iPAQ will blink whenever the battery is charging. It will remain solid when the battery is completely charged.

Since the iPAQ will be recharged whenever the Innov-X Systems Analyzer is in use, it may never be necessary to use the iPAQ power adaptor. However, care should be taken when the analyzer is not used for a period of several days, as the iPAQ uses some power even when it is powered off. It is therefore possible to completely discharge the battery simply by not using the iPAQ for several days, or by using it for several hours without recharging it.

If you do not use your Innov-X Analyzer on a daily basis, or if you will have a down period of more than several days, it is recommended that you remove the iPAQ from the Analyzer when it is not in use and plug in the iPAQ to a power outlet to recharge it. This will ensure that your iPAQ is always charged and ready for use. You should also always plug in the power cord whenever the iPAQ is removed from the analyzer for data transfer.

If you do allow the iPAQ battery to discharge significantly, either by allowing it to sit too long unused, or by using it for a period of time without it being connected to a power source, it may not be possible to operate your analyzer. If this happens, the Innov-X software will provide an error message indicating that the iPAQ battery is too low. Recharge the iPAQ for at least a half an hour before attempting another measurement.

If the iPAQ battery is completely discharged, it will not be possible to turn on the iPAQ until it is recharged. A complete power failure will erase anything that is stored in the Main Memory of the iPAQ. All Innov-X program and data files are stored on the storage card, rather than in Main Memory, so you will not lose any data or have to reinstall the Innov-X software.

1. If the battery on the iPAQ is completely discharged, charge it for at least one half hour.
2. You will be required to follow the prompts on the iPAQ screen before you can use the iPAQ. This procedure involves realigning the screen by tapping in several spots, and going through a quick tutorial.
3. The iPAQ will reinitialize the Innov-X Systems software. A message will appear indicating that this is going to happen. You must tap ok to initialize.
4. The software will open automatically; a message will appear indicating that several registries have been restored. Tap ok to dismiss this message.
5. Set the clock to the current time. **Note, this is very important**, as your data is indexed by date. If the date in the iPAQ is incorrect, you may not be able to locate your results. The instrument will not allow you to take a reading until the date has been changed.
 - a. From the Start Menu, tap Settings.
 - b. Select the System tab, and tap clock.
 - c. Set the proper date. Further details about this procedure can be found in the HP iPAQ user's manual.

2.5 REMOVING THE IPAQ FROM THE ANALYZER

It is very important to properly remove the iPAQ Pocket PC from the analyzer to avoid damaging the connector on the back of the iPAQ.

In order to remove the iPAQ, push the iPAQ retainer shown in Fig. 2.4 towards the front of the analyzer. Holding the retainer forward, grab the iPAQ from the sides, slide the iPAQ forward until it is clear of its

connector, then tilt the front end up enough so it clears the front holder allowing the iPAQ to be lifted out of the instrument.

Note: Never grab the iPAQ and twist it side-to-side to remove it from the analyzer. Always move the iPAQ retainer forward as instructed above, slide the iPAQ forward and remove from the analyzer.



Figure 2.4. Removing the iPAQ from the analyzer.

2.6 STANDARDIZATION CAP and/or WELD TESTING MASK

All analyzers are supplied with either a standardization cap or a combination standardization cap welding mask. The standardization mask is the standard accessory. Welding masks can be purchased as an additional accessory, or in lieu of the standardization mask.

Standardization Cap

The cap clips on the front end of the analyzer and is used to standardize the system as described in Chapter 4. To attach the cap, snap it onto the nose of the analyzer over the Kapton window.

Combination Standardization Cap/Welding Mask

The standardization/welding mask is shown in Fig. 2.5. The cap clips onto the front end of the analyzer and is used to standardize the system as described in Chapter 4. To attach the cap, snap it onto the nose of the analyzer over the Kapton window. Be sure that when attaching the cap, that the solid end (as opposed to the end with the ¼" wide slit) is covering the window. To remove the mask, slide it off to either side.

The opposite end of the standardization cap serves as a welding mask. This mask is used to shield the base metal from analysis, when analyzing a weld. It is important to use this mask since failure to do so will produce an alloy chemistry that is a mixture of the base metal and the actual weld. For best results:

- Use the welding mask only for welds that are larger than the opening in the mask;
- Make solid contact between the surface of the mask and the material to test;
- Use the mask only in the Analytical Mode – not with the standard Fast ID library;
- Consider using longer test periods to compensate for the smaller testing area – especially with more difficult separations.

If it is desirable to use the welding mask in FastID mode, a user can create a special “Welding Mask Library.” Teach all relevant alloys with the welding mask in position. Make sure these fingerprints are

saved in library that contains ONLY fingerprints taught with a welding mask. When measuring a weld, make sure the “Weld” library is the only one selected. By creating a special finger print library using the welding mask, a user can get good results in the Fast ID Mode as well.



Figure 2.5 Standardization cap and welding mask. (Optional accessory)
The standard standardization cap does not have the welding slit.

2.7 TESTING STAND (optional accessory)

The testing stand is designed as a docking station for the handheld analyzer. It can be used as a bench-top system, or to test small samples. A list of components and an assembled stand is shown in Figure 2.6:

Components of the testing stand:

1. Three (3) short legs
2. Three (3) long legs
3. Lower Stand
4. Upper Stand
5. Four (4) knobs for top plate
6. Test stand cradle
7. Clip for cradle.
8. Adaptor cable (connects serial connector on iPAQ cradle to auxiliary port on analyzer)



Figure 2.6. Assembled Testing Stand

Assembly of Testing Stand

1. Insert the three Short Legs through the holes in the Lower Stand by inserting the threaded screw through the holes. This will balance the Lower Stand on the table top. (Fig. 2.7).



Figure 2.7. Mounting Lower Stand onto Short Legs.

2. Mount the three Long Legs onto the Lower Stand by inserting the threaded screws from the Short Legs into the holes on the Long Legs and turning until snug. Remove iPAQ from analyzer by following the instructions in Figure 2.4. Place the analyzer into the gap in the Lower Stand as shown. (Fig. 2.8).



Figure 2.8. Mounting Long Legs onto Lower Stand and inserting analyzer.

3. Mount the Upper Stand onto the Long Legs. The Upper Stand has holes for the screws at the end of each of the Long Legs. The Upper Stand will also fit snugly over the front end of the analyzer. Be sure that the Upper Stand is mounted so that all three screws are inserted through the holes, and the front end of the analyzer is flush with the top surface of the upper stand. (Fig. 2.9).



Figure 2.9. Mounting Upper Stand onto Testing Stand.

5. Put three knobs to secure testing stand onto analyzer. The iPAQ clip can be secured with any of the knobs. This clip grabs the base of the iPAQ cradle to hold the iPAQ securely in place.

6. Place the iPAQ in the cradle and connect it to the Auxiliary Port on the analyzer using the serial cable adaptor.



Figure 2.10. Connecting iPAQ to Auxiliary Port on analyzer.

Chapter 3 Safety Information

3.0 IMPORTANT SAFETY INFORMATION

THE XRF SHOULD NOT BE POINTED AT ANYONE OR ANY BODY PART, ENERGIZED OR DE-ENERGIZED! The safe and proper operation of the Innov-X XRF instruments is the highest priority. These instruments produce ionizing radiation and should **ONLY** be operated by individuals, who have been trained by Innov-X Systems, Inc. and received a manufacturer's training certificate. Innov-X recommends that operators and companies implement a written Radiation Safety Program, with safety components specific to the site and application of use of the instrument. The Radiation Safety Program should be reviewed annually and revised appropriately by a competent individual.

Innov-X analyzers must be used by trained operators, according to the instructions presented in this manual. Improper usage may circumvent safety protections and could potentially cause harm to the user. Pay attention to all warning labels and messages.

Important Notice for all Canadian Users:

Canadian Federal Regulations (Radiation Emitting Devices Act) require that all Canadian users must be certified according to NRC Standard CAN/CGSB-48.97/2-2000 in order to use this device.

For this certification contact: Natural Resources Canada, Manager Nondestructive Testing Certification, CANMET, 568 Booth St., Ottawa, ON, K1A 0G1; Tele: (613) 943-0583; Fax(613) 943-8297.

Users are advised to contact their appropriate federal/provincial./territorial radiation protection agency for applicable rules of operation.

The Innov-X analyzer is a very safe instrument when used according to manufacturer's recommended safety procedures as detailed in this chapter.

Radiation levels during testing are < 0.1 mR/hr on all surfaces of the analyzer except at or near the exit port for the radiation. This means that if an operator follows standard operating procedures, they will not obtain any detectable radiation dose above naturally occurring background radiation, on their hand while holding the analyzer, or on any area of their body.

This chapter details specifics of the radiation levels. It covers both standard (safe) and un-safe methods of operation, it provides radiation emission information, and also provides dose estimates for unsafe operations.

3.1 GENERAL SAFETY PRECAUTIONS AND INFORMATION:

Retain and follow all product safety and operating instructions. Observe all warnings on the product and in the operating instructions. To reduce the risk of bodily injury, electric shock, fire and damage to the equipment, observe the following precautions:

Heed service markings. Except as explained in this documentation, do not service any Innov-X product yourself. Opening or removing covers may expose you to electric shock. Service needed on components inside these compartments should be done only by Innov-X Systems, INC.

Damage requiring service:

- The power cord, plug or battery contacts for the battery charger are damaged.

- Liquid has been spilled or an object has fallen onto the instrument.
- The instrument has been exposed to rain or water.
- The instrument has been dropped or damaged.
- There are noticeable signs of overheating.
- The instrument does not operate normally when you follow operating instructions.

Safety Precautions:

Use the correct external power source: Ensure that the voltage is appropriate (100V-240 V/ 50-60 Hz) for charging the battery packs. Do not overload an electrical outlet, power strip, or convenience receptacle. The overall load should not exceed 80% of the branch circuit rating.

Use cables and power cords properly:

Plug the battery charger into a grounded electrical outlet that is easily accessible at all times. Do not pull on cords and cables. When unplugging the cord from the electrical outlet, grasp and pull the cord by the plug.

Handle battery packs properly; do not: disassemble, crush, puncture, short external contacts, dispose of in fire or water, or expose a battery pack to temperatures higher than 60 °C (140 °F). Do not attempt to open or service a battery pack.

WARNING: Danger of explosion if battery is incorrectly substituted. Replace only with Innov-X specified batteries. Used batteries may be returned to Innov-X Systems for disposal.

3.2 INNOV-X SYSTEMS – RECOMMENDED RADIATION SAFETY TRAINING COMPONENTS

Individual Companies and States have specific regulations and guidelines for the use of X-ray tube generated ionizing radiation. The purpose of the recommendations below is to provide generic guidance for an ALARA - best practice - approach to radiation safety. These recommendations do not replace the requirement to understand and comply with the specific policies of any state or organization.

1. **Proper Usage.** Never point the instrument at another person. Never point the instrument into the air and perform a test. Never hold a sample in your hand and test that part of the sample.
2. **Establish Controlled Areas.** The location of storage and use should be of restricted access to limit potential exposure to ionizing radiation. In use, the target should not be hand held and the area at least three paces beyond the target should be unoccupied.
3. **Specific Controls.** The instrument should be stored, in a locked case, or locked cabinets when not in use. When in use, it must remain in the direct control of a factory trained, certified operator.
4. **Time - Distance - Shielding Policies.** Operators should minimize the time around the energized instrument, maximize the distance from the instrument window, and shoot into high density materials whenever possible. Under no circumstances should the operator point the instrument at themselves or others.
5. **Prevent Exposure to Ionizing Radiation.** - All reasonable measures, including labeling, operator training and certification, and the concepts of time, distance, & shielding, should be implemented to limit radiation exposure to *as low as reasonably achievable* (ALARA).
6. **Personal Monitoring.** Radiation control regulations may require implementation of a radiation monitoring program, where each instrument operator wears a film badge or TLD detector for an initial period of 1 year to establish a baseline exposure record. Continuing radiation monitoring after this

period is recommended, but may be discontinued if accepted by radiation control regulators. Please refer to Sect. 3.10 for a list of providers of film badges.

3.3 INNOV-X SAFETY FEATURES

The Innov-X analyzer is very safe when used correctly, however the analyzer does emit radiation through the analyzer window, and all precautions must be taken to reduce exposure to this radiation. In order to minimize the possibility of accidental exposure, the following safety features are standard in all Innov-X analyzers.

1. “Deadman” trigger. The trigger must be held for the duration of the test. This requires that the user consciously depress the trigger whenever x-rays are emitted, and ensures that the analyzer is attended at all times while x-rays are emitted.

Upon completion of safety training, an INNOV-X certified trainer may deactivate this feature upon request. The deactivation of the trigger is recommended only if long tests are required (such as for soil mode) and if the unit is used primarily by only 1 or 2 users who utilize it frequently, in a very controlled environment. In situations where multiple users are sharing the unit, it is recommended that the deadman trigger remain active.

Note: Canadian Regulations require that the deadman trigger be used at all times. This feature will not be disabled for usage in Canada.

2. Software Trigger lock. Before using the trigger, the user must tap on a lock icon located in the lower right hand corner of the iPAQ screen. The user must then confirm that they wish to unlock the trigger. If the instrument is used continuously, the software trigger lock will remain off. If five minutes elapse between tests, the trigger will lock automatically.
3. Software Proximity sensor. The software requires that a sample be present in front of the analyzing window. This prevents the accidental exposure of bystanders to an open beam. If the analyzer detects that a sample is not present, it will abort the test and shut off x-rays two seconds after the test is started.

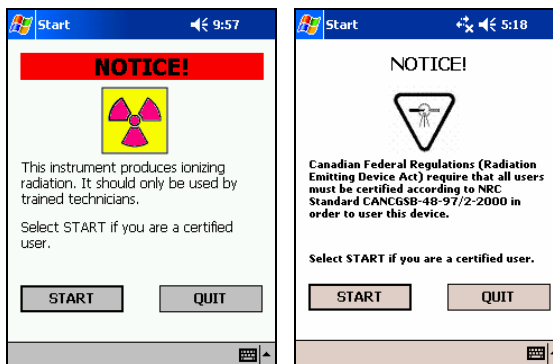
3.4 PERFORMING A TEST FOLLOWING APPROPRIATE RADIATION SAFETY PROCEDURES

Starting the Analyzer:

When an operator opens the Innov-X software on the iPAQ, he or she will be presented with one of the displays shown to the right. Provided an operator has received training from an authorized Innov-X trainer, he/she should tap the START button to begin using the analyzer.

In Canada, INNOV-X ANALYZERS MUST BE OPERATED BY CERTIFIED USERS ONLY!

From this point the operator is presented with the main menu of the analyzer to choose an operating mode and begin testing (described in Chapter 4). The remainder of this section is dedicated to operational and safety aspects that pertain to safe use and storage of the analyzer.



Starting a test using the trigger.

When the trigger is depressed, the analyzer supplies power to the x-ray tube and opens the shutter to emit x-rays.

If deadman trigger is enabled, the trigger must be depressed for the duration of the test. Releasing the trigger will close the shutter and immediately end the test. If deadman trigger is disabled, pulling the trigger once will start a test, pulling it again will stop it.



Figure 3.1 Handle of analyzer. Trigger is located at top of handle.

Starting a Test Using the “Start” Icon on the iPAQ Screen

This feature is disabled in all units shipped. It will become active only if the “deadman” trigger is disabled.

An operator may also begin a test by pressing the **Start** button on the touch screen, as shown at the right. The **Start** button, rather than the trigger, is generally used when the analyzer is docked into the testing stand.

This Feature is not available in Canada. All tests must be started via the trigger.



3.5 CORRECT AND INCORRECT INSTRUMENT USAGE:

The Innov-X XRF analyzer can be used in several different testing configurations. Safety guidelines are described for each configuration.

Configuration 1: Usage as a Handheld Alloy Analyzer:

In this configuration the analyzer is held in the hand, placed on various types of samples and a test is performed. Samples include pipes, valves, large pieces of scrap metal, basically any sample large enough to be tested in place, rather than held in the operator's hand. Point the instrument at a metal sample such that no part of your body including hands and/or fingers is near the aperture of the analyzer where x-rays are emitted.

Using the analyzer in this manner assures that the operator will not obtain a radiation dose to any body part or extremity in excess of naturally occurring background radiation. The radiation at any surface of the analyzer is < 0.1 mR/hr except at the exit port and the immediate area around the exit port.

The user should take care that personnel are not located within 3' (1 m) of the front end of the analyzer during testing, in the direction of the x-ray beam. Provided the analysis window is completely covered, there is virtually no radiation being emitted around the area of the sample. However, if a small component or curved surface is being analyzed, some radiation will be detectable.

Configuration 2: Usage in the Testing Stand

Innov-X strongly recommends that testing small pieces or small samples (rod, fasteners, turnings, XRF sample cups, bagged samples, etc.) be analyzed using the Innov-X Testing Stand. This allows the sample to be placed onto the analysis window of the analyzer without requiring the sample to be held by the operator. See figure below titled “Testing Stand Operation.”

Note for Canadian Usage: The testing stand is not available for use in Canada at this time because it has not received regulatory approval yet. When an interlocked version of the testing stand has received regulatory approval, it will be available for sale into Canada. Please contact Innov-X Systems for an update on this process at 781-938-5005.

Figure 3.2 Testing Stand Operation. Please refer to **Section 2.7: Testing Stand** for assembly instructions.

Warning: Innov-X strongly recommends that operators do NOT hold samples in their hand for testing. Never hold a small sample in your hand, and test that sample, such that your hand is exposed to the x-ray beam being emitted from the analyzer. This type of testing produces a small but non-negligible radiation dose to the operator’s hand. Please see **Section 3.7: Radiation Doses for Several Scenarios** for dose levels. Also, see **Figure 3.4** for an example of incorrect usage.



Figure 3.2.

Testing of Small Components:

Operators often are required to test small components, particularly in the field of alloy analysis. Examples of small samples include turnings, weld rod, wires, fasteners, nuts and/or bolts.

There are specific procedures to test small components. These procedures should be followed at all times. **Never hold a small part with your fingers or in the palm of your hand and perform a test. Doing so may deliver a significant dose of radiation to your fingers or hand.** Please refer to the Examples of Mis-use below.

Method 1: Testing a sample lying on a flat surface.



Figures 3.2.: Performing a testing for a sample lying on the surface of a table. This is a good way to test small samples, rather than holding them in your hand.

To analyzer small sample:

- Place the sample onto a flat surface.
- Place the window of the analyzer onto the sample and begin the test.

Safety Precautions:

Do not test samples in this manner at a desk or table where the operator is sitting. If the desk is made of wood or another non-metallic material, some radiation will penetrate the desk and may provide exposure to legs or feet if the operator is sitting at the desk or table.

Analytical Precautions:

If the sample does not completely cover the window, be sure the surface used does not contain metals or even trace levels of metals, as this may affect the accuracy of the XRF result. The XRF may report the presence of additional metals in the surface material. For this type of testing, it is good to place the sample onto a piece of 1100series aluminum alloy and perform the analysis. The operator should disable the aluminum analysis capability (See Section 8.3.3 in the manual for instructions).

Method 2: Use the testing stand as described above (see also Fig. 3.2).

Examples of Incorrect and Possible Unsafe Operation:

Improper Operation, DO NOT TEST SAMPLES LIKE THIS:

Exposure to the operator's hand/fingers will likely be minimal for this type of a testing, because the operator's hands and fingers are not in the primary beam. However, Innov-X believes that this type of the analyzer sets a poor safety precedent in that any operation where the operator places their fingers or hands near the window should not be permitted.



Figure 3.3. Incorrect Usage. While the dose to the operator's fingers/hand is negligible, testing this way sets a poor safety example for other operators, possibly encouraging other unsafe usage. Innov-X strongly recommends against this type of testing.

DO NOT TEST SAMPLES LIKE THIS:

Never hold a sample in your hand such that any part of your body or appendages are exposed to the x-ray beam. Testing samples in this way may generate significant radiation exposure (up to 27 R/hr) to the operator's fingers.



Figure 4.4 Extreme example of incorrect usage. An operator should NEVER hold small samples by hand

3.6 RADIATION WARNING LIGHTS AND LABELING:

3.6.1 Main Power switch and Indicator Light:

The main power switch is found on the rear of the unit and is shown in the figure to the left. Pressing the switch for several seconds will turn on the main power. A green LED indicates the main power is on. The main power must be turned on in order to operate the unit however, this switch DOES NOT turn on the x-ray tube. No power will be supplied to the x-ray tube unit the Innov-X software is started.



3.6.2 Probe Light and Probe Label:

The Innov-X analyzer is equipped with warning lights that alert the operator when the tube is receiving power, and when x-rays are being emitted from the analyzer. Please see Fig. 3.5.

When the red light on the front nose of the analyzer is ON continuously (not blinking), this indicates the x-ray tube is receiving a low level of electrical power and the shutter is closed. The system is producing a low level of x-rays internally in this condition, but the shutter is providing adequate shielding to keep x-ray levels below levels of detection. The instrument is safe to be carried around or set down in this configuration.

When the red light is blinking, this indicates the tube is powered, the shutter is open and the analyzer is emitting x-ray radiation out of the analysis window. The analyzer should only be pointed at a sample, or be in the testing stand with a sample resting on the window, in this configuration.

3.6.3 Display on Back of Analyzer:

The display on the back of the analyzer, shown in Fig. 3.6, provides a “testing” message to indicate that the x-ray tube is energized and the shutter is open. This display is for testing conditions (i.e. overhead) where the operator cannot see the Probe Light or the iPAQ display.

3.6.4 Label Behind iPAQ:

The analyzer also has a label just below the iPAQ indicating, as shown in Figure 3.7:

CAUTION: Radiation. This Equipment Produces Radiation When Energized.

This label is required by most regulatory agencies. The term “When Energized” refers to the condition where the tube is fully energized and the shutter is open. This condition is also indicated by the red blinking light on the probe.



Figure 3.5. Probe light and labeling. When the light is on continuously, the x-ray tube is receiving minimal power and it is producing a minimum level of x-rays. The shutter is also closed so there is no radiation exposure to the operator or bystanders.



Figure 3.6. Back light on analyzer.



Figure 3.7. Label behind iPAQ. Top version is used in Canada

3.7 RADIATION LEVELS FROM ANALYZER

Two pictures of the analyzer are shown below. In the first picture, all the relevant components referenced in this radiation safety section are displayed and labeled. The second picture shows a close-up of the front end of the window. The four sides A, B, C and D are indicated on this picture because they are referenced in terms of radiation levels output by the analyzer. The measured radiation levels for standard operating conditions are shown in the figures and tables below. Standard operating conditions are tube voltage operating at 35 kV, tube current of 5 uA, and 2 mm aluminum filtration.



Figure 3.8 Innov-X Analyzer, Side View



Figure 3.9 Innov-X Analyzer, Front View

Radiation Levels (mrem/hr) for Alloy Analysis, Standard Beam Conditions: 35kV, 5 uA, 2mm aluminum filtering:

Sample at Window	Trigger	Location A (Top)	Location B (Right Side)	Location C (Bottom)	Location D (Left Side)
Blank (Air)	<0.1	<0.1	<0.1	<0.1	<0.1
Metal	<0.1	<0.1	<0.1	<0.1	<0.1

Table 3.1. Dose rates (units of mrem/hr) at various locations with a metal sample covering the window and with no sample present. For “no sample” the analyzer is shooting the x-ray beam into air.

As shown in the Table 3-1, the dose to the operator’s hand is negligible. The radiation levels at the side surfaces of the instrument snout (aluminum housing) are all <0.1 mrem/hour. Despite these low levels of radiation, there is no reason for any body part to be in the locations denoted A, B, C and D!

Table 3-2 shows the radiation levels directly in the x-ray beam that is emitted from the analyzer. Radiation levels at the exit aperture (or “port”) are substantial. There is no reason for the operator or any personnel to be exposed by the direct beam. Operators should never hold samples in their fingers or cupped in their hands, as this may generate a significant radiation exposure.

Operations should never point the analyzer at another person and start a test, as this may also provide significant exposure to the person if they are within a few inches of the port of the instrument.

Radiation Levels in the Primary Beam Versus Distance from Port:

For Alloy Analysis, Standard Beam Conditions: 35kV, 5 uA, 2mm aluminum filtering:

Tube Conditions	At Trigger, or any part of operator’s body.	At Window	4 inches	12 inches	36 inches	48 inches
35 kV, 5 uA, 2 mm Al filtering	<0.05	28,160	2,080	186	24	14
15 kV, 25 uA, thinner filter material	< 0.05	27,780	1,620	145	19	11

Table 3.2. Dose rates (units of mrem/hr) in the direct x-ray beam being emitted from the analyzer

3.8 RADIATION DOSES FOR SEVERAL SCENARIOS

In this section we provide data, concrete examples of use and misuse of the analyzer and common questions and answers we encounter when training personnel on the safe use of the Innov-X analyzer. The goal is to explain scenarios of safe versus improper usage of the analyzer.

The table below presents radiation doses for normal operating conditions and also for examples of misuse of the analyzer and even extreme misuse. Innov-X provides installation training that includes detailed radiation safety training and documentation designed to prevent misuse of the analyzer

Example of Instrument Usage	Radiation Exposure and Comments
Normal Operation - Dose to Hand: User analyzes samples according to standard operating procedures described in this manual. Assumption: Operator using system with x-ray tube ON for 8 hours/day, 5 days/week, 50 weeks/year. (Practically constant usage). Normal Operation – Dose to Torso: Analyzer is used under the same operating conditions described above.	Maximum exposure is to operator's hand, at the trigger. Exposure is < 0.1 mrem/hr. Annual exposure to hand is then < 200 mrem (2mSv). US: Maximum exposure under OSHA regulations is 50,000 mrem annually. Thus continuous operation provides a dose that is at least 250 times lower than maximum allowed by OSHA. Canada: Maximum exposure under ICRP regulations is 500 mSv for radiation workers and 50 mSv for the general public. Thus continuous operation provides a dosage 250 times lower for a radiation worker and and 25 times lower for the general public. Exposure to Torso is so low it cannot be measured. To be conservative we use the same figure as the trigger, <0.1 mrem hr. Annual exposure using operating conditions above is < 40 mrem. (0.4 mSv) Maximum allowed is 5,000 mrem under OSHA and 20 mSv under ICRP for radiation workers (1 mSv for general public).
For the x-ray energy emitted by portable XRF analyzers (10-60 keV region), the bone in the fingers will absorb radiation about 3-5 times more than soft tissue, so the bone would be at an elevated radiation risk compared to soft tissue. For this reason no person shall hold a test specimen in front of the window with the fingers in the direct beam, or direct the beam at any part of the human body. Reference: Health Physics 66(4):463-471;1994.	
Misuse Example 1: Operator holds samples in front of window with fingers, such that fingers are directly in the primary beam. Do not do this!.	For fingers at the port, in the primary beam, the maximum dose to the fingers is 28,160 mrem/hr. Assume an operator performs a 10 sec test (typical). The dose to the operator's fingers or hand is $28,160 \times (10/3600) = 78$ mrem. If the operator did this 641 times/year they would exceed the allowable annual dose of 50,000 mrem to an extremity. In Canada, the maximum allowed dose is 500 mSv/year (Canada ICRP radiation worker) or 50 mSv/year (Canada ICRP general public). If the test time was 30 seconds instead of 10 seconds, the operator would receive a dose of 234 mrem for each exposure, and thus would exceed the annual safe limit of 50,000 mrem after 213 tests. Even though it is unlikely to make this mistake so many times in a year, do not even do it once. Take the extra time to test a sample on a surface or use a testing stand. Note: If the operator takes an average of only two shortcuts per week and places his/her fingers within the primary x-ray beam at the window, they will exceed the annual dose rate.

Misuse Example 2:

Operator places analyzer against body and pulls the trigger to start a test. Analyzer tests to preset testing time (usually 10 seconds) unless operator pulls trigger again to stop test. This applies to analyzer being in contact with operator or with bystander.

Misuse Example 3:

Operator manages to initiate a test for 10 seconds and exposes a bystander that is standing 12" away from analyzer port. What is exposure to bystander?

Note: The proximity sensor would automatically shut down the x-ray tube after 2 seconds, so this is an extremely improbable occurrence.

Note 2: Equations to scale these to other scenarios involving longer or shorter tests, and bystander being at distances other than 12" are provided at right.

Dose at exit of sampling window is 28,160 mrem/hr.

Dose for a 10 second exposure with analyzer in contact with Torso: 78 mrem (.78 mSv).

US: If an operator did this act 64 times in a year, the operator would exceed the annual safe dosage to the torso of 5,000 mrem/year. The maximum dose of 5,000 mrem/year is a whole body limit, which does not truly apply in this case because the x-ray beam size is small (about 2 cm² area – 1.5 cm x 1.3 cm – at the port). Applying correction factors for the beam size is complex and beyond the scope of this manual. The important point is that for proper operation there is no reason to ever exposure any part of the human body directly to the x-ray source. This example serves to provide estimated exposure in the event this occurs.

If the testing time was 30 seconds instead of 10 seconds, thus the operator placed the port against his body or that of a bystander and performed a 30 second test, the dose would be 234 mrem. This is about the same as a mammogram. Repeating this gross mis-use 22 times would exceed the annual allowable limits.

Canada: Radiation worker would have to repeat this example (234 mrem exposure) of gross misuse 8 times to achieve the ICRP level of 20 mSv. (general public 1.3 times to achieve limit of 1mSv)

Dose to bystander at 1 foot is 350 mrem/hr. For a 10 second exposure dose is 1 mrem. This is 5,000 times lower than the allowable dose to a worker in a year. This would have to happen 5,000 times to for that worker or bystander to obtain the maximum allowable dose.

Formula for calculating other scenarios:

$$Dose = 1 \text{ mrem} \left(\frac{13.25}{D + 1.25} \right)^2 \times \left(\frac{t}{10} \right)$$

D = distance from port in inches

T = testing time

Example: Bystander is 3' away from port for a 30 second test. In this case the dose is calculated as:

$$Dose = 1 \text{ mrem} \left(\frac{13.25}{36 + 1.25} \right)^2 \times \left(\frac{30}{10} \right) = 0.38 \text{ mrem}$$

US OSHA: Maximum allowable level is 5,000 mrem assuming bystander's torso is exposed. Thus, this misuse would have to occur 12,500 times in a year to the same bystander before that bystander achieved his maximum allowed dose.

ICRP: 5000 times for rad worker, 250 for general public

Comparative: Radiation Doses from Typical Exposures to Ionizing Radiation

Common medical and/or dental x-rays:	20-30 mrem each.
Mammogram:	100-200 mrem
Flying in a commercial jet coast to coast (6 hrs.):	1-2 mrem.
Daily exposure from background radiation: * depends on geographic location	0.3 to 0.5 mrem/day

Table 3.3 Radiation Doses from Typical Exposures to Ionizing Radiation

From the above table, a single case of analyzer misuse, thus producing a one-time exposure of 70-250 mrem, is comparable with single-event common medical x-ray procedures such as an annual chest x-ray or mammogram, or 25-50 airline flights in a year, and thus is not considered harmful. Regular misuse, such as taking safety shortcuts twice weekly, produces radiation exposure that greatly exceeds these typical levels and should be avoided entirely.

3.9 COMMON QUESTIONS AND ANSWERS REGARDING RADIATION SAFETY

Question: When I'm shooting a piece of pipe or valve on a rack or on a table top, is there any exposure to people standing in other locations, or standing several feet away from the analyzer?

Answer: Even a thin amount of metal sample (1-2 mm thickness) is enough to completely attenuate the x-ray beam emitted from the Innov-X analyzer. Shooting a piece of material that covers the sampling window on the analyzer will completely shield any bystanders from radiation exposure. However, good practice recommends that the area for at least 4-5 feet in front of the analyzer is clear of people.

Question: If I forgot to switch the safety on the trigger to "ON", I pick up the analyzer and accidentally pull the trigger, is that dangerous to nearby personnel?

Answer: No, this example of misuse is not dangerous, but it may produce a non-negligible radiation exposure to nearby personnel. For an exposure to occur, the following things must happen. First, you must be holding the analyzer so that a bystander is actually standing in the x-ray beam being emitted. Just being near the analyzer is totally safe otherwise. Second, the bystander must be within 1-3 feet from the nose of the analyzer in addition to being in the beam path, to receive any appreciable dose. If all of these conditions are true, the dose received by a bystander is still extremely low. It ranges between 0.1 to 0.5 mrem depending on the exact location of the bystander. This dose is 10,000 to 50,000 times less than the allowed dose. Please see Misuse Example 4 in the table above.

Question: Do I need to create restricted areas where I am using the analyzer?

Answer: No, provided you are following normal operating procedures there is no reason to restrict access to an area where the analyzer is in use. The operator should take precautions to keep any personnel more than 3 feet away from the sampling window of the analyzer in the event of accidental misuse as detailed above. Should the operator also elect to test small components like weld rod as shown in Figure 3.3, the operator should also be sure that no personnel are standing within about 4-5 feet of the sampling window.

Question: How does the x-ray tube in the Innov-X system compare to a radiography system used for taking images of metal parts.

Answer: The x-ray tube used in the Innov-X system produces between 1,000 and 10,000 times lower power than most radiography systems (0.5-1 watt for Innov-X versus kW for radiography systems). This is because a portable XRF is designed to perform surface analysis of alloys and other samples, whereas radiography systems are designed to shoot x-rays entirely through metal components in order to obtain an image on the other side of the object being bombarded with x-rays. For example, many tube-based radiography systems use a 300-400 kV tube and currents in the tens or hundreds of milliamps (mA). The Innov-X analyzer uses a tube operating at 35 kV and 5-30 micro-amperes. The radiation levels produced are therefore thousands or tens of thousands times lower with the Innov-X system.

Question: Should we use dosimeter badges with the Innov-X analyzer.

Answer: Dosimeter badges are required by some states, and optional by other states. Innov-X recommends that operators wear badges, at least for the first year of operation, as a general precaution to flag any misuse of the analyzer. Dosimeter badges are available for the torso (generally worn on the belt loop or shirt pocket) and are available as “ring” badges. The best single badge to obtain is a ring badge that is worn on a finger, on the opposite hand used to hold the analyzer. This will record accidental exposure for the most likely case – an operator grabbing a small sample and holding it in one hand while analyzing it. Note: these badges generally have a threshold of 10 mrem, and are renewed monthly. So it will take several cases of misuse even to obtain a reading on a typical badge. When purchasing a badge, obtain the type used for x-ray and low energy gamma ray radiation.

3.10 SAFE GUARDS AND EMERGENCY RESPONSE

The main safeguards to use as an owner of an Innov-X portable XRF are really intended to restrict access to properly trained operators. **Note: Canadian regulations require certified personnel to use the device, refer to section 3.0 in this chapter.**

1. Keep the system in a controlled location, where only authorized users are likely to have access to the analyzer at any given time.
2. Make a simple sign that is kept with the analyzer indicating that an operator must have completed a training class provided by your company or must have attended an Innov-X training course in order to use the analyzer. Note that when the Innov-X system is turned on, the screen displays a message indicating that the system should only be used by authorized personnel.

Emergency Response:

Because the Innov-X system is a battery operated, x-ray tube based analyzer, the emergency response plan is very simple. If the operator believes the analyzer is locked up in an “OPEN” position, they should do two things:

1. Press the On/Off switch on the base to power the analyzer off. The green LED indicator will turn off, indicating system power is off. At this point it is not possible for the analyzer to be producing x-rays.
2. As an additional precaution, the operator may remove the battery trap door at the bottom of the analyzer (have the nose pointing away from personnel), and pull out the battery. Even if the operator has failed to properly power the system off in Step #1, removing the battery guarantees that no x-rays can be produced. There is no electrical power being provided to the x-ray tube.

Note: It would be highly unusual for an operator to somehow lock up the analyzer with the x-ray tube powered on. This would require the operator to crash the iPAQ during an analysis. If this happens the analyzer will shut off the x-ray tube 10 seconds after the last communication with the iPAQ. However, if at any time the operator believes the x-ray tube is on and no test is in progress, powering off the analyzer and

restarting will automatically shut down the x-ray tube and close the shutter. It will no longer be possible to produce x-rays at this point.

3.11 DOSIMETER BADGES

Dosimeter badges are provided as a monthly service by several companies, listed in this section (see below). The badges are generally provided monthly, and the operator returns the previous month badges to the company for analysis. The operator receives a monthly report showing any personnel with readings higher than typical background radiation.

Dosimeter badges are required by some states, and optional by other states. Innov-X recommends that operators wear badges, at least for the first year of operation, as a general precaution to flag any misuse of the analyzer. Dosimeter badges are available for the torso (generally worn on the belt loop or shirt pocket) and are available as “ring” badges. The best single badge to obtain is a ring badge that is worn on a finger, on the opposite hand used to hold the analyzer. This will record accidental exposure for the most likely case – an operator grabbing a small sample and holding it in one hand while analyzing it. Note: these badges generally have a threshold of 10 mrem, and are renewed monthly. So it will take several cases of misuse even to obtain a reading on a typical badge. When purchasing a badge, obtain the type used for x-ray and low energy gamma ray radiation.

Dosimeter Companies:

Here are two companies that provide badges as a regular service. There are certainly many more.

Landauer Inc.
Glenwood, IL
708-755-7000

AEIL
Houston, TX
713-790-9719

3.12 TYPICAL REGISTRATION REQUIREMENTS

Innov-X maintains a database of the registration requirements for every state, including sample registration forms. Most states require some form of registration, and generally they require the registration to be received within 30 days of receipt of the instrument. Some states require no registration, while a few require notification in advance. Please contact Innov-X for specific questions regarding the state where the instrument will be used, or for copies of registration forms.

In general a company will have to provide the following information regarding the device:

1. Purpose of device. Generally this is “Analytical” or “Industrial.” Be sure to inform the state registration office that the device will NOT be used for radiography or for medical uses.
2. Radiation Safety Officer – Monitors training, safe use, and controls access to the instrument.
3. Authorized Users – Trained by Innov-X Factory Authorized Representatives in the safe and proper use of the XRF.
4. Operating parameters of the analyzer – 35 kV, 5-30 micro-amps.
5. Type of system, either fixed, mobile or portable. Generally the correct choice is “Portable.”
6. User Training Specified – Indicate that only individuals receiving manufacturer training, documented by a manufacturer’s training certificate will operate the instrument.
7. Personal Monitoring. This may be required by radiation control authorities. Many registration forms will ask that you indicate whether or not you intend to perform dosimeter monitoring.
8. Copy of Registration & Manual at the Job Site

If you have any questions regarding the type of registration form or filling out the form, please contact Innov-X Systems. Many states may confuse a portable XRF system that uses a tube with medical or

industrial radiography systems. This is because of the relative newness of portable tube-based systems. In all likelihood, Innov-X personnel have experience providing the necessary documentation to the state in question, and can readily assist the customer in this process.

Chapter 4 Operation

4.0 OPERATION - GENERAL

Power to the instrument is controlled by the ON/OFF button located at the rear of the analyzer. The green LED next to this button will illuminate when the analyzer power is on. The iPAQ operates on the Microsoft Windows CE ® operating system and is activated separately by the power button on the right top face, just over the display. The trigger is locked via the software.

4.1 WORKING WITH THE HP iPAQ Pocket PC®

The Microsoft Windows CE ® operating system and Innov-X software provided on the iPAQ handheld computer are operated by user input through the touch screen. For comprehensive details on the iPAQ's operation, please refer to the iPAQ reference materials included with your unit.

General tips

- The Start Menu is found in the upper left corner of the iPAQ screen. This is used to launch all applications, including the Innov-X Systems Analyzer software.
- The instrument is designed as a “point and shoot” system that requires little, if any, entry of information for most operations. In the event the user modifies the grade library, enters testing information data, or performs other functions, it will be necessary to enter data via the virtual keyboard, which can be accessed by tapping the keyboard icon in the lower right corner. The iPAQ also includes character recognition software. This can be selected from the drop-down menu to the right of the keyboard icon.
- The File toolbar which will be used to Change Functions, Screens and Options is located at the bottom of the screen.
- It is possible to cut, copy, rename and delete files from within Windows File Explorer by selecting the file to be modified and holding the stylus on the screen for 2 seconds.
- Pressing buttons on the bottom of the iPAQ will perform various functions that are described in the iPAQ documentation. The button on the right hand side of the analyzer is the iPAQ task manager. Pressing this button will show all programs that are currently open. Open files can be closed from this menu. Simply hold the stylus on the file for a few seconds. The option to close the file will appear.

4.2 OPERATION - MAIN SOFTWARE SCREENS

The Innov-X Software consists of three main screens:

- **Main Menu screen:** Used to select the analysis mode, open the results screen, and change the administrator password.
- **Analysis Screen:** Used to change settings, edit libraries, and perform tests.
- **Results Screen:** Displays results from current reading, allows scrolling back to previous test results. Allows recorded data to be exported to a comma delimited file which is directly compatible with Microsoft Excel.

4.2.1 Innov-X Main Menu

The main menu below appears upon startup. The Main Menu allows you to choose an analysis mode, as well as perform certain administrative functions such as changing your login password. The modes which

are available on the analyzer are shown in blue. For information on adding additional analysis modes to an analyzer, please contact the Innov-X Sales Department at 781-938-5005.

- **Use the Main Menu to select the desired analysis mode.**
The analysis mode can be selected by either tapping on the name of the method (shown in blue) or by selecting the appropriate mode from the Modes menu.
- The administrative password can be changed by selecting **Options → Change Password.**
- It is possible to go directly to the Results Screen by selecting **View→Results.** If the results screen is opened in this manner, it is possible to view results when the iPAQ is not connected to the analyzer.

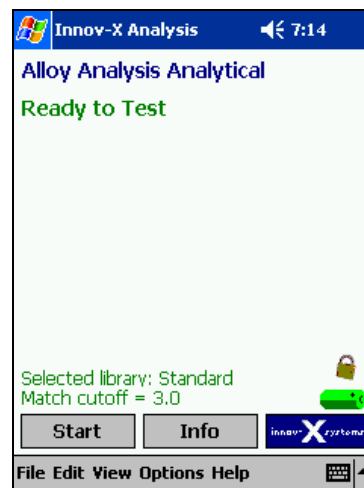


4.2.2 The Analysis Screen

Selecting a mode opens the analysis window for that mode. All data acquisition and analyzer control are done from this window. This window allows the user to start or stop an analysis, change testing parameters, and modify the fingerprint and grade libraries (Alloy Analysis only).

The analysis screen runs continually while during normal instrument operation. From the results menu, it is always possible to go back to the Analysis screen by selecting **File→Exit** or by tapping the X in the upper right hand corner of the screen.

The analysis screen for Analytical mode is shown to the right. Screens from other modes are similar and will be described in later in this manual. The analysis screen shows the name of the mode that is currently active, a start/stop button (which is inactive in most cases), an info button that is used to enter descriptive information for any given test, a trigger lock and a battery indicator. In addition, a message appears directly below the name of the mode which will indicate the current state of the analyzer. Typically it reads “Ready to Test,” but also provides other information in certain circumstances. Any mode specific information will be displayed at the bottom of the screen above the menu choices.



4.2.3 The Results Screen

The Results screen displays the current reading and old data. All data handling functions such as exporting and deleting readings are carried out from this screen. Once the Results Screen is open, the user may start new tests without going back to the analysis screen by pulling and holding the trigger. Tapping the X in the upper right hand corner will return the user to the analysis screen without starting a test. If no analysis mode is running, an Exit button will appear which will close the Results screen.

The Results screen is automatically shown at the completion of any analysis. It can also be accessed from the analysis screen for any mode or the **Main Menu**, by selecting **View→Results**. Once the Results screen has been opened, the information which is displayed can be changed by selecting options from the View menu. The various viewing options will be described in detail in later chapters.

Element	%	+/-
Cr	17.84	0.33
Mn	1.73	0.20
Fe	67.76	0.71
Ni	10.42	0.35
Mo	2.25	0.04

4.3 PASSWORDS - ABOUT PASSWORD PROTECTION

Certain functions such as adding and deleting fingerprints from the libraries, and Pass/Fail setup have been specified as Administrative Level Functions. These functions are described in detail in later sections of the manual. In order to use these functions, a password must be entered. The default password is set as the lowercase letter “z”. This password can be entered whenever the system prompts for a password.

Changing the Administrator Password.

The Administrator password may be changed at any time from the **Innov-X Main Menu** by choosing **Options→Change Password**. When the change password option is selected, this screen will appear.

If you are changing the password for the first time, enter the letter “z”; otherwise enter the current system password. Then, choose a password and enter it twice, once in the “New Password” box and again in the “Confirm Password” box. Passwords may be any combination of letters or numbers.

4.4 STANDARDIZATION

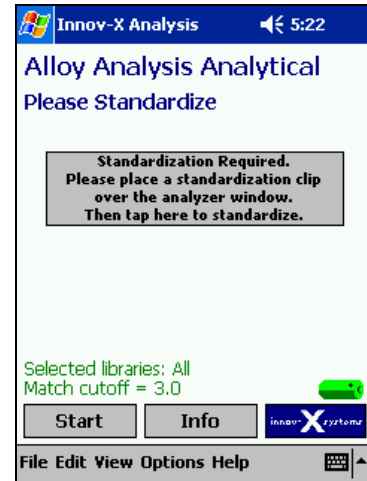
4.4.1 Standardization Procedure

Before performing tests, it is necessary to standardize the instrument. This automated procedure involves collecting a spectrum on a known standard (Alloy 316) and comparing a variety of parameters to values stored when the instrument was calibrated at the factory. If there are any problems with the instrument, they will be indicated by an error message.

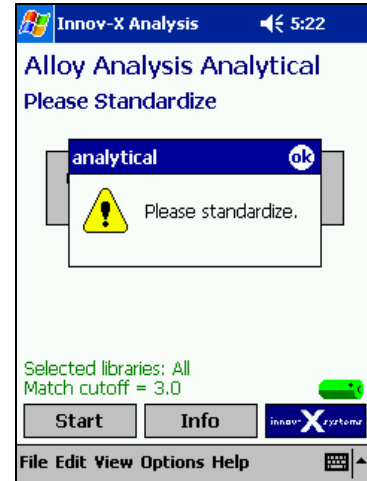
The standardization procedure takes about 1 minute. Standardization must be done any time the analyzer hardware is initiated or restarted and must be repeated if the instrument is operating for more than 4 hours.

It is possible to re-standardize the instrument at any point while the software is running. Standardization is always initiated from the Analysis Screen of any Mode.

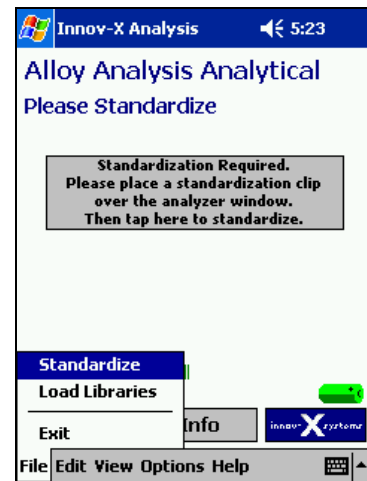
If the analyzer is restarted, you will be required to standardize the instrument before performing any measurements. This is indicated by the message “**Standardization Required. Please place a standardization clip over the analyzer window. Then tap here to standardize.**” on the analysis screen



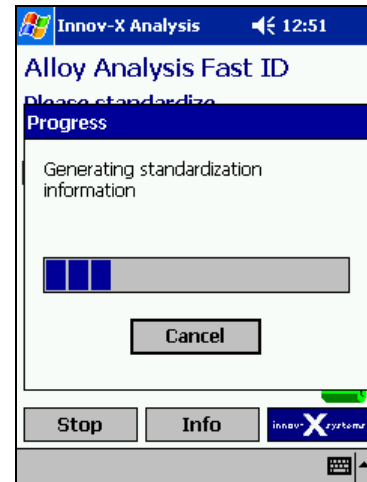
It is not possible to start a test before standardization. If the trigger is pulled before the standardization procedure is completed, a message box will appear. Press **ok** to acknowledge and clear the message.



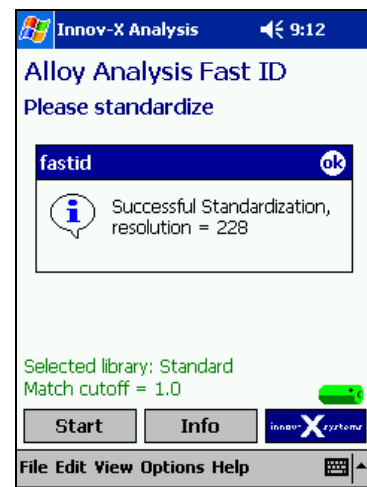
To initiate the standardization procedure, snap the standardization piece on the front of the instrument. Verify that it completely covers the analyzer window. When using a standardization mask with a weld collimator, be sure that the solid portion of the mask covers the analyzer window. Tap the grey box in the center of the screen or select **File→Standardize** to begin.



When standardization is in progress, the red light on the top of the instrument will blink, indicating that the X-ray tube is energized and the shutter is open. In addition, a status bar will appear, tracking the progress of the measurement.

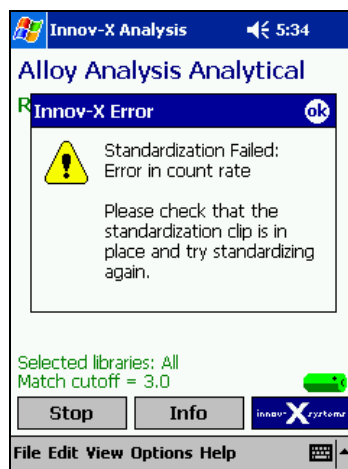
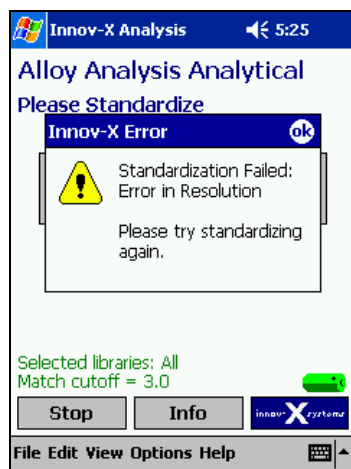


When standardization is complete, the message “Successful Standardization” will appear, along with the resolution of the instrument. Tap **ok** to acknowledge and clear the message. The instrument is ready for testing.

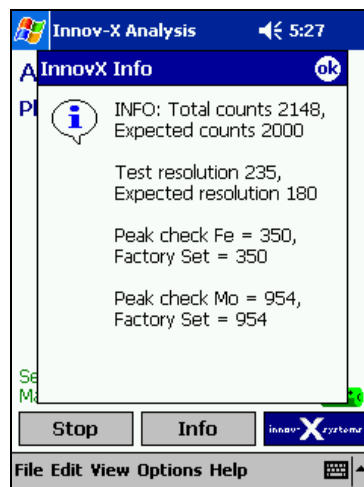
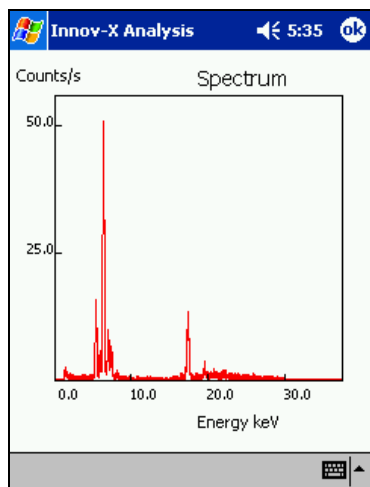


4.4.2 Standardization Errors

The analyzer performs several diagnostic checks during the standardization process. If the standardization fails, the instrument will prompt the user regarding the next step. Several errors could occur while standardizing: “Wrong Standardization Material,” “Error in Resolution” or “Error in Count Rate”

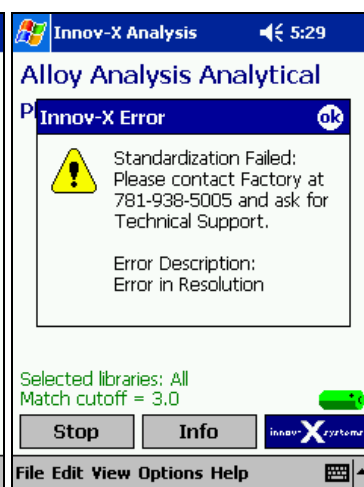
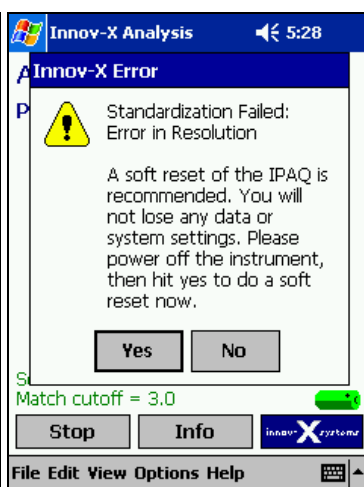
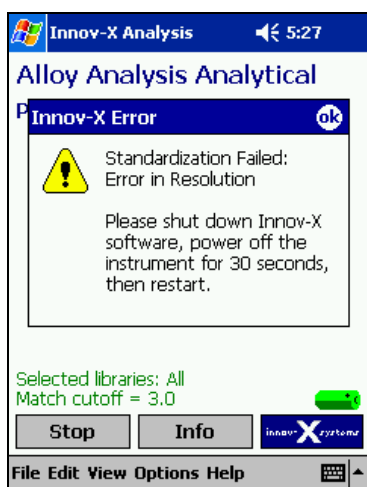


After closing the Standardization Failed message, two additional screens will appear. The first is a picture of the spectrum generated during the standardization. The second is a summary comparing factory set values for resolution, count rate, and peak positions to values calculated during the standardization.



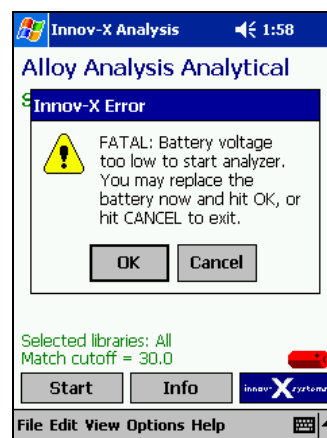
When standardization fails, verify that the standardization mask is in place, and attempt standardization again. To restandardize after a failure, tap the grey box in the center of the display, or choose **File→Standardize**. If you are using a weld collimator, make sure that the solid part of the mask is covering the window.

If standardization fails again, exit the analysis screen and power off the instrument. Restart and restandardize. If the standardization fails a 3rd time, you will be prompted to perform a soft reset of the iPAQ. Selecting Yes on this screen will automatically soft reset the IPAQ. You should also power cycle the instrument. Restart and restandardize. If the standardization fails again, replace the battery in the instrument and attempt another standardization. If this fails, please contact the Innov-X Systems service center at **781-938-5005**.



4.4.3 Battery Replacement and Initialization/Standardization

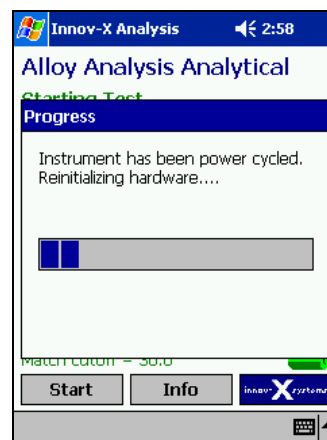
When the battery is too low to take a measurement, an error message will appear:



In order to continue testing, replace the battery immediately, and then tap “OK.” The analysis screen will remain open, and the instrument will reinitialize. This process will take 1 minute. It is not necessary to re-standardize, provided that less than 4 hours has elapsed since the last standardization and the battery swap is completed within 10 minutes.

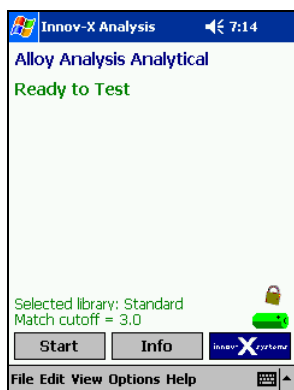
After re-initialization is completed, testing can continue.

If the battery is not replaced, and cancel is selected, the Analysis screen will close. When the software is restarted, the instrument will go through a complete 1 minute initialization and will require standardization.

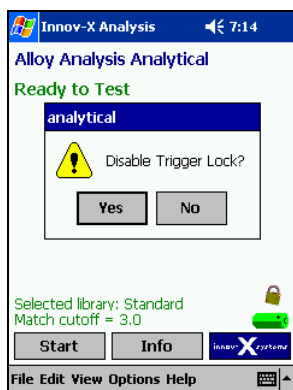


4.5 THE SOFTWARE TRIGGER LOCK

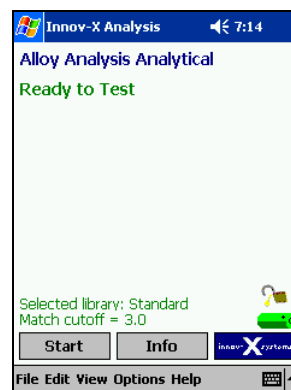
Innov-X analyzers are equipped with a software trigger lock which prevents the trigger from being actuated unintentionally. The lock is released by tapping an icon on the iPAQ screen. Once the lock is released, it will remain unlocked for subsequent tests, until more than five minutes has elapsed between tests. At that point, the trigger lock will be activated and will need to be disabled before additional testing can commence.



Tap the lock icon located directly above the battery indicator.



Select yes to disable the trigger lock



The open lock icon indicates when the trigger is disabled.

4.6 TEST INFORMATION - LABEL INPUT

Information such as sample name, and identifying characteristics can be stored with each measurement. This is done from the test information (Test Info) screen which can be accessed from the **Analysis Screen** of any mode by tapping the **Info** button, or selecting *Edit*→*Edit Test Information*.

The **Test Info** screen consists of eight fields. The name and format of each field can be changed by using the **Modify Test Info Template** feature described in section 4.6.1 **Modifying the Test Info Template**. The process of entering test information prior to each analysis is described in section 4.6.2 **Entering Test Information**. Finally, the process of entering or changing test information after the analysis has been completed is described in section 4.6.3 **Editing Test Info from the Results Screen**.

4.6.1 Modifying the Test Info Template

Test Info fields are modified via the Modify Test Info Template option found in the edit menu on the analysis screen in every software mode. Each field can be designated to be Direct Entry, Drop-down, or Tree. Direct entry fields allow users to enter characters directly from the virtual keyboard, or a bar code reader. Drop down menus provide a list of options to choose from. Trees are more complicated drop-downs; which allow users to subdivide large numbers of choices for ease in quickly locating the correct label. For example, a user may set up a tree with several parts for a main assembly. Subassemblies for the parts can be linked to their parent parts.

To make any changes to the Test Info format, select *Edit* → *Modify Test Info Template* from the analysis screen of any Mode. Modifications of Test Info screens are specific to each mode, and will need to be made to each mode if more than one is used.

Field Name	Field Type	Current Tree
Sample	Direct Edit	
field2	Direct Edit	
field3	Dropdown	
field4	Dropdown	
field5	Dropdown	
	Dropdown	
	Dropdown	
	Dropdown	

4.6.1a Changing Field Names

Field names can be edited by tapping on the current name. This will open an editable text box. A new name can be entered with the virtual keyboard. Selecting another cell or tapping **ok** will save this info.

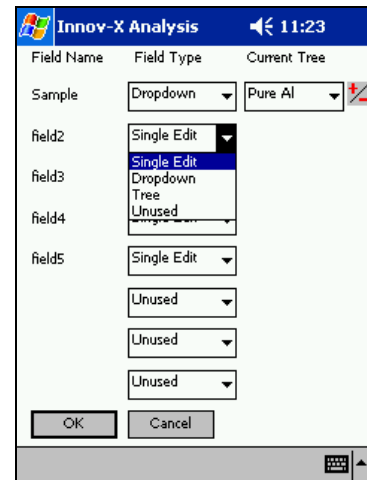
Field Name	Field Type	Current Tree
field1	Single Edit	
field2	Single Edit	
field3	Single Edit	
field4	Single Edit	
field5	Single Edit	
field6	Unused	

4.6.1b Selecting Field Type

From the Modify Test Info screen, the type of field can be selected from a drop-down menu. Simply tap the arrow in the Field Type box for the field being modified.

- Select **Direct Edit** for a text field which will accept data from the virtual keyboard, or a bar code scanner.
- Select **Drop-down** for a drop-down list
- Select **Tree** for a Drop-down menu with many choices, some of which may be grouped into categories and subcategories.

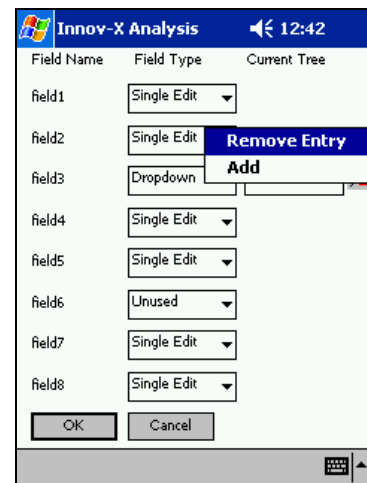
Select **Unused** to eliminate the field from the Test Info screen.



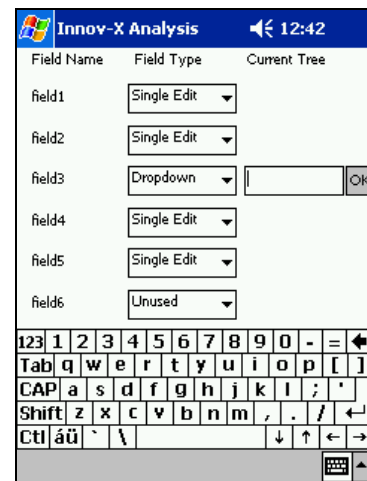
4.6.1c Changing Drop-down Menu Entries

Once a field has been designated a drop-down menu, entries can be added or deleted by clicking the +/- symbol to the right of the field. Two choices will appear; **Remove Entry** and **Add**.

To delete a drop-down entry, first select the label to be deleted, then press +/- and tap **Remove Entry**.



To add an entry from a drop-down list, tap the +/- symbol next to appropriate field, and select **Add**. Type the new info into the blank text box that appears. Select **OK** and the entry will be added to the drop-down menu.



Repeat the process above to complete the complete drop-down list.

If it is anticipated that a drop-down field will not be used for all samples, enter an empty field as a choice so you can choose to leave the field blank.

Field Name	Field Type	Current Tree
field1	Dropdown	
field2	Direct Edit	
field3	Direct Edit	
field4	Direct Edit	
field5	Dropdown	a
field6	Direct Edit	
field7	Direct Edit	
field8	Direct Edit	

4.6.1d Changing Tree lists.

Once a field has been designated a tree, modifications to the contents of the tree can be made by tapping the +/- symbol to the right of the tree.

Field Name	Field Type	Current Tree
Sample	Direct Edit	
field2	Direct Edit	
field3	Tree	Material Sp
field4	Dropdown	
field5	Dropdown	

All modifications to trees are made from the menu shown on the right.

It is possible to add, edit, delete or rename trees. Select the appropriate choice from the menu to perform any of these functions.

When you have finished creating/editing your tree, highlight it and select **Done**.

Trees

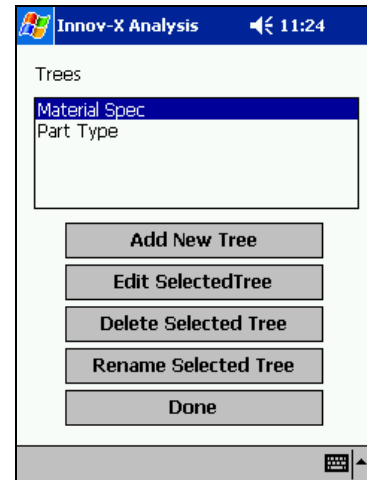
- Material Spec
- Part Type

Add New Tree
 Edit Selected Tree
 Delete Selected Tree
 Rename Selected Tree
 Done

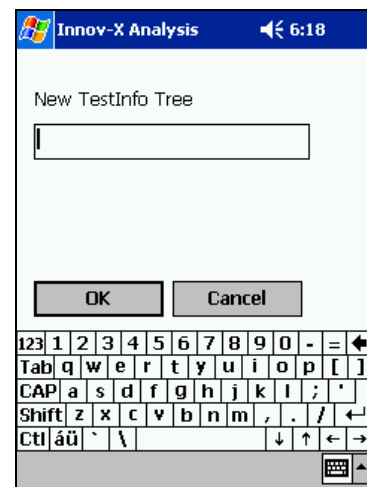
The following is an example of how a user might create a tree:
 A manufacturer of tubes and valves tests all parts to ensure that they're made of the proper material. The company's QC procedure involves labeling each test with the part number of the item. Rather than forcing operators to look through a long list of part numbers, a tree is created in order to subdivide the parts number into groups based on part type.

The procedure for creating the tree is as follows:

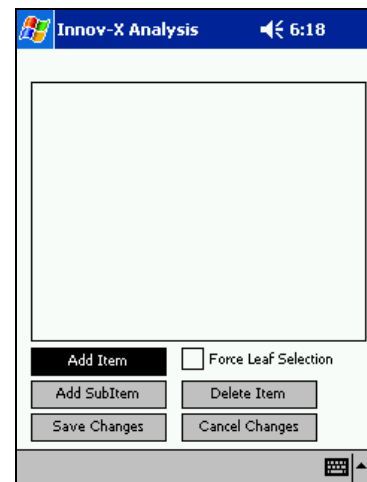
Select: Add New Tree:



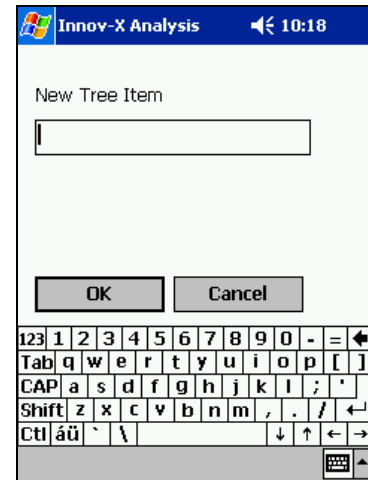
Enter the Name of the Tree in the text box and select OK.



Tap Add to add the first item

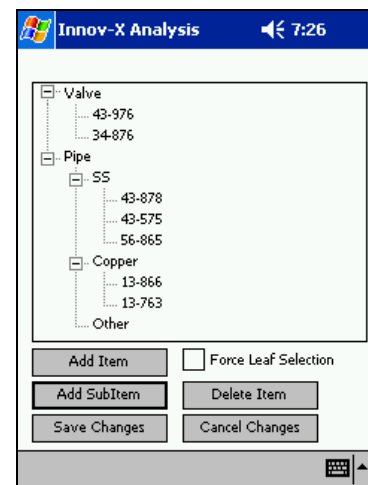


Enter the name of the item



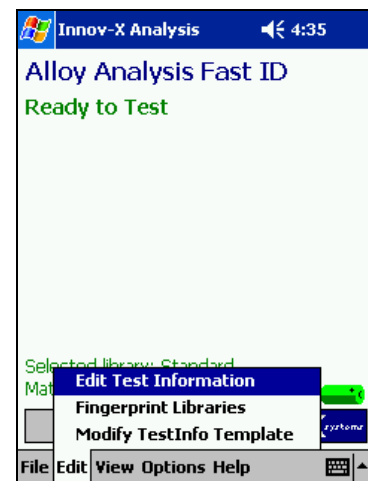
Once the tree is started, continue to Tap Add Item to add a top level menu item, or select an item and tap Add SubItem to link a subcategory to the item. Continue until all items have been added.

In this example, the part numbers for pipes and valves are separated into categories. The pipes are further subdivided by material type.



4.6.2 Entering Test Information

1. To enter the Test Info screen, you must be in the Analysis Screen. If the Results Screen is open, tap the ⊗ in the upper right hand corner to return to the Analysis Screen. From the Analysis Screen, select **Edit**→**Edit Test Information**, or tap the **Info** icon.



2. To enter a unique sample name or number, select a direct entry field by tapping anywhere within the field. Use the virtual keyboard to enter the information.

The screenshot shows the 'Innov-X Analysis' app interface. At the top, there's a status bar with a signal strength icon, the time '4:35', and a battery icon. Below the title bar, there are seven input fields labeled 'field1' through 'field7'. 'field1' contains the text 'test'. Below the fields is a virtual keyboard with rows for numbers (1-0), letters (QWERTYUIOP), letters (ASDFGHJKL), letters (ZXCVBNM), and function keys (Ctrl, Shift, Space, Enter, Backspace, Arrow keys). The keyboard is in a light gray theme.

3. To select information from one of the drop-down menus, tap the arrow to the right of the box. Select the desired entry.

This screenshot shows the same app interface, but now 'field3' is a drop-down menu. A small black arrow icon is visible to the right of the field. The menu is open, showing a list of options: 'a', 'b', 'c', and 'SN'. The option 'b' is highlighted with a blue background. The other fields remain empty. At the bottom, there are 'OK' and 'Cancel' buttons.

4. Some drop-down fields are formatted as trees. To select information from these fields, tap the arrow to the right of the box. A screen will appear showing options. The plus (+) symbol will appear before some choices indicating the presence of sub-items. Tap on the + symbol to expand the menu. Tap on any item or sub-item to select it, then press **Select**.

This screenshot shows a tree view for 'field3'. The tree structure is as follows:

- Valve (selected)
- Pipe
 - SS
 - 43-878
 - 43-575
 - 56-865
 - Copper
- Other

 The 'Valve' item is highlighted with a blue background. At the bottom, there are 'Select' and 'Cancel' buttons.

5. When all the necessary data have been entered, select OK
6. The information entered in the test info screen will be saved with each reading until the test info screen is modified again.

4.6.3 Editing Test Info from the results screen

Test information can be edited, or added to a test after its completion.

- From the results screen, scroll to the reading to be modified.
- Select **View** → **Test Info** to see in the information which is already stored.
- Select **Edit** → **Edit Test Info** to bring up the editing menu.



You will then be presented with the same test information screen described in **Section 4.5.2: Entering Test Information**.

4.7 EXPORTING AND ERASING DATA

Because the memory of the iPAQ is limited, you should periodically backup the data on your analyzer, and erase the memory. Depending on test volume, it is recommended that all data is erased on a weekly or monthly basis.

4.7.1 Installing ActiveSync

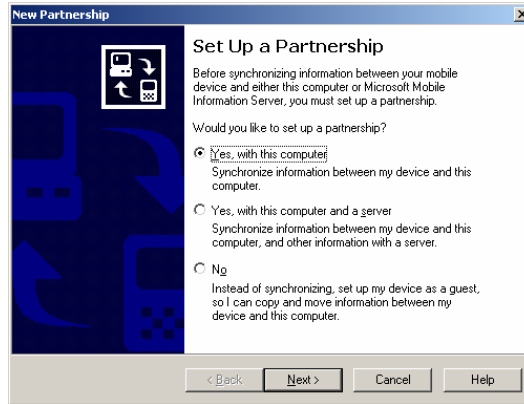
In order to copy files between the iPAQ and a desktop PC, Microsoft Active Sync Software must be installed on the desktop PC. Innov-X strongly recommends that you download the latest version of ActiveSync from the internet. ActiveSync v3.7 may be downloaded from <http://www.microsoft.com/windowsmobile/resources/downloads/pocketpc/activesync37.msp>

If it is not possible to download the latest version, an ActiveSync CD (v3.5) was shipped with your analyzer. Check behind the foam in the instrument case.

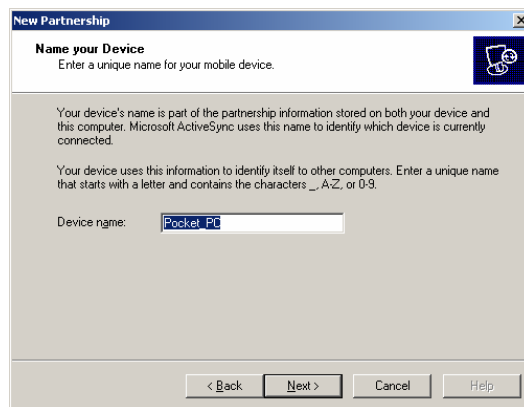
The iPAQ cradle should be hooked up to the USB port on the desktop computer before installing software.

The Procedure for installing and setting up ActiveSync is as follows:

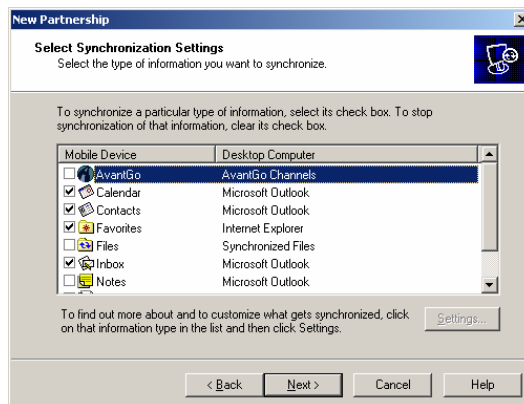
1. Insert the ActiveSync CD in your CD Drive. It will start automatically. The CD contains information about Getting Started with Your Pocket PC. This changes periodically, so it's difficult to describe exactly what the screens will look like. Step through the screens until you see the option "Install ActiveSync." Select this to start the installation process.
2. Follow the prompts on the screen. When given the choice, select "Run this program from its current location" and click OK.
3. Complete the install process. You will be required to restart your computer in order to complete the installation.
4. After restarting your computer, dock the iPAQ in the cradle. The iPAQ should automatically communicate with your computer. If it doesn't, check the connections and try removing the iPAQ and reseating it. If that doesn't work, try doing a soft reset on the iPAQ.
5. When the computer communicates, you will be prompted to "Set Up a Partnership." Select "Yes, with this computer"



6. Enter a name for your iPAQ and click next.



7. You will be prompted to “Select Synchronization Settings.” **Select “Files” only. *It is important to make sure that Files is the only item checked. Otherwise, the files such as address books and emails will be copied from the desktop computer to the iPAQ.***



8. Step through the rest of the process.
9. A folder will automatically be created on the PC’s desktop with the name of the device entered in step 8 above. Results files saved on the iPAQ will automatically be synched and will be stored in this folder. Opening this folder and clicking on the name of the file will open the file in Excel.
10. After ActiveSync is set up correctly, copying results to a desktop computer will consist of

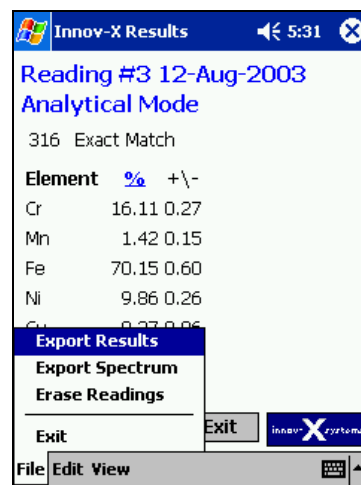
- Exporting results on the iPAQ. (described in section 4.6.2)
- Synching the iPAQ to the computer
- Opening the results in Excel for viewing, or printing.

4.7.2 Exporting Results

All data from your Innov-X Systems analyzer can be exported as a comma delimited text file (csv). This format allows the data to be easily exported to spreadsheet programs. It is possible to export all data from a single day, or to export all data saved in the iPAQ. Results and spectra are exported separately.

To export or erase data, you must be in the Results Screen. This is automatically opened when a reading is taken, or can be accessed by choosing **View→Results** from any analysis screen.

From the results screen, select **File→Export Results**



You can choose to export All Readings or just Readings on a specific date. Choosing **All Readings**: will export all readings saved in memory and is a good choice if you want to backup all data stored on the instrument before deleting. If a large number of readings stored, this option will take several minutes.

Choosing **Export Readings on date** requires that you pick a date from the calendar below. It is strongly recommended that you use this option and export data on a daily basis.

The customize export option allows users with administrative password privileges to customize the format in which data is exported. This is described in **Section 4.7.3: Customizing Results Export**.



After choosing which readings to export, you may choose to export all data, or just data from a specific mode. Selecting the arrow to the right of the mode to export will open a drop-down menu. Select the mode for which you want to export data.

All standardization data are stored as results files. These data are automatically included in exported results files when the selected “Mode to export” is **All**. Additionally, it is possible to export only the standardization data by selecting **Standardization** as the “Mode to export.”

When the proper selections have been made, select **OK**. A **Save As** box will appear. Select the folder in which you want to save the data, and name the file. The file Type will always be **Comma Separated Values**. The recommended Location is Main memory and Folder is **None**. This will export files into the “My Documents” folder in the main Memory of the iPAQ.

If you select a File Name which already exists, you will be asked if you want to replace the existing file. If you do, select **Yes**. Otherwise select **No** and choose another file name.

The first screenshot shows the 'Innov-X Results' window at 5:32. It has two radio buttons: 'All Readings' (unselected) and 'Export readings on date.' (selected). Below them is a 'Mode to export:' dropdown menu currently set to 'All'. To the right is a 'Customize Export' button. At the bottom are 'OK' and 'Cancel' buttons. A calendar grid is visible, with the date 24 highlighted.

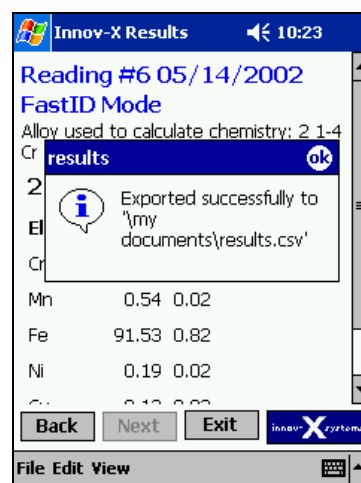
The second screenshot shows the same window, but the 'Mode to export:' dropdown menu is open, showing options: 'All', 'Dust Wipe', 'Empirical Mode', 'Soil Mode', and 'Standardization' (which is highlighted). The calendar grid remains at the bottom.

The third screenshot shows the 'Save As' dialog box. The 'Name' field contains 'results'. The 'Folder' dropdown is set to 'None'. The 'Type' dropdown is set to 'Comma Separated Values'. The 'Location' dropdown is set to 'Main memory'. 'OK' and 'Cancel' buttons are at the bottom. Below the dialog box is a QWERTY keyboard layout.

A status bar will indicate the progress of the export. It may take several minutes to export many readings. Daily downloading and weekly erasing of data simplifies and shortens this procedure.



When all readings are exported, a message will appear confirming the export. Tap **ok** to acknowledge and clear the reading.



4.7.3 Customizing Results Export

All units come with a standard results export format which reports a variety of information relevant to a test. Users can select which fields are exported as well as modify the order.

To modify exported results files, select **File → Export Readings** from the Results screen.

Tap the **Customize Export** box.

Enter the administrative level password when prompted.



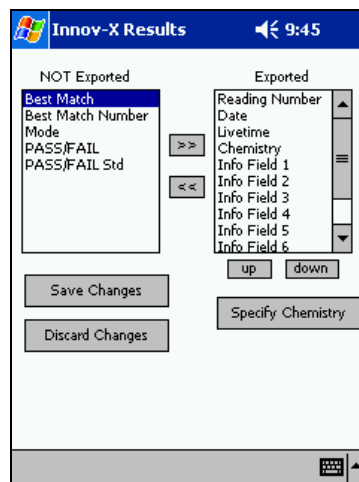
Two columns appear on the screen; the column on the left lists fields which will NOT be exported, and the right-hand column lists fields which will be exported.

Fields can be moved from one column to another via the >> and << buttons located in the center of the screen

Exported field order can be changed by using the **Up/Down** buttons. Select a field and move it up or down as desired

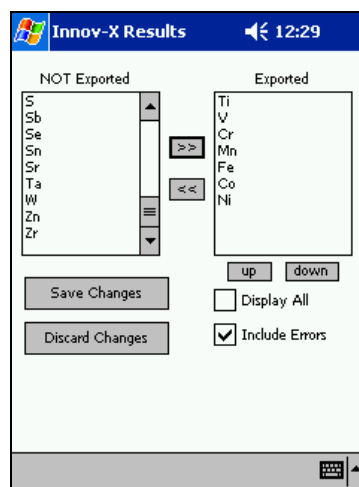
Once all changes have been made, choose **Specify Chemistry** if changes need to be made to the list of exported elements.

In chemistry is not edited, select **Save Changes** to keep the modified settings, or **Discard Changes** to ignore any changes.



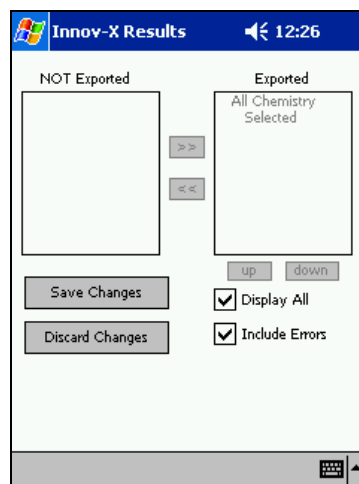
The Specify Chemistry screen resembles the previous screen. Move elements to the appropriate column, depending on whether or not an element should appear in exported files.

Select **Include Errors** to export the error associated with each measurement.



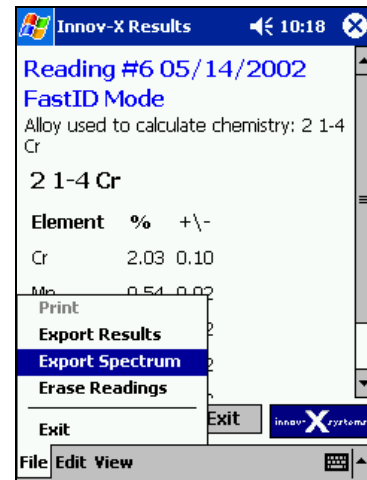
Select **Display All** to include all measured elements. *This setting is recommended, as it will ensure that all data measured with the instrument is exported.*

When all changes have been made, tap **Save Changes** or **Discard changes**, depending on whether the changes should be saved.

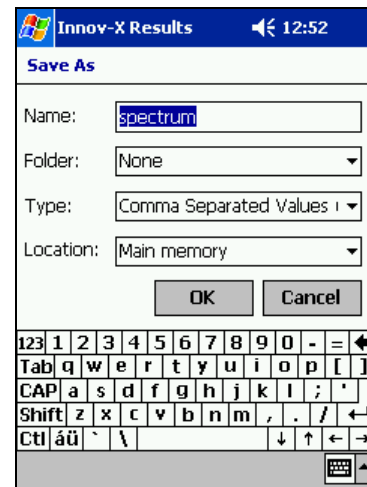


4.7.4 Exporting spectra

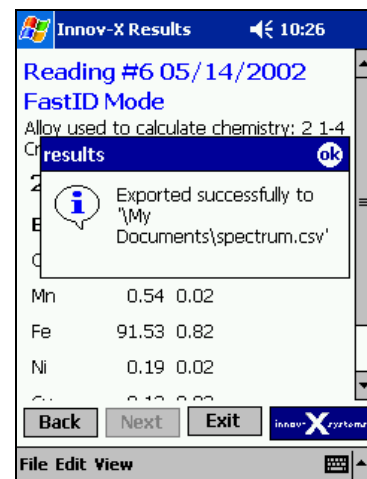
Only one spectrum may be exported at a time. In the results screen, scroll to the reading for which you wish to export the spectrum, and **Select File**→**Export Spectrum**.



Choose the File name, and make sure that **Comma Separated Values** and **Main Memory** are selected. This will save the spectrum to the My Documents folder in the Main Memory of the iPAQ.



A message will appear indicating a successful export. Tap **ok** to acknowledge and clear the window.



4.7.5 Erasing readings

It is possible to erase a single reading, a range of readings, all readings from a specific data, or all readings before a specific date.

In order to erase a single reading, the reading to be erased must be displayed on the screen before selecting delete. If necessary scroll to the reading you wish to delete.

In order to select a range of readings, you must have a reading open from the date you wish to delete the readings. If a reading from the desired date is not open, you may select **View→Go to date**, and select the appropriate date.

The reading displayed in the results screen is not relevant if you want to delete all readings from a specific date, or all readings before a specific date .

From the results screen, select **File→Erase Readings**.

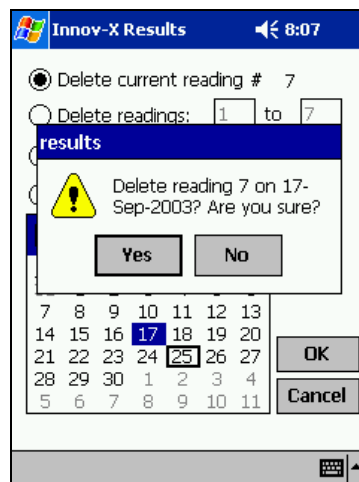
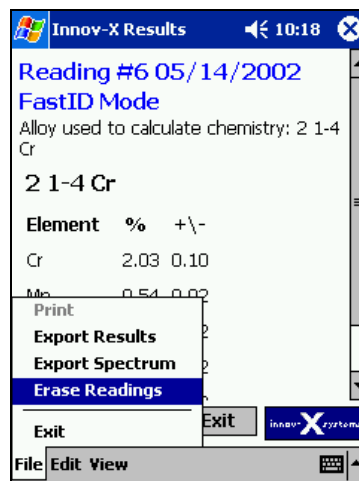
A message box will appear prompting you to enter your password. Enter your administrative level password and select **OK**.

A dialogue box will appear allowing a choice of which results to delete. Select the appropriate choice:

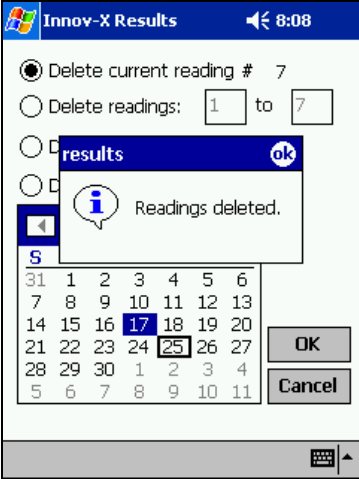
- Selecting **Delete current reading** will delete the reading that is currently open.
- Choosing **Delete readings XX to XX** will delete a range of readings from the date of the reading that is currently open.
- **Delete all readings on date** deletes all readings from a specific day.
- **Delete readings before date** deletes all readings taken prior to a specific day.

If you select **Delete all readings on date** or **Delete readings before date**, you must specify a date from the calendar. The default date is the current date.

When you've selected the readings to delete, Click **OK**. You will be asked if you're sure you want to proceed. If you want to proceed with the data erase, select **Yes**. Otherwise, click **No**.



A message will indicate the readings were successfully deleted. Tap **ok** to acknowledge and clear the message window.



Chapter 5 Soil Analysis

The Innov-X analyzer can be used to analyze in situ (directly on the ground), bagged or prepared soil samples. A guide to Soil analysis using field portable X-ray fluorescence is found in the appendix. This document summarizes EPA Method 6200 which is the standard protocol for field screening. It also provides information on prepared sample testing.

5.0 CHECK STANDARDS

It is recommended that a check standard is measured after each standardization, and periodically throughout the day. Innov-X provides several NIST certified standards for verification. The certified values for these samples are provided in the appendix. At least one standard should be measured for a minimum of 1 minute. Elemental concentrations for elements of interest plus or minus the error on the reading should be within 20% of the standard value. The Field screening guide in the appendix describes in more detail recommended quality assurance considerations.

The standards provided with the XRF analyzer are contained in XRF sample cups with a Mylar window (through which the soil can be viewed) on one side, and a solid cap on the other side. Samples should be measured in the sample cup, through the Mylar window. The best way to measure a prepared sample is using the test stand. If this is not available, the sample may be placed on the ground, and the analyzer may be pointed downwards in full contact with the soil cup. Do not hold the soil cup in your hand while measuring.

5.1 SAMPLE PRESENTATION

In situ testing:

In situ testing is performed by pointing the analyzer at the ground. Any grass or large rocks should be cleared away and the analyzer should be held such that the front of the probe head is held flush to the ground.

Since dirt can accumulate on the analyzer window, it is recommended that the window is wiped clean after each analysis. The window should also be checked to ensure it is not ripped or punctured. Instructions for replacing the window are found in the appendix.

Bagged or prepared sample testing:

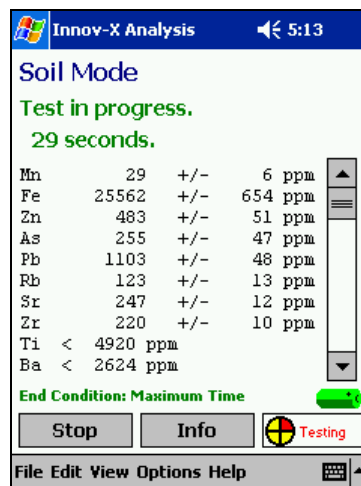
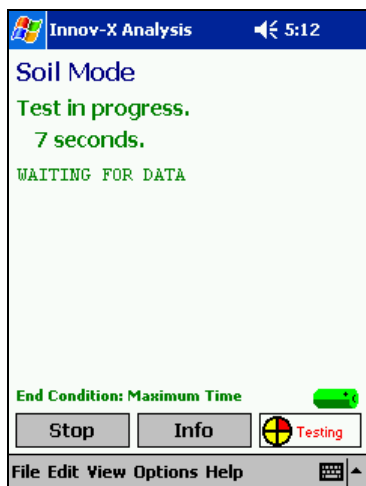
It is strongly recommended that all prepared samples be analyzed in the testing stand. Samples should be placed on top of the testing stand, completely covering the window. **Never hold prepared or bagged samples while testing**, as this could expose the operator to the x-ray beam.

Avoid measuring very thin samples, as this can affect results. Prepare samples cups to contain at least 0.5 inches of packed samples. When analyzing bagged samples, make sure that sufficient sample exists in the bag to completely cover the window with a sample thickness of a minimum of 0.5 inches.

5.2 TESTING IN SOIL MODE

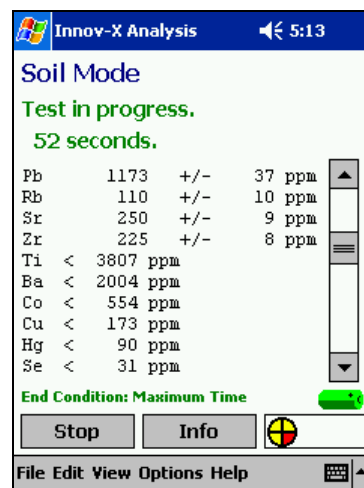
After the instrument has been standardized, testing can begin. Simply pull the trigger or press **Start** on the iPAQ screen to begin the test. The red warning light on the top of the instrument will blink, indicating X-rays are being emitted. The screen will display the words “Test in progress” and the time elapsed. The word “Testing” will blink on and off in the low right hand corner of the screen.

After a minimum time has elapsed, intermediate results will be displayed on the screen. Until this minimum time has elapsed, the words “WAITING FOR DATA” will appear instead. This minimum time can be set by the user by selecting **Options→Set Testing Times**, which is described in **Section 5.4: Soil Mode Options**. Each line of the results display shows the name of an element, its calculated concentration and the error on the measurement. This error is the 1 sigma error on the counting statistics of the measurement. The error will decrease with increased testing time.



Too many elements are measured in soil mode to display them at one time. However, it is possible to use the scroll bar located to the right of the chemistry display to view other elements. The complete display shows detected elements first, listed in order of emission line energy, from lowest to highest. Following the detected elements are the elements which are below the detection limit of the instrument. These elements are shown as less than a calculated LOD. This LOD is defined as three times the error on the counting statistics of the measurement.

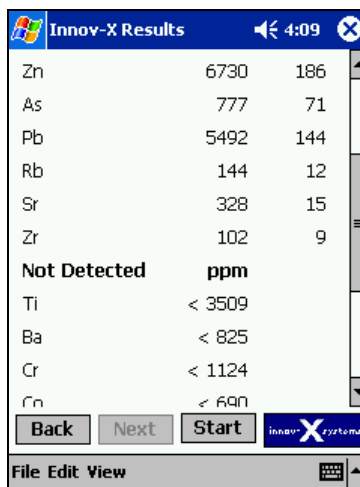
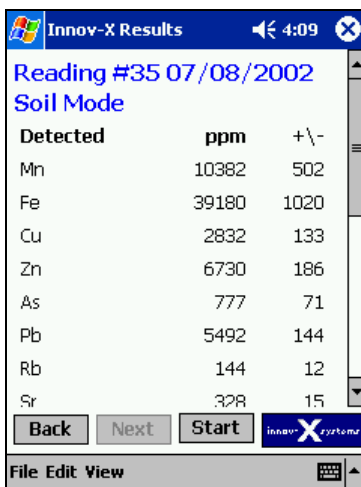
When the measurement is complete the results screen will open, displaying the final results of the measurement.



5.3 SOIL RESULTS SCREEN

5.3.1 Results View Menu

The standard Soil Mode results screen displays the concentration (in ppm) and error in measurement for detected elements, followed by the list of non-detected elements with the calculated limit of detection for each element for that test. If the display does not show soil chemistry results, change the display by selecting **View→Results**.

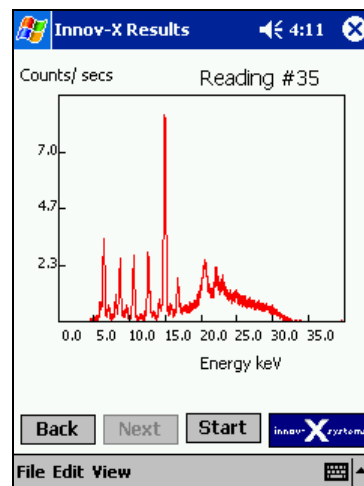


The standard soil chemistry display can be modified by using the View Menu. As with all Innov-X analytical modes, it is possible to view spectra and Test Information.

5.3.2 Spectrum Screen

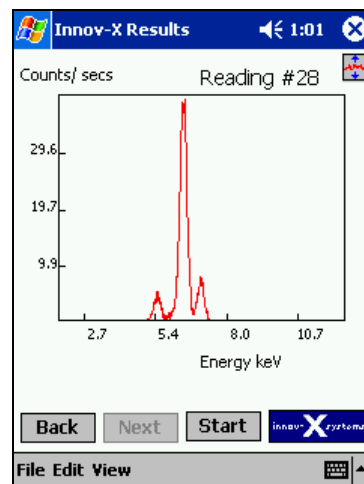
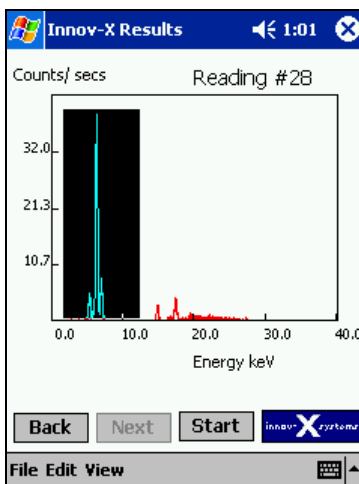
This screen displays a plot of the x-ray fluorescence spectrum for an individual test, plotting the intensity on the y-axis versus the energy of the fluorescence x-rays on the x-axis.

Tapping on the spectra will show the energy scale and counts rate at the selected point



It is possible to zoom in on certain areas of the graph by selecting one corner and drawing out the region

Tapping the symbol in the upper right hand corner beneath the X will restore the graph to full scale.



5.3.3 Test Info Screen

The test information screen shows any test information that was entered prior to the start of the test. Changes to that test information can be made by selecting **Edit**→**Test Information**.

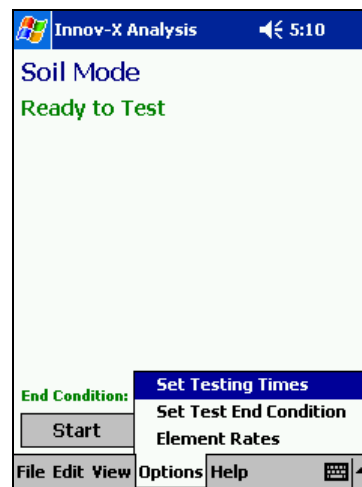
5.4 SOIL MODE OPTIONS

The length of tests in Soil Mode is user settable. Users may select a minimum testing time, and as well as choose from a variety of test end conditions.

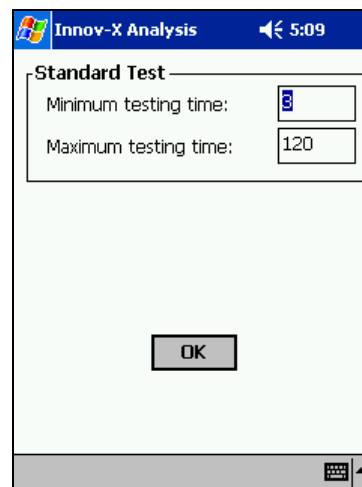
The options related to test time are contained in two menus: **Options**→**Set Testing Times**, and **Options**→**Set Test End Condition**. **Set Testing Times** contains minimum and maximum testing time information, while **Set Test End Condition** allows the user to select test end conditions.

5.4.1 Set Testing Times

To set the minimum and maximum test lengths, select **Options**→**Set Testing Times**



A screen appears prompting you to enter a Minimum and Maximum Testing times. Instruments equipped with the optional LEAP package will be able to set Light Element Testing times in this screen, as well.



The minimum testing time is the required time that must elapse before results can be calculated. Live Update results will not be displayed on the screen until the minimum has elapsed, likewise a test must complete the minimum time before any test end condition can be used. If a test is stopped before the minimum testing time has elapsed, the test will be aborted, and no results will be calculated.

Maximum testing time is relevant only if “Maximum Testing Time” is selected from **Set Test End Condition**. This will automatically end the test at a preset testing time. Typically, the maximum testing time will be in excess of 30 seconds, and may be 1 or 2 minutes, depending on detection limits and desired precision.

It should be noted, that all testing times in this section refer to “Real Time,” the time the measurement takes when timed on a normal clock. The time stored with each analytical result (accessible by selecting **View**→**Test Information** from the Results screen), refers to the test’s “Live Time”. This is the amount of time that the analyzer hardware was collecting spectra. Since there is some detector dead time associated with a measurement, the live time of a test will be slightly shorter than the preset “Real time”.

5.4.2 Soil Mode Test End Condition

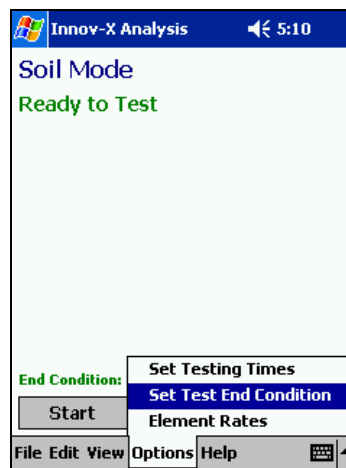
Four options exist for the test end criteria in soil mode. Depending on your application, you may choose to end the test manually, at a preset testing time, or when the uncertainty in the measurement is within a

specified relative standard deviation of the reading. Additionally, you can set up an action level for a single element. As soon as the measuring statistics are good enough to ensure that the reading is above, below or at the action level, the test will end automatically. This allows for very rapid tests for elements that are well above or below an action level.

In all modes, pressing Stop, or pulling the trigger will end the test. If the minimum testing time has elapsed, results will be calculated. Otherwise the test will be aborted without calculating results.

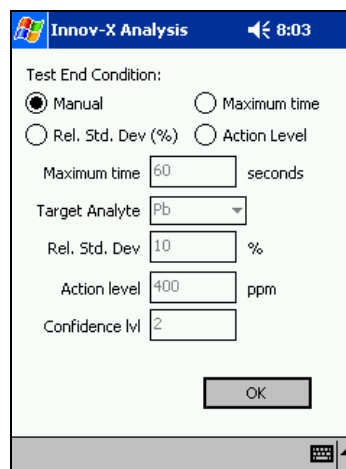
Changes to the test end condition are made by selecting **Options→Set Test End Condition**

The currently selected end condition will be displayed at the bottom of the screen above the Start button on the Ready To Test screen.



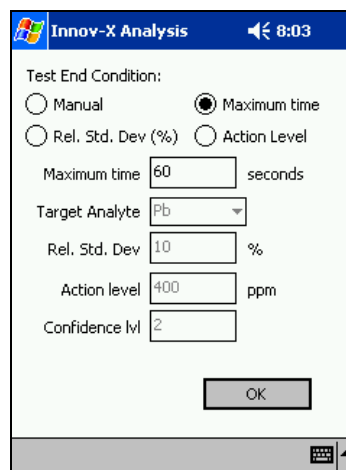
Manual: This option allows you to look at the results which are being continually updated on the screen and determine when the results look satisfactory. The test will continue until the trigger is pulled, or **Stop** is tapped on the iPAQ screen. Results will be calculated if the testing time has exceeded the Minimum Test time which is set up in **Options→Set Testing Times**. In order to preserve battery life, the software will stop if the testing time exceeds 300 seconds, since there is little to no advantage to continuing a test beyond 300 seconds.

To use Manual Test End Condition, simply choose **Options→Set Test End Condition** and select **Manual**. Press **OK** to return to the analysis screen.



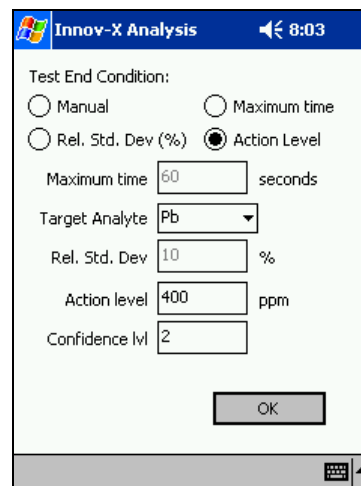
Maximum Time: If Maximum Time is selected, the test will continue until the preset time is reached. This is useful if you wish to do a set of measurements with the same testing time.

To choose to end test based on a maximum time, select **Options→Set Test End Condition** and select **Maximum Time**. Enter the desired testing time in the appropriate box. Tap OK to save your selections.



Action Level: System ends test when result for target analyte including chosen precision level is above or below pre-set action level.

To choose to end a test based on an Action Level, select **Options**→**Set Test End Condition** and select **Action Level**. Select a target analyte, specify an action level in ppm, and a confidence level. This confidence level refers to the number of sigma required for the precision. This should typically be set to 2. Tap **OK** to save your selections.



Innov-X Analysis 8:03

Test End Condition:

☐ Manual ☐ Maximum time

☐ Rel. Std. Dev (%) ☒ Action Level

Maximum time 60 seconds

Target Analyte Pb

Rel. Std. Dev 10 %

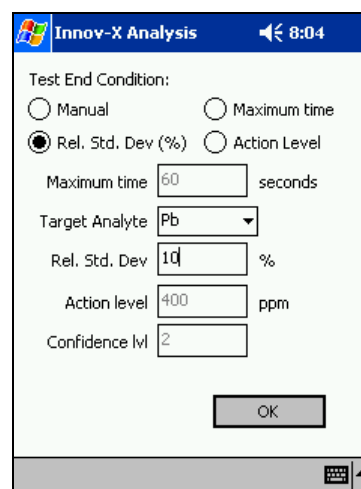
Action level 400 ppm

Confidence lvl 2

OK

Relative Standard Deviation (RSD): When RSD is selected as a test end criteria, the system will end a test when the relative standard deviation on a target analyte reaches a pre-set level. This standard deviation is specified as a percentage of the reading. For example, if the measured value for an analyte was 1000 ppm, and the RSD was set to 10, the reading would stop when the error reached 100 ppm, or 10% of 1000.

To choose to end a test based on a Relative Standard Deviation, select **Options**→**Set Test End Condition** and select **Rel. Std. Dev (%)**. Select a target analyte and the desired Relative Standard Deviation. Tap **OK** to save your selections.



Innov-X Analysis 8:04

Test End Condition:

☐ Manual ☐ Maximum time

☒ Rel. Std. Dev (%) ☐ Action Level

Maximum time 60 seconds

Target Analyte Pb

Rel. Std. Dev 10 %

Action level 400 ppm

Confidence lvl 2

OK

5.5 LEAP Mode (Light Element Analysis Program):

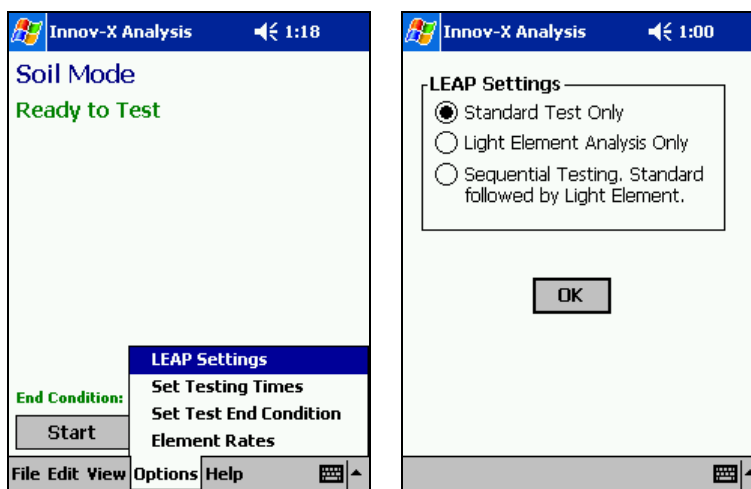
This is a factory installed optional module. Instruments can be upgraded to LEAP capabilities. Please contact the Innov-X Systems Sales department for information and pricing.

The LEAP module provides the lowest possible detection limits for elements lighter than iron. The standard LEAP package includes the elements Ti, Ba and Cr. Elements as low as Phosphorus can be detected with the Advanced LEAP package which includes a thin window detector.

The standard x-ray beam conditions used by Innov-X environmental analyzers are designed to provide good excitation for a wide range of detected elements. However it is not possible to select one beam condition which provides the absolute best excitation conditions for all elements of interest. Elements such as Chromium produce lower energy x-rays than other elements analyzed. These lower energy x-rays are not as effectively excited by the standard conditions. LEAP works by changing the X-ray tube beam conditions to settings which are optimized for the detection of elements lighter than iron. Instruments are factory calibrated with the LEAP beam conditions for all applicable elements.

5.5.1 LEAP Settings

To activate LEAP, select **Options**→**LEAP Settings** from the Soil analysis screen. This brings up the menu shown below on the right.

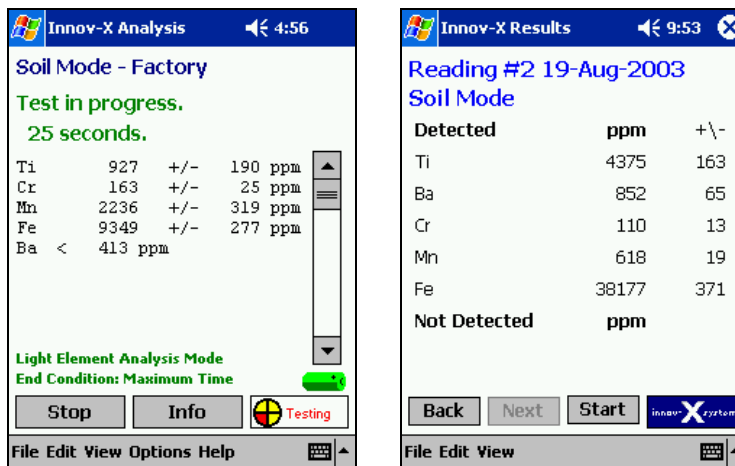


Standard Test Only: The analyzer will provide analysis for the standard suite of elements.

Light Element Analysis Only: The analyzer will provide analysis for elements in the LEAP suite (Typically Ti, Ba and Cr)

Sequential Testing: When sequential testing is selected, all tests will start with an analysis of elements in the standard suite. If that test ends due to reaching the selected end condition of Maximum Test Time, Action Level, or RSD, then the analyzer will immediately begin a second test analyzing the LEAP suite of elements. At the conclusion of this test, the Results screen will open with two new entries. The first summarizes the standard test results, while the second summarizes the LEAP results. For safety reasons, the second test will not begin if the test ends due to user intervention (pulling the trigger or hitting Stop). In this case, the Results screen will open with only one reading.

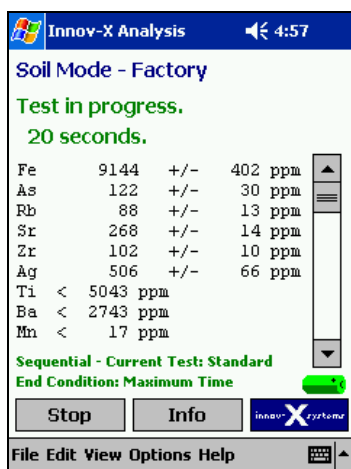
If Light Element Analysis Only is activated, the words “Light Element Analysis Mode” will appear above the currently selected End Condition. Instrument operation in this mode is identical to Standard (Non-LEAP) analysis. Tests can be started or stopped either by pulling the trigger, or by tapping the Start/Stop button on the iPAQ screen. The results screen for a test will show results for all elements analyzed with the LEAP mode.



Test in progress screen, LEAP Only, Live Updates on

Results Screen Showing LEAP results

If Sequential testing is selected, the words “Sequential – Current Test: Standard” will appear above the currently selected End Condition. When a test is started, the instrument will appear to operate in the same manner as a Standard test. However, if the test ends according to the specified end condition (excluding Manual), the results screen will not open. Instead, the timer will reset to 0, and the description of the current test will change from “Standard” to “LEAP”. The live update screen will begin to show analysis for all LEAP elements.



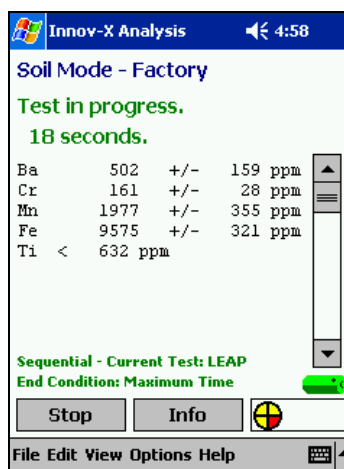
Element	Concentration	Error	Unit
Fe	9144	+/-	402 ppm
As	122	+/-	30 ppm
Rb	88	+/-	13 ppm
Sr	268	+/-	14 ppm
Zr	102	+/-	10 ppm
Ag	506	+/-	66 ppm
Ti	< 5043		ppm
Ba	< 2743		ppm
Mn	< 17		ppm

Sequential - Current Test: Standard
End Condition: Maximum Time

Stop Info

File Edit View Options Help

Test in progress screen,
Sequential.
First Test – Standard Analysis.



Element	Concentration	Error	Unit
Ba	502	+/-	159 ppm
Cr	161	+/-	28 ppm
Mn	1977	+/-	355 ppm
Fe	9575	+/-	321 ppm
Ti	< 632		ppm

Sequential - Current Test: LEAP
End Condition: Maximum Time

Stop Info

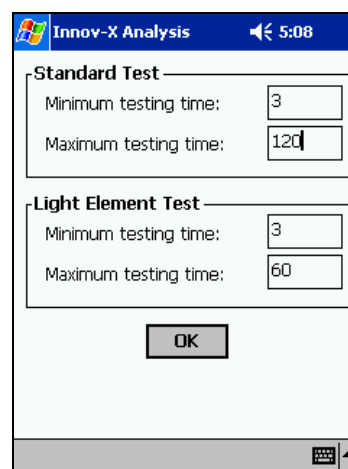
File Edit View Options Help

Test in progress screen,
Sequential.
Second Test – LEAP Analysis

5.5.2 Testing Times

To set the minimum and maximum test lengths for LEAP analysis, select **Options→Set Testing Times**.

The testing time screen includes an extra section labeled “Light Element Test” that is not found on non-LEAP systems. These are the minimum and maximum test lengths for any LEAP tests.



Innov-X Analysis 5:08

Standard Test

Minimum testing time: 3

Maximum testing time: 120

Light Element Test

Minimum testing time: 3

Maximum testing time: 60

OK

As with standard tests, the minimum testing time is the required time that must elapse before results can be calculated. Live Update results will not be displayed on the screen until the minimum has elapsed, likewise a test must complete the minimum time before any test end condition can be used. If a test is stopped before the minimum testing time has elapsed, the test will be aborted, and no results will be calculated.

Appendix 1: Troubleshooting Guide—Soil Analysis

Problem	Possible Solutions
Software won't start: Software will not start when the Innov-X Systems Icon is tapped.	The flash card or the iPAQ may not be correctly seated in the black external sleeve. Remove the flash card and press it firmly into its holder. Press the iPAQ down into the black sleeve.
Software won't start: Software doesn't start when the Innov-X System icon is tapped; instead, the following error message occurs: "Cannot find 'startup' (or one of its components). Make sure the path and filename are correct and all the required libraries are available"	The flash card or the iPAQ may not be correctly seated in the black external sleeve. Remove the flash card and press it firmly into its holder. Press the iPAQ down into the black sleeve.
iPAQ locks up: iPAQ screen "locks up" and doesn't respond when screen is tapped or buttons are pressed	Remove the iPAQ from the analyzer and perform a soft reset by pressing the tip of the stylus into the small indentation found on the bottom of the iPAQ. If the iPAQ is lying flat on a table with the screen facing upwards, the reset button is found to the extreme right of the side containing the power plug and connector. See Page 4 of the Compaq "Getting Started" manual for an illustration showing the location of the reset button.

Analyzer will not standardize	Try again. Choose File -> Standardize to attempt a new standardization. Also be sure the standardization cap is on correctly, and that the solid half is in front of the window. It is OK to try this 2-3 times in the event of a failure. If a repeat attempt fails: Change the battery. In some cases the battery may be too low to provide enough power for tube startup. Follow this procedure: Reset the iPAQ; Turn off the analyzer and remove the battery. Verify that the battery is completely charged. If it is not, replace it with a fresh battery. Even if the battery has been recently recharged, remove it, and replace it in the analyzer. Restart the analyzer and software. Wait several minutes after the software has initialized before attempting standardization.
Results screen doesn't show new readings after a test is completed	Check the date on the iPAQ. The Innov-X Systems software indexes stored results by date. If the date is incorrect, results may not be displayed in the correct order.
Serial Communication Error Message: Serial Communication error occurs because iPAQ has been removed from instrument or cradle, with the software open and the instrument standardized.	This error reflects the temporary loss in communications when the iPAQ was removed. To avoid this problem, always use the File / Exit command to exit the software properly. Try simply removing and reseating the iPAQ to solve this problem. If that fails, see steps 1 – 4 below.
Serial communication error on startup, or while testing.	1. If the analysis screen is still open, attempt another test. 2. Verify that the iPAQ is correctly seated in the analyzer by removing and replacing it. 3. Remove the iPAQ and perform a soft reset. Replace iPAQ and restart software. 4. Turn the analyzer off and restart it.

Results take a very long time to display on the first test of the day.	There may be too many readings stored in memory. Erase readings from the results screen by selecting <i>File</i> → <i>Delete Readings</i> .
Trigger will not start test.	Verify that the trigger lock is off. Reset the instrument. If this fails, call Innov-X Systems Technical Support at 781-938-5005.
Broken Kapton Window	The window is designed as a barrier to dust and dirt. If it is damaged, it should be replaced. To change the window: Turn off the analyzer Remove the screws holding the front plate in place. Remove the old kapton and adhesive, replace with new kapton and replace front plate. Important Note: It is very important to avoid getting dirt and sharp objects within the probe, due to the close proximity of the detector. Do not use the analyzer without a kapton window for any length of time. Also, be very careful when removing/replacing screws in face plate so as to not accidentally damage the detector. If the detector is damaged, the instrument will require factory service.
Results screen shows message “Error in calculation: No Results”	The soil mode calculation is only valid for “soil-like” samples which contain primarily light elements such as carbon, oxygen and silicon. If a dense, highly metallic sample is analyzed, the calculation fails. Make sure the sample being analyzed is a soil sample, if it is and this message occurs repeatedly; call Innov-X technical support.

Appendix 2:

Metals in Soil Analysis Using Field Portable X-ray Fluorescence

A guideline to using portable XRF according to EPA Method 6200, basic overview of the technique of x-ray fluorescence (XRF), appropriate data quality assurance protocols and sample preparation steps for operators analyzing prepared soil samples.

Prepared by:

**Innov-X Systems, Inc.
January, 2003**

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Section 1: Regulatory Status for Field Portable XRF

EPA Reference Method 6200 has been incorporated into SW486 under RCRA, and is now available for field portable XRF analysis of soils and sediments. Please call or email Innov-X Systems for a copy of Method 6200.

Method 6200: Field Portable XRF Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment.

Features of this method:

1. It is a field screening method, for analysis of *in-situ* or bagged samples.
2. The method provides basic quality assurance methods, including calibration verification, determination of instrument precision, accuracy and limit of detection.
3. The method recognizes that some XRF instruments do not require site-specific calibrations by the operator, that is, the factory calibration provides appropriate data quality.
4. The method recommends that a minimum of 5-10% of samples tested by XRF be confirmed by an outside laboratory using a total-digestion EPA analytical reference method.

The purpose of EPA Method 6200 is NOT to replace laboratory analysis. There are two primary sources of error in assessing a site for metal concentration: **Analytical error** and **Sampling error**. Analytical error is the error in the analysis of any one sample by whatever technique is used, for example XRF, ICP, or AA. Sampling error arises when too few samples are collected and tested. In this case an incomplete picture of the extent of metals contamination may be obtained. Although any one sample may be analyzed with very high analytical accuracy, measuring too few samples may result in contamination plumes being mis-judged in size, or depth into the soil. In extreme cases contamination may be missed entirely.

EPA Method 6200 was developed to reduce Sampling Errors by increasing the number of samples measured. In general, a large number of screening-level measurements provide a better characterization of contamination than a small number of measurements produced by sample removal and analytical analysis. Portable XRF is an ideal tool to make a large quantity of measurements in a short period of time. A large number of *in-situ* samples provides detailed data on contamination profiles, depth (provided surface soil is moved aside), and approximate contamination levels. Portable XRF also can provide results with a high degree of analytical accuracy on any given sample. Please see Section 2 “Overview of Field Usage” for this discussion.

Section 2: Overview of Field Usage:

Field portable XRF is generally used in three ways to test for metals in soil:

- ❑ **In-situ soil testing:** The XRF is placed directly onto the ground for soil testing. Operators remove any plant growth and foreign objects so that the analyzer probe is flush to the soil.
- ❑ **Bagged soil sample testing.** A soil sample is collected in a thin plastic bag (i.e. a “Baggie”) and testing directly through the Baggie. Except for a few elements – namely Cr, V and Ba – testing through the thin plastic used for a plastic bag has little effect on the test result. Results for Cr, V and Ba will be lower by 20-30%.
- ❑ **Prepared soil sample testing.** Prepared sample testing assures the operator of the maximum possible accuracy. Prepared sample tests require a sample to be collected, dried if necessary, sieved and ground into a powder. The prepared sample is then placed into a baggie or XRF cup for analysis. **A complete Soil Preparation Guide is provided in Appendix 1.**

All analytical methods require a uniform, homogenous sample for the best results. **XRF is no different!** The methods described in EPA Method 6200, namely In-situ and bagged sample testing, are considered *field-screening methods*. Although a field-screening method, in-situ testing is a valuable technique because it generates a great deal of data very quickly. Prepared soil samples generally offer the best accuracy, albeit with several minutes of sample preparation required per sample.



Figure 1. Use of a field portable XRF for in-situ soil testing.

Subsection 2-A: Data Quality Objectives.

The objectives of the testing generally determine the mixture of in-situ versus prepared sample testing. It is important to understand your data quality objectives (DQO) in order to determine the appropriate mix of field screening and prepared sample testing.

In-situ testing usually provides only screening-level data quality. This is because analytical testing always requires a uniform, homogeneous sample matrix. A laboratory achieves this by digesting the sample into a hot acid before analysis. Testing directly on the ground does not ensure uniformity is met. Preparing a sample provides a uniform sample and likely better analytical data quality, although several minutes of testing time is required.

Most portable XRF operators use a mixture of in-situ and prepared sample testing. Several examples are described below. The exact mixture of in-situ and prepared sample testing depends upon the goals of the soil testing. The examples below serve as guidelines. Please contact Innov-X (1-866-4 Innov-X or 866-446-6689) to discuss your specific testing requirements.

Example 1: Initial site investigation to provide detailed contamination data with efficient use of laboratory analysis costs.

Problem: Site needs to be assessed for metals contamination. Little information is available about what metals are present, likely contamination levels or geographic profile of contamination.

The goal of testing is to determine what metals are present at what levels, both in area and in depth into soil. Additionally, testing will locate possible contamination plumes and/or possible sources of contamination.

Recommended Testing Plan: This example uses predominately in-situ testing. The analyst will perform in-situ testing, and gather samples into plastic bags for XRF analysis. A testing grid should be established in two or three dimensions, every several feet. XRF tests can be taken at each location or bagged samples can be collected from each location for later analysis. The in-situ data for each element analyzed may be plotted in a 2-dimensional grid (X, Y coordinates versus elemental concentration) to profile a site. These concentration profiles are ideal for showing contamination patterns, boundaries and plumes. Combining this data with historical use data from the site often allows the operator to deduce sources of contamination. Obtaining this level of geographic data with purely laboratory analysis would produce excessive analytical costs.

Prepared sample analysis should also be done to confirm the regions where in-situ data indicates low or non-detected levels of metal contaminant. There is little need to prepare areas where in-situ testing indicates high concentration levels. Innov-X recommends the same procedure as EPA Method 6200. For locations where in-situ tested indicate low or non-detected concentrations, calculate the total number of in-situ tests, collect 5% of this number of tests from the various locations, and prepare these samples according to Appendix 1. Use these prepared samples to confirm the findings of the in-situ testing. Send a subset of these prepared samples to a laboratory for confirmatory results.

Cost Justification. To adequately characterize a site may require 100-200 samples/acre to be sure the contaminated areas are firmly established. This work may be done with in-situ testing to generate laboratory savings of \$5,000 - \$10,000/acre depending upon the number of elements being analyzed. The cost reduction in off-site analysis often justifies the price of the XRF.

Example 2: Monitor remediation efforts and assure site meets clearance levels before contractors leave the site.

Goal: Minimize remediation costs by only treating contaminated soil, and obtain immediate verification that various site locations meet clearance objectives.

Recommended Testing Plan: This type of project uses a lot of both in-situ and prepared sample testing. Use in-situ testing to thoroughly delineate contamination regions in both area and depth. To determine depth profiles, test surface soil, remove at least 1-2 inches, and retest. Repeat this step as necessary to profile contamination depth to guide remediation activities. (XRF is a surface technique and only analysis the first few mm of soil sample). As part of clearance, collect several samples from “cleared” area. Prepare samples according to Appendix 1 and test with portable XRF.

If XRF indicates that concentration levels are in excess of clearance requirements, then continue remediation efforts.

If XRF indicates that concentration levels are below clearance requirements, then discontinue remediation efforts, and send a subset of the samples to an analytical laboratory to confirm results. Most operators safely assume that the cleanup requirements have been met for the elements in question, but await final analysis from the laboratory.

If XRF lists concentration levels as non-detected, but the detection level reported exceeds clearance requirements, send samples to a laboratory for final results.

Cost Justification: In-situ results are used to guide remediation efforts, in order to obtain maximum efficiency. Efficiency is produced because contamination boundaries are firmly established, thus avoiding remediation efforts with “clean” soil. Prepared sample testing is used to assure that clearance requirements are met on-site in near real-time (pending laboratory confirmation). Costs savings are generated by avoiding clearance failures. The contractors can leave the site earlier and will not be called back to the site for additional cleanup.

Important Note: Never clear a site based solely on in-situ testing. Always use well-prepared samples to make a clearance decision.

Example 3: Minimize volume of hazardous waste for treatment or disposal.

Goal: For some cleanup projects, the cost of soil disposal in a hazardous waste landfill is much greater than disposal in a standard landfill. Testing soil samples with XRF may minimize the amount of “clean” soil that is inadvertently shipped to a hazardous-waste landfill.

Recommended Testing Plan: This example is almost entirely prepared sample testing. Representative samples are removed from the soil being hauled to landfill. Obtaining an accurate analysis of the samples is crucial for making a hazardous versus non-hazardous determination. For this reason, prepared sample testing is strongly recommended.

Important Note: These types of samples are subject to TCLP procedures for the landfill determination. In general, 20 times the XRF result should be less than the allowable limit for the metal in question. Please contact Innov-X Systems for more details on testing samples versus TCLP regulatory requirements.

Section 3: Quality Assurance.

Quality assurance is detailed for both the proper use of the analyzer (which is also provided in Method 6200) and for verifying the data quality of in-situ testing. All operators should perform the QC procedure, regardless of their data quality objectives. Method 6200 has strict requirements about quality assurance. Additionally, Innov-X recommends that operators verify the data quality of in-situ test results, if they are using in-situ data to guide their reporting or remediation decisions. Procedures are listed below:

3.1: Proper verification of instrument operation

These procedures are taken from EPA Method 6200 and updated to be specific to the Innov-X analyzer. Quality assurance here consists of testing known standards to verify calibration, as well as testing blank standards to determine limits of detection and to check for sample cross-contamination or instrument contamination. EPA Method 6200 provides a detailed procedure, which is provided here in abbreviated form.

Components of instrument QC:

1. An energy calibration check sample at least twice daily
2. An instrument blank for every 20 environmental samples
3. A method blank for every 20 prepared samples
4. A calibration verification check sample for every 20 samples
5. A precision sample at least one per day.
6. A confirmatory sample for every 10 environmental samples

Energy Calibration Check: The Innov-X analyzer performs this automatically; this is the purpose of the standardization check when the analyzer is started. The software does not allow the analyzer to be used if the standardization is not completed.

Instrument Blank: The operator should use the SiO₂ (silicon dioxide) blank provided with the analyzer. The purpose of this test is to verify there is no contamination on the analyzer window or other component that is “seen” by the x-rays. Method 6200 recommends an instrument blank at least once per day, preferably every 20 samples. For either in-situ or prepared-sample testing, the operator should just test the SiO₂ blank to be sure there are no reported contaminant metals.

Method Blank: The purpose of the method blank is to verify that cross-contamination is not introduced into samples during the sample preparation process. Method 6200 recommends following the sample preparation procedures with clean SiO₂ once every 20 prepared samples. This QC step is not required if the operator is not preparing samples.

Calibration Verification: Innov-X provides NIST standard reference samples for calibration check by operator. The operator should perform a 2-minute test on a NIST standard. The difference between the XRF result for an element and the value of the standard should be 20% or less. Calibration Verification should be performed upon instrument startup and periodically during testing. Note: Innov-X recommends a calibration check every 4 hours. EPA Method 6200 recommends a calibration check every 20 samples. NIST reference standards are generally applicable for Pb, As, Cr, Cu, Zn. Innov-X provides additional reference standards for other RCRA or Priority Pollutant metals including Cd, Se, Ag, Hg, Ag, Ba, Sn, Sb, and Ni.

Precision Verification: Quoting from EPA “A minimum of one precision sample should be run per day by conducting from 7 to 10 replicate measurements of the sample. The precision is assessed by calculating a relative standard deviation (RSD) of the replicate measurements for the analyte. The RSD values should be less than 20 percent for most analytes, except chromium, for which the value should be less than 30 percent.

Confirmatory Sample: It is recommended that one confirmatory sample is run for every 10 samples collected. According to EPA Method 6200: “Confirmatory samples are collected from the same sample material that is analyzed on site, but are sent to an off-site laboratory for formal analysis. The purpose of a confirmatory sample is to judge the accuracy of the data obtained by analysis on site and to allow corrections, if necessary.”

Important Notes about confirmatory samples:

Innov-X always recommends that customers compare prepared-sample results to laboratory results. To do this, collect and prepare a sample following the protocols of Appendix 1. Take a subsample and submit to the laboratory for analysis. The single largest error in XRF analysis is lack of sample preparation. For the best comparison, always use prepared samples.

3.2: Determining data quality of in-situ testing:

For operators relying extensively on in-situ testing, it is important to determine the data quality of this testing at a given site. *This protocol is not intended for every sample, but rather for a small percentage of samples considered representative of the site.* If the operator can demonstrate that quantitative data is achieved with little or no sample preparation, then the site characterization will be completed much more quickly but correctly.

For example, an operator may be able to demonstrate that the XRF result changes considerably when samples are passed through a 2 mm sieve, but that XRF results do NOT change appreciably upon finer sieving. In this case the operator can conclude that good XRF data is achievable with only 2 mm sieving. Sieving only to this level requires far less time than a more robust sample preparation. A protocol to determine the appropriate level of sample preparation is the following:

1. Delineate a region of soil approximately 4" x 4".
2. Perform several in-situ tests in this area, or collect the top (approximately) quarter inch of soil from this region, bag the soil, test through the bag. In either case, average the results.
3. If you did not bag the in-situ test sample, collect the top (approximately) quarter inch of soil from this region and sieve through the 2 mm sieve provided. Otherwise sieve the bagged sample used for the in-situ test. Thoroughly mix the sieved sample, and place some of the sieved material into an XRF cup, and perform a test of this sample.
4. If the results of this prepared sample differ less than 20% with the average in-situ result, this indicates the soil in this region is reasonably homogeneous. The data quality in this case is probably at the semi-quantitative level, rather than just screening data.
5. If the results differ by more than 20%, this indicates the soil is not very homogeneous, and there are serious particle size effects affecting your in-situ measurements.
6. In this case, sieve the sample through the 250 μ m sieve. Mix this sample and place a subsample into an XRF cup for testing. If this result differs from the previous by less than 20% then this indicates that at a minimum the 2mm sieving is necessary to achieve higher data quality.

7. If this result differs by more than 20% from the sample sieved through 2 mm, then particle size effects are still affecting the XRF result. In this case samples should be sieved through 125 μm to assure data quality at the quantitative level.

Section 4: Calibration for Innov-X Portable XRF

The Innov-X analyzer may run three different calibration methods, described below. In nearly all cases, customers use the Compton Normalization method. This method (recognized in EPA 6200) offers speed, ease of use, and generally good accuracy for concentration ranges from the ppm level up to 2-3% concentrations. As most field-testing is seeking to remediate or locate environmental contaminants, the upper limit of the calibration (2-3%) is generally not a limitation. If customers do require a calibration up to 100% concentration (i.e. a pure element) then Innov-X recommends they also include the Fundamental Parameters (FP) software module with the analyzer. The FP module may be added at time of purchase or as an upgrade at any later date.

Note: In general customers do not need to calibrate the Innov-X analyzer for soil testing. The analyzer is delivered with a factory calibration, generally based upon the Compton Normalization (CN) method. The CN method has been proven over the past several years to provide a robust calibration generally independent of site-specific soil matrix chemistry. The operator may calibrate the Innov-X system if desired, but calibration is not required to use the analyzer effectively. All customers should follow the QC procedure described in Section 3, which includes a check of the calibration.

The final model is the empirical calibration. In this case, customers run standards to generate calibration curves for various elements in specific soil matrices. Provided the sample is well-prepared, the empirical method generally yields the most accurate result. In our experience, the accuracy gains going from Compton Normalization to Empirical Mode are small and not worth the extra effort in setting up calibration curves. (The greatest source of error for in-field XRF analysis of soil is lack of adequate sample preparation, thus there is little gained in developing a sophisticated empirical calibration if the operator does to grind and homogenize the all measured samples). The empirical calibration module is an optional software package, available for an upgrade fee at the time of purchase, or as an upgrade at any later date.

Calibration Requirements:

The concentration of an element in a soil sample is well-described by the formula:

$$w_i = \frac{k_i}{M(Z,i)} I_i$$

k_i = calibration constant for element “i”

w_i = concentration of element “i” – the quantity being measured.

I_i = measured x-ray intensity from element “i”

$M(Z,I)$ = Soil matrix value

The factory calibration determines the value of the calibration constants k_i for each element, and a typical value $M(Z,I)$. The calibration method – either CN, fundamental parameters, or empirical – performs the necessary corrections to the value $M(Z,I)$ that are important for the site-specific soil chemistry. The XRF analyzer uses the measured intensity of each element's fluorescence from the sample, and the calibration data, to produce elemental concentrations.

Compton Normalization:

The Compton Normalization method calibration consists of the analysis of a single, well-characterized standard, such as an SRM or SSCS. The standard data are normalized to the Compton peak. The Compton peak is produced from incoherent backscattering of X-ray radiation from the excitation source and is present in the spectrum of every sample. The matrix affects the way in which source radiation is scattered off the samples. This scatter is directly related to the intensity of the Compton peak. For that reason, normalizing to the Compton peak can reduce problems with matrix effects that vary among samples. Compton normalization is similar to the use of internal standards in analysis for organic analytes.

Fundamental Parameters Calibration:

The fundamental parameters (FP) calibration is a "standardless" calibration. Rather than establishing a unit's calibration curve by measuring its response to standards that contain analytes of known concentrations, FP calibration relies on the known physics of the spectrometer's response to pure elements to set the calibration. Built-in mathematical algorithms are used to adjust the calibration for analysis of soil samples and to compensate for the effects of the soil matrix. The FP calibration is performed by the manufacturer, but the analyst can adjust the calibration curves (slope and y-intercept) on the bases of results of analyses of check samples, such as SRMs which are analyzed in the field.

Empirical Calibration:

The empirical calibration method requires that a number of site-specific calibration standards (SSCS) are used to establish calibration parameters. The instrument response to known analytes is measured and used to create calibration curves. Empirical calibration is effective because the samples used closely match the sample matrix. SSCSs are well-prepared samples collected from the site of interest in which the concentrations of analytes have been determined by inductively coupled plasma (ICP), atomic absorption (AA), or other methods approved by the US Environmental Protection Agency (EPA). The standards should contain all the analytes of interest and interfering analytes. Manufacturers recommend that 10 to 20 calibration samples be used to generate a calibration curve. The empirical method is the least desirable calibration method as it requires that new standards and curves are generated for each site that is analyzed.

Section 5: Effects of Moisture on XRF Results:

Sample moisture has two effects on XRF results:

- ❑ It alters the soil chemistry, since water is another chemical compound that comprises the soil matrix.
- ❑ Moisture impedes the ability to properly prepare samples.

- ❑ Laboratory results are provided on a “dry weight” basis.

Effect on Soil Chemistry:

While the presence of significant moisture does impact the soil chemistry, modern XRF analyzers all perform automatic corrections for variations in soil chemistry from site to site. Indeed, such variations are expected, and that is the reason analyzers use Compton Normalization or fundamental parameters, in order to correct for moisture content changes as well as other differences in soil geochemistry.

EPA Method 6200 states “Moisture content above 20 percent may cause problems, since moisture alters the soil matrix for which the FPXRF has been calibrated.” However, the Compton Normalization or fundamental parameters methods are implemented in order to automatically correct results for changes to the soil matrix. Thus, we believe that soil moisture is not a significant effect on accuracy due to effects of soil matrix, except for the “dilution” effect that can cause discrepancies with laboratory results which is described below.

Sample preparation issues:

The inability to adequately prepare a wet sample is, we believe, the single biggest contributor to errors when testing wet samples. It is very difficult to grind or sieve a wet sample. The highest quality XRF results are generally obtained from prepared samples. If the operator is unwilling to dry the sample to prepare it, comparisons to the laboratory may yield poorer correlation since the samples are not homogeneous.

Laboratory Tests on Dry-Weigh Basis:

Laboratories always dry samples prior to analysis. They report percent weight content based upon a dry sample basis. Portable XRF may often be used to analyze wet samples in the field, and results are thus reported that include the moisture content. Thus, with all other factors the same, the laboratory will report results higher than portable XRF. The results will be higher by the amount of moisture content in the sample. For example laboratory results will be 10% higher compared to XRF results, if the sample contained 10% by weight water when it was tested with XRF. Recall, this applies to samples where other possible sources of error are the same or negligible.

Section 6: Comparing XRF Results to Laboratory Results:

Innov-X strongly recommends that operators compare prepared sample results to laboratory results. This is because prepared-sample results yield the best possible accuracy with portable XRF. Moreover, the most common source of error is due to non-uniform samples. The XRF technique, nor can any analytical technique, properly account for non-uniform sample types.

To perform a comparison between XRF results and laboratory:

1. Collect a sample and prepare it according to the sample preparation guide in Appendix 1.

2. Take a sub-sample (5-10 grams) of the fully-prepared sample, place it into an XRF cup and perform at least a one-minute test on that sample.
3. Send the same sample to the laboratory for wet chemistry analysis.
4. Require the laboratory to use a total-digestion method. If the laboratory does not use a total digestion method, they may not extract all of the elemental metal from the sample. In this case, the lab result will be lower than the XRF result. Incomplete sample digestion is one of the most common sources of laboratory error, thus it is very important to request a total digestion method.

Example of Error: The operator collects a bag of sample, performs XRF analysis on one part of the bag, and sends the bag, or part of the bag of sample to a laboratory for analysis. The laboratory reports a very different value than the operator obtained with the XRF.

Problem: Since the sample is very non-homogeneous, the operator did not obtain a result that was representative of the entire bag of sample. The lab analyzed a different part of the sample and obtained a very different result due to the non-uniformity of the sample. The solution to this problem is, at a minimum, to test several locations in the bag of sample and report the average value. Also note the differences between the tests, as this is indicative of the non-uniformity of the sample. Operator should send entire bag of sample to the lab, and instruct lab to prepare the sample before removing sub-sample for lab analysis.

Best Practice: The operator should homogenize and prepare the entire bag of sample, and then collect a sub sample for XRF testing. After testing, the same sample should be sent to the lab.

Section 7: Common Interferences:

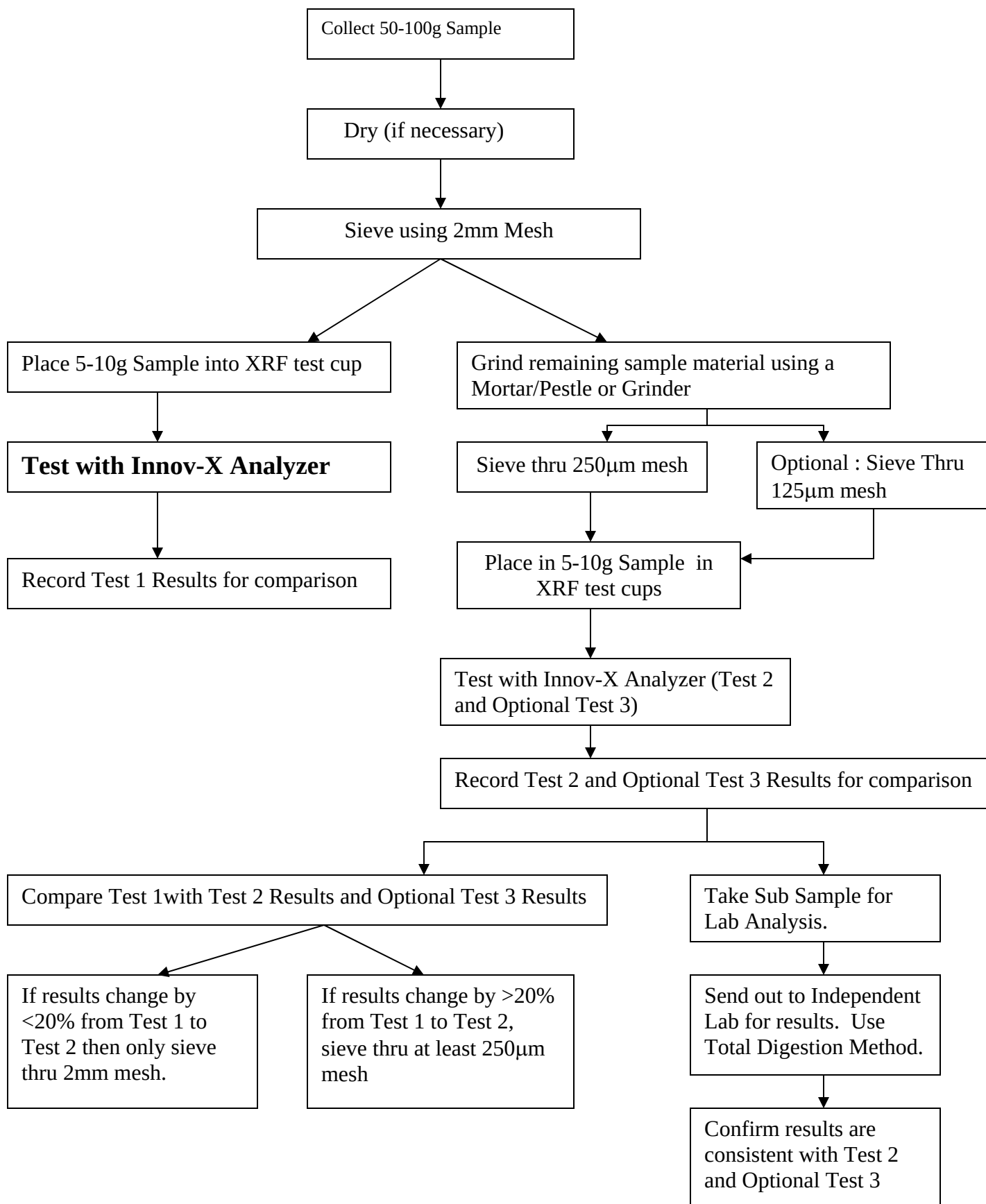
An interference occurs when the spectral peak from one element overlaps either partially or completely with the spectral peak of another. If the XRF is calibrated for both elements (CASE 1) i.e. the one causing the interference and the one being interfered with, it is generally capable of correctly handling the interference. In this case, the element being interfered with may be measured with a poorer detection limit or poorer precision, but the analytical results should still be acceptable for field-portable XRF. If the XRF is not calibrated for the element causing the interference (CASE 2), then the XRF may report the presence of elements not in the sample, or greatly elevated concentrations of elements in or not in the sample.

Example CASE 1: Lead and arsenic. Most XRFs are calibrated for lead and arsenic. Lead interferes with arsenic (not vice-versa though). The net effect is a worsened detection limit for arsenic, and poorer precision. The XRF handles the correction automatically, but the precision is affected. The loss of precision is also reported by the XRF. (Please refer to Innov-X Applications Sheet: *In-field Analysis of Lead and Arsenic in Soil Using Portable XRF* for more detail).

Example CASE 2: Bromine in the sample, but XRF is not calibrated for bromine. Bromine, as a fire retardant, is being seen more and more in soil and other sample types. For this reason, Innov-X analyzers include Br in the calibration data. If Br is not calibrated, but is present in the sample, the analyzer will report highly elevated levels of Pb, Hg and As. The levels will depend upon the concentration of Br in the sample.

Interferences between elements can be broadly categorized into a) Z, Z-1, Z+1 interferences, and b) K/L interferences. Interference type “a” occurs when high levels of an element of atomic number Z are present. This can cause elevated levels of elements with atomic number Z-1 or Z+1. Generally, portable XRFs have good correction methods, so this interference only causes problems with very high levels of the element in question. Example: High concentrations of Fe (Z=26) in excess of 10% may cause elevated levels of Mn or Co (Z=25 or Z=27 respectively).

The type “b” interference occurs when the L-shell line of one element overlaps with the K-shell spectral line of another element. The most common example is the lead/arsenic interference where the L-alpha line of lead is in nearly the exact same location as the K-alpha line of arsenic.



Appendix 3: Guide to Product Registration

Generally, the Innov-X portable XRF system must be registered in the state of usage. Registration requirements are somewhat state dependent, but there are many similarities. You may contact Innov-X at 866-4-Innov-X (781-938-5005) to receive specific registration information. Innov-X also maintains sample registrations for every state that we can forward to you.

Common Registration Features:

Most states require the following for registering an x-ray emitting device that does NOT use radioactive sources:

1. Registration within 30 days of receipt of the analyzer.
2. Annual fee ranging from \$25 to \$100, depending upon the state.
3. Basic registration form with main information described below.

Common information required on Registration Form, and responses:

Company name, address, phone/fax numbers.

Name of responsible person:	Generally the person designated as the Radiation Safety Officer (RSO).
Name of the manufacturer:	Innov-X Systems, Inc., Woburn, MA
Model of Analyzer:	Alpha XXXX
Tube Operating Parameters:	40 kV, 20 uA current.
Type of Analysis:	Choose Analytical or Industrial (as opposed to radiography, medical, dental, veterinarian, etc.)
Utilization Mode:	Portable or Mobile assuming you will carry system to different locations. Fixed or stationary ONLY if you will always use the analyzer in the docking station

General Appendix 1

Technical Specifications

Description:

Innov-X Systems analyzers are hand-held, battery operated energy dispersive x-ray fluorescence analyzers. They are utilized for the detection and quantification of elements ranging from phosphorus (atomic number 15) through uranium (atomic number 92). Measurable concentrations of elements range from ppm to 100%.

Weight:	2.625 lbs (Base wt.) 3.375 lbs (1.6 kg) with batteries
Excitation Source:	X-ray tube, Ag or W anode, 10-40 kV, 5-50 uA, 5 filter positions
Detector:	Si PiN diode, thermoelectrically cooled, resolution < 280 eV.
Power:	Li-ion batteries, or AC power with Testing Stand
Battery Life:	4-8 hours, depending on duty cycle.
Display:	Color, high-resolution touch screen with variable backlighting on analyzer. Software available for PC/laptop operation also.
Data Storage:	10,000 tests with spectra minimum, expandable to 100,000+ with 1 Gb flash card.
Computer:	HP iPAQ with Intel processor, 64 Mb minimum memory, Windows CE operating system (unless operated from PC).
Optional Accessories:	Bluetooth wireless printing and data transfer, integrated bar-code reader, wireless LAN, other standard PDA accessories.

Operating Conditions

Temp 0 – 40° C

Humidity 10 – 90 % RH, no condensation

Altitude rating 2000 meters

Innov-X Analyzer Limited Warranty

General Terms

EXCEPT AS EXPRESSLY SET FORTH IN THIS LIMITED WARRANTY, INNOV-X SYSTEMS, INC. (INNOV-X) MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. INNOV-X EXPRESSLY DISCLAIMS ALL WARRANTIES AND CONDITIONS NOT STATED IN THIS LIMITED WARRANTY. ANY IMPLIED WARRANTIES THAT MAY BE IMPOSED BY LAW ARE LIMITED IN DURATION TO THE LIMITED WARRANTY PERIOD.

This Limited Warranty applies to Innov-X analyzers sold or leased from Innov-X its affiliates, authorized resellers, or country distributors (collectively referred to in this Limited Warranty as ("Innov-X")).

Innov-X warrants that the analyzer and all its internal components that you have purchased are free from defects in materials or workmanship under normal use during the Limited Warranty Period. The Limited Warranty Period starts on the date of shipment by Innov-X. You may be required to provide proof of purchase or lease as a condition of receiving warranty service. You are entitled to warranty service according to the terms and conditions of this document if a repair to your Innov-X analyzer is required within the Limited Warranty Period.

During the Limited Warranty Period, Innov-X will repair or replace the defective component parts. All component parts removed under this Limited Warranty become the property of Innov-X. In the unlikely event that your Innov-X analyzer has a recurring failure, Innov-X, at its discretion, may elect to provide you with a replacement unit of Innov-X's choosing that is at least equivalent to your Innov-X analyzer. This is your exclusive remedy for defective products. The repaired or replacement analyzer is warranted for the remainder of the limited Warranty Period.

YOU SHOULD MAKE PERIODIC BACKUP COPIES OF THE DATA STORED ON YOUR ANALYZER AS A PRECAUTION AGAINST POSSIBLE FAILURES, ALTERATION, OR LOSS OF THE DATA. BEFORE RETURNING ANY UNIT FOR SERVICE, BE SURE TO BACK UP DATA AND REMOVE ANY CONFIDENTIAL, PROPRIETARY, OR PERSONAL INFORMATION. INNOV-X IS NOT RESPONSIBLE FOR DAMAGE TO OR LOSS OF ANY PROGRAMS, OR DATA. INNOV-X IS NOT RESPONSIBLE FOR THE RESTORATION OR REINSTALLATION OF ANY PROGRAMS OR DATA OTHER THAN SOFTWARE INSTALLED BY INNOV-X WHEN THE ANALYZER IS MANUFACTURED.

Innov-X does not warrant that the operation of this analyzer will be uninterrupted or error-free. Innov-X is not responsible for damage that occurs as a result of your failure to follow the instructions that came with the Innov-X analyzer.

This Limited Warranty does not apply to expendable parts. This Limited Warranty does not extend to any analyzer from which the serial number has been removed or that has been damaged or rendered defective (A) as a result of accident, misuse, abuse, or other external causes; (b) by operation outside the usage parameters stated in user documentation that shipped with the product; (c) by modification or service by anyone other than (i) Innov-X, or (ii) a Innov-X authorized service provider, (d) installation of software not approved by Innov-X.

These terms and conditions constitute the complete and exclusive warranty agreement between you and Innov-X regarding the Innov-X analyzer you have purchased or leased. These terms and conditions supersede any prior agreements or representations --- including representations made in Innov-X sales literature or advice given to you by Innov-X or any agent or employee of Innov-X --- that may have been made in connection with your purchase or lease of the Innov-X analyzer. No change to the conditions of this Limited Warranty is valid unless it is made in writing and signed by an authorized representative of Innov-X.

Limitation of Liability

IF YOUR INNOV-X ANALYZER FAILS TO WORK AS WARRANTED ABOVE, YOUR SOLE AND EXCLUSIVE REMEDY SHALL BE REPAIR OR REPLACEMENT. INNOV-X'S MAXIMUM LIABILITY UNDER THIS LIMITED WARRANTY IS EXPRESSLY LIMITED TO THE LESSER OF THE PRICE YOU HAVE PAID FOR THE ANALYZER OR THE COST OF REPAIR OR REPLACEMENT OF ANY COMPONENTS THAT MALFUNCTION IN CONDITION OF NORMAL USE.

INNOV-X IS NOT LIABLE FOR ANY DAMAGE CAUSED BY THE PRODUCT OR THE FAILURE OF THE PRODUCT TO PERFORM INCLUDING ANY LOST PROFITS OR SAVINGS OR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. INNOV-X IS NOT LIABLE FOR ANY CLAIM MADE BY A THIRD PARTY OR MADE BY YOU FOR A THIRD PARTY.

THIS LIMITATION OF LIABILITY APPLIES WHETHER DAMAGE ARE SOUGHT, OR A CLAIM MADE, UNDER THIS LIMITED WARRANTY OR AS A TORT CLAIM (INCLUDING NEGLIGENCE AND STRICT PRODUCT LIABILITY), A CONTRACT CLAIM, OR ANY OTHER CLAIM. THIS LIMITATION OF LIABILITY CANNOT BE WAIVED OR AMENDED BY ANY PERSON. THIS LIMITATION OF LIABILITY WILL BE EFFECTIVE EVEN IF YOU HAVE ADVISED INNOV-X OR AN AUTHORIZED REPRESENTATIVE OF INNOV-X OF THE POSSIBILITY OF ANY SUCH DAMAGES.

Software

This Limited Warranty does not warrant software products. The Innov-X software installed on your analyzer is covered by the Innov-X Software License.

Warranty Period

The warranty period for a Model XT-245 or Model XT-260 Innov-X analyzer is two years or four thousand hours of use, whichever occurs first. The warranty for all other analyzers is one year or two thousands hours of use whichever occurs first. This warranty does not extend to expendable parts. Extended warranties are available from Innov-X.

Warranty Returns

A Return Material Authorization (RMA) Number must be obtained from the INNOV-X Service Department before any items can be shipped to the factory. Returned goods will not be accepted without an RMA Number. Customer will bear all shipping charges for warranty repairs. All goods returned to the factory for warranty repair should be properly packed to avoid damage and clearly marked with the RMA Number.

Warranty Repairs

Warranty repairs will be done either at the customer's site or at the INNOV-X plant, at our option. All service rendered by INNOV-X will be performed in a professional manner by qualified personnel.

Contacting Innov-X

Be sure to have the following information available before you call Innov-X:

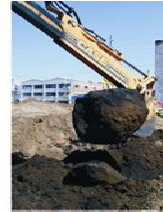
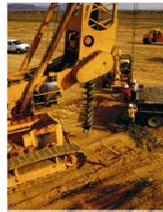
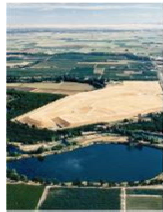
- Analyzer serial number, model name, and model number
- Applicable error messages
- Description of problem
- Detailed questions

Methods of Contact

- Phone: 781-635-5005
- Fax 781-938-0128
- Email service@Innov-Xsys.com
- Mail & Shipping Address: Innov-X Systems, Inc. 10 Gill Street, Suite Q. Woburn MA 01801

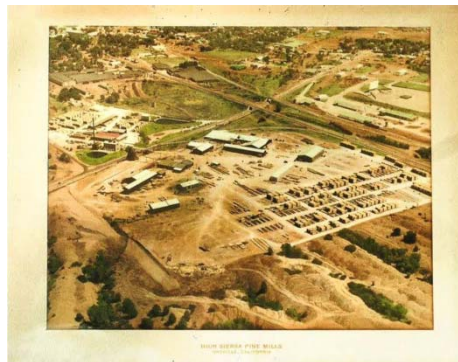
APPENDIX B

REVISED QUALITY ASSURANCE PROJECT PLAN



Revised Quality Assurance Project Plan

City of Oroville
Brownfields Site-Specific Site Assessment



Presented to:

CITY OF OROVILLE
1735 Montgomery Street
Oroville, California 95965
(530) 538-2433

Presented by:

SCS ENGINEERS
2167 Montgomery Street, Suite B
Oroville, California 95965
(530) 533-5898

August 17, 2016
Project Number: 01215033.00

Revised Quality Assurance Project Plan

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- B Laboratory QA/QC and Analytical Method Documentation
- C SOPs for Field Equipment Decontamination, Soil Sampling, Groundwater Collection, Sample Collection and Handling, and Documentation
- D Chain-of-Custody, Shipping Labels, and Custody Seal Example
- E Field Checklist of Equipment
- F Field Data Sheet

LIST OF ACRONYMS AND ABBREVIATIONS

AAI	All Appropriate Inquiry
ACM	Asbestos Containing Material
ATSDR	Agency for Toxic Substances and Disease Registry
ASTM	American Society of Testing and Materials
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHHSLs	California Human Health Screening Levels
COC	Chain-of-Custody
COPC	Chemicals of Potential Concern
CRM	Certified Reference Materials
DGBRPA	Downtown Gateway Brownfields Redevelopment Project Area
DHS	Department of Health Services
DQA	Data Quality Assessment
DQIs	Data Quality Indicators
DQO	Data Quality Objective
DTSC	Department of Toxic Substances Control
EDD	Electronic Database Deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
ESLs	Environmental Screening Levels
FSP	Field Sampling Plan
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HPLC	High Performance Liquid Chromatography
ICP/MS	Inductively Coupled Plasma Mass Spectrometry
IDW	Investigation-Derived Waste
IS	Internal Standard
LBP	Lead Based Paint
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
LUST	Leaking Underground Storage Tank
MCLs	Maximum Contaminant Levels
µg/L	Micrograms Per Liter
mg/L	Milligrams Per Liter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NVLAP	
OEHHA	Office of Environmental Health Hazard Assessment
OSHA	Occupational Safety and Health Administration

PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCP	Pentachlorophenol
PHGs	Public Health Goals
POPI	Pacific Oroville Power Inc.
PPE	Personal Protective Equipment
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SCS	SCS Engineers
SFRWQCB	San Francisco Regional Water Quality Control Board
SOP	Standard Operating Procedure
SVOCs	Semi Volatile Organic Compounds
TBD	To Be Determined
TPH	Total Petroleum Hydrocarbons
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
XRF	X-Ray Fluorescence

1.0 OVERVIEW

In 2012, the City of Oroville prepared a Quality Assurance Project Plan (QAPP) with assistance from Brown and Caldwell (B&C) and Converse Consultants (Converse) for application to City of Oroville's Brownfields Community-Wide Site Assessment Project. The City of Oroville received a Brownfields Community-Wide Site Assessment Grant (BF-00T5131-0) from the United States Environmental Protection Agency (EPA) to inventory and assess properties impacted by hazardous substances and petroleum products in the Brownfields project area. The Brownfields grant project area was defined as the Downtown Gateway Brownfields Redevelopment Project Area (DGBRPA).

In 2014, the City of Oroville was awarded two additional EPA Grants, including a Brownfields Community-Wide Site Assessment Grant for an industrial area in the southern portion of Oroville referred to as Industrial Unit 2 or IU2 and a Site-Specific Brownfield Assessment Grant for Hazardous Substances and Petroleum Hydrocarbons (Grant No. R09-14-A-003) for a property located at the northern portion of IU2, the Former Las Plumas Mill Site. In an effort to maximize use of EPA Grant funding, the City of Oroville agreed to allow SCS to revise the 2012 QAPP for use in conducting work under the 2014 Site-Specific Grant (City of Oroville, 2012).

1.1 BACKGROUND

The City of Oroville (Figure 1-1) was incorporated in 1906 and encompasses approximately 12.9 square miles. The Feather River flows from the Sierra Nevada foothills into Lake Oroville, California's second largest reservoir (3.5 million acre-feet of water). The Feather River also flows through the City of Oroville to the Sacramento Delta with a portion diverted to Southern California for metropolitan drinking water and water to support agriculture in Kern County.

The region's economy was based on resource extraction, including mining and lumber processing. Gold dredging and mining in the Feather River has left a legacy of heavy metals, including mercury in the River's sediment. In the Oroville general area, several industries operated that include but are not limited to: wood treatment facilities including Koppers Industries, Inc., Louisiana-Pacific Corp., and Sierra Pacific Industries; salvage yards/recyclers; and Western Pacific's rail yard maintenance facility. Close to the historic downtown area, activities and businesses included historic mining activities, railroad services, unregulated municipal dumps, dry cleaners, gasoline stations, and auto related sales and services.

According to the Department of Toxic Substances Control's (DTSC) hazardous substance online database EnviroStor and the State Water Resources Control Board (SWRCB) online database GeoTracker, facilities in the general Oroville area caused releases of volatile organic compounds (VOCs), dioxin, pentachlorophenol (PCP), polycyclic aromatic hydrocarbons (PAHs), formaldehyde, metals including lead, arsenic and chromium, polychlorinated bi-phenyls (PCBs), and petroleum hydrocarbons into the soil and groundwater. The DGBRPA (Figure 1-2) was selected in 2010 because of the excessive number of potential Brownfield sites that impact the plan to implement downtown redevelopment. The 2014 Brownfield Grants subsequently targeted the former Las Plumas Lumber Mill Facility (1245 Oro Dam Boulevard or the Site) and a 2,169 project area that consists of industrial and commercial zones of Oroville, including southern Oroville (see Figures 1-3 and 1-4).

The Site-specific Grant provides funding to characterize the potential presence and extent of contamination from former timber operations at the 39-acre former Las Plumas Lumber Mill Facility at 1245 Oro Dam Boulevard.

The 2012 and 2014 Brownfields Community-Wide Site Assessment Grants allow the City of Oroville to perform Phase I and Phase II Environmental Site Assessments (ESAs). Brownfields Phase II ESAs are conducted to understand the nature and extent of contamination that may impact site redevelopment or reuse. The 2014 Site specific Grant allows for performance of a Phase II ESA to collect Site data and compare values to applicable regulatory standards that may assist in making decisions regarding cleanup and property reuse, followed by identification and analysis of possible remedial alternatives which could facilitate safe, productive Site redevelopment and re-use.

1.2 REVISED QAPP DEVELOPMENT

This document has been derived from the 2012 QAPP, modified to apply to the current, Site-Specific Grant activities, and presents functions, procedures, and specific quality assurance (QA) and quality control (QC) activities so that analytical data are consistently produced and of known quality to achieve the data quality objectives defined in Section 2 of this QAPP.

The 2012 QAPP provided procedures for planning, implementation, and assessment in the collection of samples to ensure data are of sufficient quality to help make redevelopment decisions. Sampling design strategies are used as guides to evaluate factors unique to a site, including redevelopment options, exposure potential, projected site reuse, and financial resources. The 2012 QAPP has been modified to address anticipated field activities associated with Phase II ESA work at the Site, with Site-specific sampling design strategies identified in the Field Sampling Plan (FSP) developed for the Site.

Together, these two documents serve to completely describe the quality assurance/quality control (QA/QC) program that will be implemented as part of the 2014 Brownfields Site-Specific Assessment Grant Project.

The QAPP Amendment followed the format used for the 2012 document, which was derived following EPA QA/G-5, Guidance for the Preparation of Quality Assurance Project Plans (EPA, 2002). The QAPP elements were developed following EPA QA/R-5, Requirements for Quality Assurance Project Plans (EPA, 2001) and EPA Region 9 R9QA/03.2, Requirements for Quality Assurance Program Plans (EPA, 2010).

The purpose of the QAPP Amendment is to establish data collection and analysis methods and procedures so that data collected during the Site-specific Phase II ESA are of known and documented quality and useful for the purposes for which they are intended. The procedures described herein are designed to ensure that precise, accurate, representative, comparable, and complete data are collected throughout the data collection program.

2.0 PROJECT MANAGEMENT

2.1 PROGRAM ORGANIZATION AND ROLES

The Brownfields Site Specific Assessment Grant is being administered by the City of Oroville. SCS Engineers (SCS) is responsible for conducting assessment activities in accordance with the Amended QAPP. Figure 2-1 provides an organizational structure showing relationships of individuals and lines of communication among organizations and program personnel.

Table 2-1 provides the names and contact information for the designated personnel responsible for project quality control that will receive copies of reports necessary to implement the overall program.

Table 2-1 City of Oroville Brownfields Project Team

Name	Affiliation	Title	Contact Information
Mr. Donald Rust	City of Oroville	Project Coordinator	Ph: (530) 538-2405 Fax: (530) 538-2468 drust@cityoforoville.org
Mr. Daniel Johnson	SCS Engineers	Principal-In-Charge and Quality Assurance Officer	Ph: (858) 571-5500 Fax: (858) 571-5357 djohnson@scsengineers.com
Mr. James Ritchie	SCS Engineers	Program Manager	Ph: (925) 426-0080 Fax: (925) 426-0707 jritchie@scsengineers.com
Mr. Gary Pons	SCS Engineers	Health and Safety Coordinator	Ph: (562) 426-9544 Fax: (562) 427-0805 gpons@scsengineers.com
Mr. Jonathan Meronek	SCS Engineers	Graphic Information System	Ph: (707) 546-9461 Fax: (707) 544-5769 jmeronek@scsengineers.com
Ms. Eugenia E. McNaughton, Ph.D.	EPA Quality Assurance Office	EPA's QAM	Ph: (415) 972-3411 Fax: (415) 947-3564 Mcnaughton.eugenia@epa.gov
Mr. Eric Byous	EPA Brownfields Program	EPA's Project Manager	Ph: (415) 972-3581 Fax: (415) 947-3528 byous.eric@epa.gov
Ms. Melanie Ollila	Pace Analytical Laboratory	Laboratory Director	Ph: (612) 607-6352 melanie.ollila@pacelabs.com

QAM = Quality Assurance Manager

EPA = United States Environmental Protection Agency

TBD = To Be Determined

2.1.1 Environmental Protection Agency

The federal government, through EPA, operates a national Brownfields and Revitalization Program and serves as the administrator for the EPA Brownfields Community-Wide Site Assessment Grants, as authorized under Section 104(k) of the Brownfields Law.

EPA Quality Assurance Manager – Dr. Eugenia E. McNaughton, Ph.D., Manager of EPA’s Quality Assurance Office (QAO), has the responsibility to ensure that the QAPP and FSP documents contain the type and quality of data needed for environmental decisions and that the methods required for collecting, analyzing, and assessing the data will support these decisions.

Dr. McNaughton, or her designee, will coordinate with Mr. Eric Byous, the EPA Project Officer, regarding the review and approval process.

EPA Project Manager – Mr. Eric Byous has the overall responsibility of ensuring that the work meets the grant terms and conditions and coordinates directly with Mr. Donald Rust, Project Coordinator for the City of Oroville. The EPA Project Officer oversees the project schedule and budget and is responsible for ensuring compliance with the project guidelines, including approving the QAPP and FSP documents.

2.1.2 City of Oroville Project Coordinator

The City of Oroville, as the grantee, is responsible for adhering to the terms and conditions of the cooperative agreement with EPA. The City of Oroville is the principal data user and decision maker and will interface with EPA’s Project Manager, Eric Byous, and EPA QAM, Eugenia E. McNaughton, Ph.D., to assure adherence to the QAPP. Mr. Donald Rust, Project Coordinator, has the responsibilities and duties for the following: define project objectives; establish project policy and procedures to address specific needs of the project; review and analyze overall task performance; approve work products submitted by the consultants; and, represent the City at meetings..

2.1.3 Consultant Responsibilities

Under the direction of the Project Coordinator, the consultant, SCS Engineers, is responsible for implementing the Site-specific work. Primary roles include: developing and following the FSP and Revised QAPP; sample collection, data validation, data processing, data interpretation, presentation and reporting; and, creating and following the QA procedures and QC measures associated with these activities. Descriptions of project responsibilities below refer to positions of the specific team members.

Principal-in-Charge and Quality Control Officer - Mr. Daniel Johnson is the Principal-in-Charge and QA/QC task leader and will be responsible for the overall technical review for the project and will ensure the necessary resources are available to complete the scope of work. He will have the ultimate decision making authority for the decisions made by the consulting team. He is also responsible for final review of documents including Work Plans, the FSP, and Revised QAPP, and for evaluating the proposed field work and assuring that the required QA/QC

procedures are in place before personnel are dispatched to the field. Mr. Johnson will also review Reports to assure the quality of the final product.

Program Manager – Mr. James Ritchie of SCS Engineers is responsible for overall Phase II project planning including: establishing project objectives, scope, budget, schedule, and preparing the final submittals. He will coordinate with the Field Team Leader to schedule and coordinate field and laboratory activities. The Program Manager is responsible for the implementation of this QAPP and the Phase II Work Plan and FSP, and will provide overall direction for the QC function of field and laboratory activities. The Program Manager or his designee will, as necessary, perform audits, surveillance, document reviews, and other functions as required to determine the continued effectiveness of this Revised QAPP. The Program Manager has the authority to stop work that is not in compliance with the FSP and QAPP. He will ensure that the work products associated with this QAPP are delivered to those on the distribution list. Other responsibilities will include:

- Reporting regularly to the Quality Control Officer on the status of QAPP implementation;
- Providing quality orientation training and disseminating applicable quality information to the project staff;
- Coordinating all QC functions on the project to include assigning quality review staff and integrating the efforts of the project chemist into the overall QC mission;
- Identifying the need for corrective actions and initiating, recommending, and coordinating solutions for data quality issues;
- Reviewing laboratory procurement documents to assure applicable quality requirements are adequately stipulated and followed;
- Receiving electronic deliverables from the project laboratories after sample analysis and placing them in the proper format prior to sending them to the Data Management Coordinator; and
- Providing QC oversight of equipment preventive maintenance and decontamination.

Data Management Coordinator – Mr. Jonathan Meronek will maintain the database, including GIS information. Mr. Meronek or designate will load the analytical data into the database per electronic data deliverable specifications provided to the selected laboratory. He will also review field and laboratory data for completeness, accuracy, and compliance with the QAPP and FSP. He will validate laboratory data and notify the Program Manager and the City of Oroville Project Coordinator of issues related to the quality or validity of laboratory data and reporting.

Field Team Leader – Mr. Paul Wisniewski is responsible for ensuring that the procedures are followed as required in the FSP document. The SCS field team will document compliance with the FSP and Standard Operating Procedures (SOPs) by recording activities and observations in the field.

2.1.4 Environmental Laboratory Services

The California Department of Public Health (CDPH) operates a laboratory evaluation and accreditation program of environmental testing laboratories to ensure that the quality of analytical data used for regulatory purposes meets the requirements of the State's drinking water, wastewater, and hazardous waste programs. All environmental laboratory services will

be provided by California accredited laboratories that have demonstrated the capability to analyze environmental samples using approved methods.

2.2 PLANNING DOCUMENTATION

The sampling activities for the Phase II ESA will be completed within a defined framework and within the schedule outlined in the Site-specific FSP and Work Plan. The program's activities are limited to field sampling, field measuring devices, laboratory analyses, and compiling information from literature for a database. Other planning documents to be prepared as part of the City of Oroville's Brownfields Site-Specific Assessment Project are discussed below.

2.2.1 Site-Specific Work Plan

To guide further assessment of the former Las Plumas Lumber Mill Site, SCS prepared a Site-Specific Work Plan [(hereafter "Work Plan"), SCS, 2016]. The Work Plan was based upon findings from the Phase I ESA prepared for the Site, which identifies areas of known or suspected use, handling, storage and/or release of hazardous materials. The Work Plan describes the Site use history and areas or features of potential concern (FOPC), as well as constituents of potential concern (COPC) and the proposed approach for collecting subsurface data to address the potential presence and extent of COPC. The Work Plan includes a Site-Specific Health and Safety Plan (HASP) and FSP as attachments to guide field efforts.

2.2.2 Site-Specific Health and Safety Plan

To protect workers during the Phase II ESA activities, a Site-specific HASP document was prepared and is included as Appendix D of the Work Plan. The HASP informs workers of potential risks during field sampling activities and provides workers with engineering controls to avoid physical hazards. The HASP describes the safe use of equipment, evaluation of hazards, safe Site investigation procedures, personal protective equipment, emergency procedures, and training required to conduct Phase II ESA activities, including the Occupational Safety and Health Administration (OSHA) certified 40 hour HAZWOPER class.

2.2.3 Field Sampling Plan

A FSP has been prepared for the Site as part of the Phase II ESA. The field sampling approach, including sample number and location and the type of media to be sampled was determined based on the Site-specific conditions and sampling objectives. The FSP has been prepared based on the "Field Sampling Plan Guidance and Template Version 1, Brownfields Project, R9QA/009.1, October 2009" and reference the "Sampling and Analysis Plan Guidance and Template, Version 3, Brownfields Assessment Projects, R9QA/008.1, September 2009."

2.2.4 Draft and Final Phase II Reports

A Draft Phase II ESA Report describing the field and analytical methods used during the investigation will be prepared by SCS. The Report will provide details of the field methods used, sample analysis request forms and procedures, laboratory results, data validation, variances from the FSP, and conclusions. A Draft Phase II ESA Summary Report will be sent to Mr. Donald Rust, City of Oroville, as well as the current property owner, Mr. Steven

Seidenglanz, for review and comments. Written comments on the Draft Phase II ESA Summary Report will be considered in preparing the Final Phase II ESA Summary Report.

2.3 PROBLEM DEFINITION AND BACKGROUND

Resource extraction, including mining and lumber processing, played an important part in the development of the City of Oroville, including several wood treatment facilities such as Koppers Industries, Inc., Louisiana-Pacific Corp., and Sierra Pacific Industries. Close to the historic downtown area, there were mining operations, railroad and old service stations. In addition, Montgomery Street, which goes through the historic downtown area, was the old State Highway 70 before it was re-routed outside of the City. Montgomery Street was, and still remains, the primary transportation route into the historic downtown and, therefore, has a significant number of auto related services.

The City's long term plan is to build upon the opportunities offered by the Feather River to re-establish downtown Oroville as a cultural, employment and residential center for the region by incorporating Feather River with adjacent land uses in a harmonious manner. The Feather River, as it runs through downtown Oroville, represents a unique natural resource that offers many potential recreational opportunities, as well as opportunities for high quality development and amenities that link to the historic downtown area. The existing and proposed recreational resources offered in the region, such as Lake Oroville, the Feather River, and Riverbend Park further enhance the potential for economic development and healthy living in Oroville.

In September 2010, EPA awarded the City of Oroville a Brownfields Community-Wide Site Assessments Grant for the assessment of potentially hazardous substances and petroleum contaminated properties in the Downtown Gateway Brownfields Redevelopment Project Area (DGBRPA). As depicted in Figure 1-2, The DGBRA Project Area (Figure 1-2) is approximately 618 acres in size and is bounded by the Feather River to the north and west, Washington Street including the enclave of Bird Street to the east, and Oroville Dam Boulevard to the south.

The DGBRPA was selected as the project study area to help create a new business assistance program to assist property and business owners in assessing any environmental conditions and understand the potential roadblocks to redevelopment or site reuse. Phase I and Phase II ESAs were conducted under the City's Brownfields Community-Wide Site Assessment Grant.

The City of Oroville worked with the public to identify potential properties for conducting ESAs under the Brownfields Community-Wide Site Assessments Grant. Properties were evaluated and prioritized based on site ranking and selection criteria including potential for the property to create economic benefits including jobs, redevelopment opportunities, benefits to the community, and degree of contamination. Properties were assigned a numerical score and ranked in order of priority for receiving Phase I and Phase II ESAs.

Following completion of work under the initial EPA Grants, the City of Oroville subsequently applied for and was awarded a Community Wide Grant for the area referred to as Industrial Unit 2 or IU2 (Figure 1-3) and a Site-specific Grant for a property located at the northern edge of IU2, namely the Former Las Plumas Lumber Mill facility at 1245 Oro Dam Boulevard (Figure 1-4).

2.4 PROJECT DESCRIPTION

The proposed Brownfields project focuses upon the former Las Plumas Lumber (Site), located at 1245 Oro Dam Blvd., Oroville, in Butte County, California on 39 acres. The Site APN 035-270-016 is bounded by Oro Dam Blvd. to the north, the Southern Pacific (SP) rail line and South Oroville to the east, and industrial zone (IU2) to the south and west. A significant portion of the property sits idle however; current on-Site businesses include a real estate office, trucking company, and a work training center. South Oroville's 5,742 residents live as close as ¼ mile to the Site and are included in the Targeted Community being the most susceptible to the Site impacts and represent some of the neediest individuals.

With South Oroville annexation occurring in 2015 the City's population increased by 30%, placing further demands on thinly stretched services. City and County agencies are collaborating to address the economic impacts from Brownfields in the community.

Oroville's industrial activities have had a cumulative effect on its economy, environment and public health. Koppers Company represents the most significant environmental impact to the community. Since 1948, on-site wood treatment activities and two fires resulted in widespread contamination. Groundwater, soil and surface water were contaminated with wood treating materials including arsenic, PCPs, dioxins, furans, and PAH. In response to the episodic air releases, governmental agencies including the Department of Health Services conducted health studies to evaluate the potential and cumulative effects. According to the Agency for Toxic Substances and Disease Registry (ATSDR), testing of backyard-raised eggs and livestock revealed the presence of dioxins and furans. ATSDR cited that workers and neighborhoods may have been exposed to contaminants from domestic well water contamination, smoky air, and soils that may have resulted in acute reversible adverse health effects.

Community members have expressed health concerns associated with drinking water containing PCPs; reported skin, respiratory and gastrointestinal disorders; long term health effects from low level exposures over a long time; and health effects from the fires. More recently, dioxins have been traced to the Pacific Oroville Power Inc. plant, or POPI, a co-generation plant in proximity to the Site, that ceased operations last year following a Butte County District Attorney's Office investigation for environmental violations. The plant which initially burned scraps of wood from forestry operations to create electricity, began using "urban waste" including construction debris as the timber industry slowed down. Dioxin is a community concern.

The area has the size and infrastructure to accommodate the needs of large-scale manufacturing or retail. The property can be attractive to new upscale retail or other businesses looking to relocate due to the large vacant parcel, which creates a build-to-suit opportunity. Addressing brownfields conditions and creating opportunities for reuse is critical to meeting the City's goal to provide adequate land for development which will in-turn increase the amount of goods and services produced (2030 General Plan). In July 2012, the City was awarded \$390,000 in funds through Strategic Growth Planning Council funded through "Prop 84" that is being used to update the City's General Plan, Zoning Codes, Zoning Map, and develop a Climate Action Plan. Part of the outcome will propose new areas for mixed use developments, crime prevention strategies through environmental design, and measures to reduce greenhouse gas emissions.

Former businesses operated as lumber processing, saw mills, and wood treatment from the 1920's to 1999, which utilized two dip tanks for treating lumber, green chain operations, electrical and machine shops, above ground and underground fuel storage tanks and dispensing,

“teepee” burner, oil fuel houses, truck service areas, and solvent and oil waste storage areas. The property owner, RSJ Investments, Louisiana Pacific purchased the 39 acre Site in 1999 with the vision to convert the blighted land into commercial, retail and a community gathering location.

A Phase I assessment performed for the City under the City’s Brownfields Community-wide Assessment Grant for the Downtown-Gateway Area (Cooperative Agreement BT 00T51301) in 2012 focused on a 200 foot wide easement proposed as the Veatch Road extension project. This three acre portion of the property did not uncover any recognized environmental conditions (RECs). However the Phase I ESA indicated the potential for significant historic releases of hazardous substances and petroleum on the Site which contained two dip tanks, abandoned older buildings, and potential for significant soil contamination common for wood-treating sites including creosote, PCP, metal salts (copper arsenate) and possibly dioxins associated with the incineration of treated wood products.

Based upon SCS’ review of the Phase I assessment, a Site-Specific Phase I ESA (American Society of Testing and Materials or ASTM-1527-13 and All Appropriate Inquiry or AAI-compliant) was performed to further evaluate Site historic activities. The Phase I ESA was completed on September 22, 2015 (SCS, 2015). The Phase I ESA identified additional contaminants and areas of concern associated with past use, storage, handling and potential releases of hazardous substances and petroleum products at the Site.

Specific constituents that will be monitored and the proposed analytical methods listed are discussed in the Site-specific FSP, along with data quality objectives (DQOs). The Site-Specific Work Plan describes surface and subsurface soil gas, soil, and groundwater sampling. Information collected from the Phase II ESA will be used to determine the potential for the property to be impacted from releases of hazardous substances and/or petroleum products. The work under the Brownfields Site Assessment Grant will help address potential conditions which pose a risk to human health and the environment, which may constrain property reuse or redevelopment opportunities. Eliminating the source and addressing contamination from the release of hazardous substances and petroleum products can facilitate the reuse of underutilized Brownfield properties to help the City of Oroville achieve its overall economic development and revitalization goals for the community.

The anticipated schedule for the forthcoming Phase II Subsurface Investigation and cleanup alternatives tasks is shown in Table 2-2.

Table 2-2 Document Preparation Timeline

Task	Anticipated Date of Initiation	Anticipated Date of Completion	Deliverable
Draft and Final Work Plan, Amended QAPP, FSP and HASP	9/1/15	7/21/16	Draft and Final Work Plan, Amended QAPP, FSP and HASP
Draft Phase II Summary Report	9/15/16	10/31/16	Draft Phase II ESA including lab reports and Chain-of-Custody forms
Final Phase II	12/1/16	12/15/16	Final Phase II ESA

Report			including lab reports and Chain-of-Custody forms

2.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASURING DATA

DQOs were selected for this project based on the expected data usage. DQOs are designed to ensure that accurate, precise, representative, and complete data are collected throughout the monitoring program. The EPA cites seven criteria for DQOs in its draft EPA Region 9 Requirements for QAPP in Region 9 (EPA, 2010). These include:

1. **Problem Statement.** A Site-specific problem statement was developed for the Site as a part of the FSP. In general, there are insufficient data to confirm that releases of hazardous substances and petroleum products resulted in the contamination of soil, subsoil, and/or waters of the State, including groundwater, both on the Site or on surrounding properties.
2. **Identify decision points.** The location and number of samples for the Site Phase II ESA shallow soils investigation are based upon data collected during the Phase I ESA. The locations were chosen to collect sufficient quantity and quality of data to identify contaminant sources in soil. Deeper or additional soil and/or groundwater sample collection locations will be based upon the shallow soil analytical results and the soil vapor survey performed coincident with the shallow soil investigation. This approach is presented in the FSP.
3. **Identify inputs to the decision.** Media-specific constituent concentrations will be compared to background levels and/or screening levels. For this program, screening levels including California Human Health Screening Levels (CHHSLs) for soil and soil vapor, San Francisco Region Water Quality Control Board (SFRWQCB) Environmental Screening levels (ESLs) as secondary screening levels for soil and soil vapor, and CDPH Regional Screening Levels (RSLs) for groundwater will be used to determine if concentrations are above regulatory limits (EPA, 2016; OEHHA, 2010; SFRWQCB 2016). The CHHSLs, ESLs and RSLs are provided in Appendix A.
4. **Define the study area.** The study area includes the Site as shown in Figure 1-4.
5. **Develop a decision rule.** Site-specific decision rules have been developed as part of the FSP. Decision rules consist of if-then statements that use screening criteria and Phase II data to establish potential actions. An example of a decision rule would be “If Site soil VOC results are below the referenced screening levels, the soil will not be considered a source of contamination.”
6. **Specify the limits on decision errors.** Maximum allowable laboratory reporting limits are provided and compared against screening levels in Appendix B.
7. **Optimize the design for obtaining data.** The investigation rationale provides the data optimization for each media (soil, soil gas, and groundwater).

2.5.1 Regulatory Requirements

The California EPA's Office of Environmental Health Hazard Assessment (OEHHA) establishes Public Health Goals (PHGs) pursuant to Health & Safety Code §116365(c) which represent concentrations of drinking water contaminants that pose no significant health risk if consumed

for a lifetime. The CDPH regulates the concentration of drinking water contaminants that pose a risk to public health through Title 22 and through compliance with the Safe Drinking Water Act regulated by the EPA. Drinking water contaminants are regulated at MCLs, which are specific for each contaminant based on their toxicity and the feasibility for removal during drinking water treatment. Health & Safety Code §116365(a) requires CDPH to establish a contaminant's MCL at a level as close to its PHG as is technically and economically feasible, placing primary emphasis on the protection of public health. In addition to CDPH's regulation of drinking water contaminants, the California State Water Quality Control Board (SWRCB) and the RWQCBs have established regulatory limits to comply with the statutory mandates.

The DTSC regulates sites that manage hazardous waste pursuant to the California Code of Regulations (CCR) Title 22 and the federal Resource Conservation and Recovery Act (RCRA). DTSC also regulates sites that have been impacted by the releases of hazardous substances pursuant to a number of state and federal authorities including federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and a number of State laws including Chapter 6.8 of the Health and Safety Code. While no regulatory levels govern the mitigation for hazardous substances, the OEHHA, on behalf of the California Environmental Protection Agency (Cal/EPA), developed the CHHSLs for 54 hazardous chemicals in soil or soil gas. The CHHSLs can be used to screen sites for potential human health concerns where releases of hazardous chemicals to soils have occurred. Concentrations below the CHHSLs thresholds are generally considered not of concern for risk to human health.

The SFRWQCB has established ESLs for the purpose of screening for environmental concerns at sites with contaminated soil and groundwater. Under most circumstances, the presence of a chemical in soil, soil gas, or groundwater at concentrations below the corresponding ESL can be assumed to not pose a significant, long-term (chronic) threat to human health and the environment. The selected constituents and rationale are outlined in the FSP. The screening levels are used to screen potentially contaminated sites to help identify release areas (FOPC), COPC, and conditions that may require further attention at the Site.

2.5.2 Measurement of Quality Objectives and Data Quality Indicators

The following sections represent Data Quality Indicators (DQIs) that were considered during the development of the FSP.

Accuracy. Accuracy describes how close an analytical measurement is to its true value. Accuracy is typically measured by analyzing a sample of known concentration (prepared using analytical-grade standards) and comparing the analytical result with the known concentration.

Precision. Precision describes how well repeated measurements agree. Precision is typically evaluated by comparing analytical results from duplicate (also called replicate) samples and calculating the relative percent difference (RPD), where RPD is defined as:

$$RPD = \left(\frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2} \right)} \right) \times 100, \text{ where } C_1 \text{ and } C_2 \text{ are the analytical results for both duplicates}$$

Precision will be measured using both field and laboratory duplicates in addition to duplicate laboratory control spikes.

Bias. The bias of the data is the systematic or persistent distortion of a measurement process that causes errors in one direction. The DQI will use reference materials or analytical spike matrix samples to determine bias data.

Representativeness. The representativeness of the data is mainly dependent on the sampling locations (spatial), sampling frequency (temporal), sample collection procedures, and analytical constituents and methods. The sampling approach described in the FSP is designed to ensure data collected during the project are representative to the extent possible.

Completeness. Completeness measures the amount of valid data needed to be obtained from a planned measurement system. It is expressed as a percentage and is calculated by subtracting the number of rejected and unreported results from the total planned results and dividing by the total number of planned results. Estimated results do not count against completeness because they are considered usable as long as limitations are identified. Results rejected because of out-of-control analytical conditions, severe matrix effects, broken or spilled samples, or samples that could not be analyzed for any other reason are subtracted from the total planned number of results to calculate completeness. The goal for the percent completeness of samples for the Site is 90% for each method and sample matrix.

Comparability. Data comparability is the confidence with which one data set can be compared to another data set. Data comparability will be achieved by using standard sampling and analytical techniques and by documenting all QA/QC measures and procedures. Comparability evaluates whether the reported data are comparable with similar data reported by other organizations. This includes analytical results that are in the same units as action levels established by regulatory programs. The use of approved analytical methods and certified laboratories will provide some level of comparability. Evaluation of performance evaluation samples is another measure of comparability. Certified laboratories are required to analyze performance evaluation samples on a regular basis to evaluate the comparability of their reported results.

Sensitivity. Sensitivity evaluates the capacity of a method or instrument to detect a target analyte above the background or noise level.

Quality Control Limits

For all types of QC samples and/or QC checks, the QC limits for precision are 20% RPD for metals, Total Petroleum Hydrocarbons (TPH), Volatile Organic Compounds (VOCs), and Polychlorinated Biphenyls (PCBs); 30% RPD for Semi-volatile Organic Compounds (SVOCs); and 40% RPD for all other compounds. The QC limits for accuracy are between 75% and 125% for metals, TPH, and VOCs; and, for all other compounds shall be between 50% and 150%.

The laboratories used for this project were requested to supply analyte- and method-specific quality control acceptance criteria which are included in the FSP. These QC Limits will be compared to the above criteria. The laboratories will qualify any data that are not within their control limits, and SCS will qualify any data that may be within the laboratory control limits but exceeds the QC limits of this project. Qualifiers will serve to alert the data users of any identified bias or uncertainty in the results.

Laboratories shall report detection limits based on current statistical detection limit studies and reporting limits based on the low standards in their calibration curves. Laboratory reporting

limits should not exceed the maximum allowable reporting limits provided in Appendix B. Proposed analytical methods shall be used unless approval for alternative methods is given by the QCO.

2.6 TRAINING AND CERTIFICATION

Field personnel that participate in sampling will have reviewed the Site-specific FSP, HASP, and Work Plan and will receive instructions, as necessary, by the project's QCO and/or Program Manager. Training will occur prior to the beginning of the Phase II sampling event. Field personnel will be trained prior to the first sampling event in sample collection procedures (including QA/QC, grab sampling techniques, completing laboratory COC forms, and the proper handling of samples), and field analysis (including instrument calibration, data recording procedures, and interpretation of collected data).

Laboratories used for the Phase II ESA conducted under this QAPP (Pace Analytical Services or Pace, and Transglobal Environmental Geochemistry or TEG) are certified under the CDPH Environmental Laboratory Accreditation Program (ELAP). Laboratory personnel are certified and trained as required by the laboratory's quality assurance manuals.

Documentation of training for field staff will be maintained by SCS unless other arrangements are made. Documentation will include a record of the training topic, training date, name and title of instructor(s), whether the class was an initial training or a refresher course, and whether the course was completed satisfactorily.

2.6.1 OSHA Hazardous Waste Operation and Emergency Response

Personnel actively involved in sample collection will have training consistent with OSHA's 29 CFR 1910.120 requirements covering Hazardous Waste Operations and Emergency Response (HAZWOPER). Prior to arrival on-Site, SCS will certify that our field and project personnel meet the requirements of pre-assignment training, consistent with OSHA 29 CFR 1910.120 paragraph (e) (3). This will consist of supplying a document certifying that each worker who will be actively involved in sampling, has received 40 hours of instruction off the Site. The personnel must also receive 8 hours of refresher training annually. All Site personnel are required to be trained in accordance with the standard. At a minimum, all personnel are required to be trained to recognize the hazards on-Site, the provisions of the HASP, and the responsible personnel.

2.6.2 Asbestos Consultant

SCS personnel responsible for sampling or otherwise disturbing potential asbestos containing building materials will be a National Emission Standards for Hazardous Air Pollutants (NESHAP) trained Asbestos Inspector and a licensed California Asbestos Consultant (CAC) or a California Site Surveillances Technician. This requires completion of a three day certified training course and a one year apprenticeship under a certified inspector. Additionally, all Asbestos Inspectors will have completed a four hour annual refresher course.

2.6.3 Lead Based Paint Inspector

SCS personnel involved in the evaluation and testing of suspected lead based paint will be certified by California Department of Health Services (DHS) as a Lead-Based Paint Inspector/Risk Assessor. For inspections involving the use of an X-ray fluorescence (XRF) meter, only persons certified on the instrument will be allowed to operate the XRF. This requires the successful completion of an eight hour class that has been approved by the manufacturer of the instrument.

2.7 DOCUMENTS AND RECORDS

The responsibility for maintaining and updating the QAPP will ultimately be with the City of Oroville. As previously stated, Daniel Johnson of SCS is assigned as the project QCO and will maintain the official approved QAPP. As necessary, the QCO, with concurrence from the Program Manager and EPA, may revise and update the QAPP after presenting the evidence for such changes and obtaining approval from EPA. The Program Manager will make sure each subcontractor involved with the Phase II ESA is aware of updates to the QAPP. Copies of the Site-specific FSP and HASP documents will be made available at the Site and subcontractors involved with the sampling activity will be required to follow these procedures. At the conclusion of field sampling activities, SCS will prepare a Phase II ESA Summary Report containing the details of field and analytical results and information from the following documents:

Quality Assurance Project Plan: The QAPP (this document) contains details on the QA and QC procedures that will be implemented throughout the project.

Field Sampling Plan: The FSP contains information regarding data quality objectives, sampling locations, frequencies, and sample collection methods.

Field Records: The Project Manager, or other designee, will maintain all field records, including field data sheets documenting results of field analyses (including XRF) and QC samples; field forms documenting equipment maintenance and calibration; and, sample collection and handling documentation (copies of chain-of-custody forms, shipping receipts, etc.).

Laboratory Records: Analytical laboratories will maintain sample receipt and storage documentation, instrument calibration logs, raw data and QC sample records. The records will be reviewed by the Data Management Coordinator for usability.

Data Validation Records: Field data sheets, field QC results, COC forms, and laboratory reports from each sampling event will be reviewed by the Project Manager or Data Management Coordinator to assure compliance with the FSP.

2.7.1 Retention of Project Documentation

The original data sheets, equipment maintenance/calibration logs, COC forms, laboratory reports, field records, training documents and data validation records will be stored by SCS Engineers until the end of the project. All records will be maintained by SCS and the selected analytical lab(s) for five years after project completion. The Final Phase II ESA Summary Report will be retained at the City of Oroville repository for the duration of the Grant period.

2.7.2 Distribution of QAPP Revisions

Revisions that occur after the QAPP is approved are to be indicated on the QAPP title page and will be distributed by the project QCO to all parties listed on the distribution list.

3.0 DATA GENERATION AND ACQUISITION

3.1 SAMPLING DESIGN PROCESS

Typical designs for sample collection are expected to be one-time events using sampling methods based on the judgment of the Program Manager. However, if after comparing the data to applicable regulatory standards, the source of the contamination is inconclusive, additional sampling may be necessary. It is anticipated the sampling design will be based on discrete sampling rather than composite sampling. Discrete sampling is useful for identifying and quantifying chemicals in an area where a release is likely to have occurred. While not anticipated for this project, in some conditions, it may be appropriate to use statistically based sampling designs that uses random or systematic sampling locations, where bias sampling is not useful. The Site-specific FSP provides detailed descriptions of the sampling approach and rationale that was used to select sampling locations, sampling frequencies, and constituents that will be analyzed.

3.2 SAMPLING TYPES AND MATERIALS

Sampling types are anticipated to include surface soil, subsurface soil, soil gas, and/or groundwater. The number, location and schedule for media samples are specified in the FSP. The FSP also recommends the assessment of structures for various building materials (asbestos, lead-based paint, and universal waste). Potential assessment of those structural materials will be conducted in accordance with applicable regulations. SOPs for conducting these types of assessments are included in Appendix C with the exception of procedures for collecting asbestos, lead-based paint, and universal waste samples. Sampling methods for these materials are also included in Appendix C.

3.2.1 Sampling Locations and Frequencies

The sampling locations and the schedule for sampling are also specified in the FSP. The duration over which samples are collected, the frequency of sampling, and whether the work will be done in phases, is also outlined in the FSP.

3.2.2 Sampling Event Planning

Advance planning for field sampling events is required to ensure that the necessary arrangements are in place and that equipment is ready. The following will be considered when planning the sampling event:

- Sample Handling and Custody Procedures – Field personnel will make arrangements with the appropriate laboratory for proper sample containers and custody forms;

- Equipment – Field personnel will ensure that sampling equipment has been properly assembled, decontaminated, calibrated, and is functioning properly prior to use as part of the pre-field check process. Each piece of equipment will be checked for calibration data and recalibrated as necessary;
- Field Forms – Field personnel will need to ensure that necessary field forms, such as field logs, soil and groundwater sampling forms, and boring logs are assembled prior to the sampling event;
- Health and Safety – Field personnel will ensure that Site-specific health and safety concerns are understood and that appropriate personal protective equipment (PPE) is gathered;
- Investigation-Derived Waste (IDW) – Field personnel will plan for the generation of IDW and arrange to have appropriate containers for IDW; and,
- Paperwork and Permits – Prior to the sampling event, field personnel will ensure that other applicable paperwork is in order, such as permits and site access agreements.

3.3 SAMPLING METHODS

Proper sample collection procedures are essential to ensure that representative and reliable data are being collected. Sample collection will be performed according to the SOPs for Sample Collection and Handling, Documentation, and Delivery, included in Appendix C. Additionally, examples of chains-of custody, shipping labels and custody seals are included in Appendix D.

Prior to sampling, the Program Manager will ensure appropriate permits are obtained. In addition to the SOPs, the QA procedures will generally follow the practices outlined below.

A checklist of equipment to be assembled and utilized for each sampling event (to be checked off prior to each sampling event) is included in Appendix E. If problems occur during sampling, the Program Manager will be notified. The source of the problem will be identified and the appropriate corrective action taken. These incidents will be documented in the project folder and filed with the appropriate forms. If the problem compromised the quality of collected data, the data will be flagged within the database.

3.3.1 Soil Vapor Sampling and Analysis

Soil vapor collection can be helpful in evaluating contamination caused by volatile organics. This requires that a void be created in the soil at a given depth where the soil vapor will be collected. This is usually achieved with direct push technology (Geoprobe). The void is sealed and a vacuum is placed on the soil and an air sample is collected. The sample can be collected in a Summa Canister and be sent to a fixed laboratory for analysis or it can be collected in a glass syringe and analyzed by an on-site laboratory. This is a quantitative survey and results from this survey would be compared to risk-based screening values. The following guidance will be followed for the collection of soil vapor: *Soil Gas Advisory*, 2015, DTSC and the Los Angeles Regional Water Quality Control Board (DTSC, 2015).

3.3.2 Soil Sampling and Analysis

The purpose of the proposed soil investigation is to assess impacts from potential releases of hazardous substances and petroleum products. This investigation will also evaluate the soil physical properties to determine if the soil is fill or native in origin, as well as how its physical properties may influence contaminant fate and transport. There are a variety of acceptable methods for collection of soil samples, and selection of an appropriate method will depend on Site conditions. Methods commonly used to collect soil samples include drilling soil borings, digging test pits, sampling via hand auger, and digging with a shovel or trowel. Soil samples will be collected from designated locations as specified in the Work Plan and FSP using methods proposed in the SOP contained in Appendix C. The number, location, depths, rationale, and requested sample analysis for collected soil samples are presented in the FSP.

3.3.3 Groundwater Sampling and Analysis

The objective of groundwater sampling is to assess potential impacts to the groundwater. Locations for groundwater sampling will be based on Phase I ESA recommendations, results of the proposed soil gas survey, and results from the shallow soil sampling program described in the FSP. Groundwater samples will be submitted for analysis of appropriate compounds as identified in the FSP. Initial groundwater samples will be collected in the upper water-bearing zone. Samples will be collected by trained staff and will follow the procedures outlined in the SOPs included in Appendix C.

3.3.4 Field Surveys (Asbestos, Lead-Based Paint, Universal Waste)

Because sampling at Brownfield sites can often involve buildings slated for reuse, there is a potential for non-routine sampling of unusual sample matrices, such as building materials. These matrices include lead-based paint (LBP), asbestos-containing materials (ACM), and other types of potentially hazardous materials, classified here as universal waste or UW. Collection of suspect ACM will be performed by a licensed CAC or a California Site Surveillances Technician following NESHAP sampling protocol.

Lead-based paint surveys may consist of both field analysis and collection of samples for laboratory analysis. Field analysis of suspected lead-based paint samples, unless otherwise specified in the FSP, would be conducted using an XRF.

3.4 SAMPLE HANDLING AND CUSTODY

Custody procedures differ among laboratories. Custody procedures of the analyzing laboratory are identified prior to field activities. Field personnel must make arrangements with the appropriate laboratory for proper sample containers, preservatives, and sampling request forms. Sample custody must be traceable from the time of sample collection until results are reported. Sample custody procedures provide a mechanism for documenting information related to sample collection and handling. Each sample will be recorded on a Field Data Sheet (see Appendix F) and a COC form (Appendix D) must be completed after sample collection and prior to sample shipment or release. The COC form, sample labels,

and field documentation must be cross-checked to verify sample identification, type of analyses, number and type of containers and preservatives. The samples will be transported or commercially shipped to the analytical lab in insulated containers within the appropriate holding time and will be accompanied by a COC form. If commercial shipment is needed, the samples will be packaged and shipped in accordance with United States Department of Transportation (USDOT) standards.

The following sample control activities must be conducted at the laboratory:

- Initial sample login and verification of samples received with the COC form;
- Document discrepancies noted during login on the COC;
- Initiate internal laboratory custody procedure;
- Verify sample preservation (e.g. temperature);
- Notify the Project Manager if problems or discrepancies are identified; and,
- Proper sample storage, including daily refrigerator temperature monitoring and sample security.

The recommended sample container type and volume, and the initial preservative for analytes that may be tested, will be identified in the FSP.

3.5 FIELD METHODS

Field measurements will be conducted by SCS staff using portable meters and/or field test kits that follow EPA-approved methods. Field measurements will be taken using the procedures recommended by the manufacturer of the meter or test kit and procedures discussed in the SOP for Field Data Collection, where applicable. Results of field measurements will be recorded on field data sheets, included as Appendix F.

Data collected using XRF methods will follow EPA-approved methods including calibration and training requirements. Results will be recorded on field data sheets created specifically for the XRF. The procedures for conducting lead-based paint surveys with the XRF will follow manufacturer instructions provided with the equipment.

3.6 ANALYTICAL METHODS

Laboratory analyses will be conducted by Pace and TEG, California-certified analytical laboratories using methods approved by the EPA. Specific analytical methods are provided in the FSP. Proposed analytical methods and maximum allowable reporting limits are provided in Appendix A. Alternative methods may be requested by the laboratories, but only upon written approval from the Quality Assurance Manager. Major laboratory equipment or instruments that may be utilized include a gas chromatograph/mass spectrometer (GC/MS), inductively coupled plasma mass spectrometer (ICP/MS), high performance liquid chromatography (HPLC), automated colorimeter, ion chromatograph, and a carbon detector. If instrument failures occur, the laboratory will take immediate corrective action and notify the Program Manager if the quality of sample results was compromised.

3.7 QUALITY CONTROL

QC samples will be collected and analyzed to ensure the accuracy and precision of both field and laboratory data. The following sections summarize the QC samples that will be collected for field and laboratory analysis.

3.7.1 Quality Control for Field Measurements

QC for field measurements will be assessed using the following methods:

- Field instruments will be inspected, maintained, and calibrated prior to each sampling event;
- Calibration-checks will be performed to verify accuracy within 24 hours before and 24 hours after each sampling day by analyzing a calibration standard; and,
- Triplicate measurements will be conducted on one sample per sampling event to evaluate precision.

Results of the QC tests will be recorded on a Field Data Sheet.

3.7.2 Quality Control for Laboratory Analyses

QC for laboratory analyses will be assessed using the results of both field-collected QC samples and laboratory-prepared QC samples, each of which is discussed below.

Field-collected QC Samples. Field-collected QC samples will primarily consist of field duplicates and blanks, which are described below.

Field Duplicates. Field duplicates will be collected at the same time and in the same manner as the primary samples and will be used to assess the precision of all steps after sample acquisition. Field duplicates will consist of collocated samples, and will be collected and analyzed at a rate of at least ten percent (10%). Field duplicates will be collected generally from locations with the highest anticipated concentrations of contaminants. However, under conditions where there are no indications of higher concentrations, a field duplicate will be collected from every tenth sample.

Trip Blanks. Trip blanks are used to determine whether sample cross-contamination has occurred during sample transportation, delivery, and storage when collecting samples to be analyzed for volatile organic compounds. Trip blanks consist of pre-filled bottles of laboratory certified water that are transported along with the collected samples in each cooler containing samples for volatiles analysis.

Either an equipment blank or a field blank will be collected each day. An equipment blank will be collected when reusable sampling equipment is used. A field blank will be collected when disposable sampling equipment is used.

Equipment Blanks. Equipment blanks will be collected in the field to assess contamination from reusable sampling equipment and other external influences. A sample bottle will be filled with certified clean water from the laboratory, and passed through the pre-cleaned (triple-rinsed with distilled water) sample collection equipment, mimicking actual sampling, and captured again for laboratory analysis.

The equipment blanks will be collected at a frequency and from the encountered media as specified in the FSP.

Field Blanks. Field blanks will be collected in the field to assess the contamination from field conditions during the sampling. A sample bottle will be filled in the field with certified clean water from the laboratory and preserved and shipped according to sample procedures. The field blank collection frequency and type is further specified in the FSP.

Other field-collected QC samples may be utilized, as needed, throughout the program if analytical results indicate the presence of QC error, such as unexplained contamination of equipment blanks, high relative percent difference (RPDs) between field duplicates, or low precision of analytical results. An additional QC sample that may be used includes the following:

Field Split. Field splits may be used occasionally to assess the precision of the selected laboratory's analytical procedures and/or methods. A field split consists of a sample that is collected and split into two different samples, one of which is shipped to the normal lab for analysis, while the other is shipped to a different lab for similar analysis using either the same or different methods, depending on what information is desired. If split samples are analyzed using the same method, then results from both labs can be compared to assess the precision of the method, whereas, if they are analyzed using different methods, results can be compared to assess the accuracy of the methods.

Laboratory-prepared QC Samples. Several additional samples will be prepared and analyzed in the laboratories to evaluate precision, accuracy, and the potential for laboratory contamination. Each laboratory will set its own warning limit criteria for QC samples based on the method requirements and the laboratory's QA Manual. The QA Manuals for selected laboratories are included in Appendix B. Descriptions of some of the laboratory-prepared QC samples that will be analyzed are included below. At a minimum, the frequency for analysis of matrix spikes (MS), duplicates, and blanks will meet method requirements.

Method Blanks. Method blanks (also called extraction blanks, procedural blanks, or preparation blanks) are used to assess laboratory contamination during all stages of sample preparation and analysis. Method blanks are prepared by the laboratory from reagent grade water and are processed through the entire analytical procedure in a manner identical to that of the samples. At a minimum, the laboratory will be required to report method blanks at a frequency of one method blank for each batch of up to 20 samples. If the laboratory method blank indicates the presence of contamination, all impacted samples in the analytical batch should be flagged. Subtracting method blank results from sample results is not permitted.

Matrix Spike (MS). MS will be used to evaluate the effect of the sample matrix on the recovery of the compound(s) of interest. In general, to prepare a MS, a field sample is first homogenized and then split into two sub samples. Samples being analyzed for VOCs and TPHg, however, will not be homogenized. Instead, a separate volume of sample will be collected for matrix spike analysis. Matrix spike samples will be

selected at random at a rate of at least 10%. One of the sub samples will be fortified with the MS solution and one sub sample will be analyzed to provide a background concentration for each analyte of interest. Recovery is the accuracy of an analytical test measured against a known analyte addition to a sample, and is calculated as follows:

$$\text{Recovery} = \left(\frac{C_{\text{matrix} + \text{spike}} - C_{\text{matrix}}}{C_{\text{spike (Expected)}}} \right) * 100 \quad \text{Where } C \text{ is the measured concentration}$$

Recovery data for the fortified compound ultimately will provide a basis for determining the accuracy of the measurement and the prevalence of matrix effects in the samples analyzed during the project. Analysis of MS duplicates (MSD) is also useful for assessing laboratory precision.

Laboratory Control Spike (LCS). Laboratory control spikes are prepared by adding a known amount of target analyte(s) to reagent-grade water. When compared to the method blank, LCSs can be used to evaluate the accuracy (recovery) of the target analytes excluding any matrix effects.

Replicate Samples. Replicate (also called duplicates) samples are prepared by splitting a sample into two or more aliquots after delivery to the lab, but prior to sample preparation. Analysis of replicates is used to assess precision of an analytical method. Replicates that are typically utilized include:

- **Laboratory replicates:** These are replicates of the raw material that is extracted and analyzed in the same manner as the original sample to measure laboratory precision;
- **MSD:** These are used to assess both laboratory precision and accuracy within the sample matrix; and
- **Laboratory Control Spike Duplicate (LCSD):** These are useful for assessing the accuracy and precision of the method, excluding matrix effects.

3.7.3 Additional Laboratory Quality Control Requirements

The laboratories providing analytical support for this project will have the appropriate facilities to store, prepare, and process samples and appropriate instrumentation and staff to provide data of the required quality within the time period dictated by the project. The laboratories shall be able to provide information documenting their ability to conduct the analyses with the required level of data quality. Such information may include results from inter-laboratory performance evaluation studies, control charts, and summary data from internal QA/QC checks, and results from analyses of Certified Reference Materials (CRM).

3.8 INSTRUMENT AND EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

3.8.1 Field Equipment

Prior to each sampling event, inspection and preventive maintenance will be performed for field equipment in accordance with the manufacturer's specifications including battery checks and routine replacement of detectors. Equipment will be re-inspected between each sampling site and after each sampling event. If problems occur and/or repair is needed during the sampling event, the field data sheet will be used to document the corrective action taken. If significant damage or equipment malfunctions are noted, the instrument(s) will be sent to the manufacturer for immediate repair.

A maintenance/calibration log will be kept by the Field Team Leader or other designee, which details the dates of instrument and sampling gear inspection, calibrations performed in the lab or field, battery replacement, dates reagents and standards are replaced, and problems noted with instruments, samplers, or reagents. The logbook will also be used to document corrective action that was taken if equipment deficiencies were noted during an inspection. A small inventory of critical spare parts for field equipment will be kept at the SCS main office and also brought in the field, if needed; however, perishable supplies or expensive parts may not be kept on hand and will be ordered when needed. All spare parts and supplies will be obtained through the equipment manufacturer or other reputable sources.

3.8.2 Laboratory Equipment

The laboratories providing support for this project will maintain analytical equipment in accordance with relevant SOPs, which include those specified by the manufacturer and those specified by the method. The laboratories will maintain a record documenting equipment inspections, as well as preventive and corrective maintenance.

3.9 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

3.9.1 Field Instruments

Field instruments will be calibrated according to the schedule recommended by the manufacturer. Standards will be purchased from a chemical supply company or prepared by (or with the assistance of) a professional laboratory. Calibration records will be kept in the maintenance/calibration log at the SCS main office where it can be easily accessed before and after equipment use. Calibrations that are performed by personnel in the field may also be recorded on the field data sheets to indicate which samples were analyzed pre- and post-calibration for the specific sampling event. If calibration is not successful or other issues pertaining to calibration arise, the equipment manufacturer will be contacted to determine the appropriate corrective action; the problem and corrective action will be documented in the maintenance/calibration logbook.

3.9.2 Laboratory Instruments

The selected laboratories are certified by the CDPH and must maintain calibration practices and calibration-checks as required by their certifications.

3.10 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Project supplies and consumables that may directly or indirectly affect the quality of results include the following:

- Conductivity, pH, and turbidity standards;
- Buffer solutions;
- Reagents; and,
- Miscellaneous supplies including batteries, dissolved oxygen membranes, and o-rings.

The Program Manager or Field Team Leader will ensure that the inspection/testing specifications and acceptance criteria are met. Upon receipt, buffer solutions, standards, reagents, and miscellaneous supplies will be inspected by the Program Manager or Field Team Leader for leaks or broken seals, and to compare the age of each reagent to the manufacturer's recommended shelf-life. Additionally, conductivity, pH, and turbidity standards will be checked by comparing their readings with those generated by the current lot of standards. Other sampling equipment will be inspected for broken or missing parts and will be tested to ensure proper operation.

Reagents will be replaced before they exceed the manufacturer's recommended shelf life, which are typically one to two years. Specific replacement dates can often be found on the product or can be determined by providing the reagent lot number to the manufacturer. Reagent replacement dates will be noted in the maintenance log.

3.11 NON-DIRECT MEASUREMENTS (EXISTING DATA)

As discussed in the Work Plan and FSP, there are no existing Site analytical data.

3.12 DATA MANAGEMENT

The data management coordinator will be primarily responsible for maintaining the project database. Laboratory data will be entered into the database. SCS's data management coordinator will be responsible for overseeing management of the project database. Additional responsibilities of the data management coordinator include QA of data collected prior to input to the database.

3.12.1 Field Data

Field data will be documented on Field Data Sheets, provided in Appendix F. One sheet will be used at each monitoring site and field staff will complete all necessary sections of the data sheet during the sampling event.

3.12.2 Analytical Data

The selected analytical laboratories will provide reports in electronic format. Requirements for electronic data deliverables (EDD) will be provided to selected analytical laboratories.

3.12.3 Data Submittal

Laboratory reports, summarizing analytical results and QC results, will be provided to SCS electronically in the agreed upon format. Copies of all COC forms and laboratory reports will be forwarded to the Data Management Coordinator and/or the Quality Assurance Manager, as assigned by the QCO for data verification and validation. The information contained within and the format of the hard-copy data report package will be determined during the initial negotiations with the laboratory and will include, at a minimum, the sample identification, sampling date/time, test method, extraction date/time, analysis date/time, analytical results, QA sample results, instrument and equipment calibration summary information, and a description of the corrective action taken to resolve data quality issues.

4.0 ASSESSMENT AND OVERSIGHT

4.1 ASSESSMENTS AND RESPONSE ACTIONS

SCS will conduct at least one field audit during the life of the project for the City of Oroville. If the audit results indicate concerns, a follow-up audit will be conducted. The field audits will be used to reveal any weaknesses in field practices and procedures. The field audits will evaluate if the field personnel are following the procedures set forth in the FSP and the SOPs. It will be the responsibility of SCS to conduct the audit(s). The audit will be performed by senior staff members who are not part of the Phase II sampling team.

During the field audit, the assessor will conduct personnel interviews and direct observations to evaluate adherence to the FSP and SOPs. Specific items that will be verified include:

- Examination of field documents (specifically that the FSP and HASP are available on-Site for reference to the field sampling team);
- Documentation of field personnel training;
- Verify that the proper laboratory containers and proper preservatives are being utilized;
- Verify that laboratory sample containers are properly labeled and stored, and that the laboratory COC is filled out properly and completely;
- Verify that the decontamination area is properly set up and functioning according to the SOP. This will be initiated in the event that decontamination is required for the field activities being conducted; and,
- Verify that field equipment in use is functioning properly.

During the audit, deficiencies will be discussed with field personnel and corrections will be made as soon as reasonably possible. An audit report will be filed with the City of Oroville within 14 days of the performance of such an audit. If the field audit identified significant non-compliance issues, a follow-up field audit will be conducted.

4.2 DELIVERABLES AND REPORTING

Interim and final reports associated with the Program will be issued by SCS to the City of Oroville and US EPA according to Table 4-1 below.

Table 4-1 QM-Management Reports

Type of Report	Frequency	Projected Delivery Date(s)	Report Recipients
Draft Revised QAPP	One time	July 2016	EPA/City of Oroville
Final QAPP	One time	July 2016	EPA/City of Oroville
Field Sampling Plan	One Site	July 2016	EPA/City of Oroville
Final Phase II ESA Summary Report	One Site	December 2016	EPA/City of Oroville

5.0 DATA VALIDATION AND USABILITY

5.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Data verification is the process of evaluating the completeness, correctness, conformance, and compliance of a specific data set against the method, procedural, or contractual requirements. Data verification evaluates whether sampling protocols, SOPs, analytical methods, and project specific planning documents (Work Plan and FSP) were followed during data generation. Verification also involves examining the data for errors or omissions. Field and laboratory staff can verify that the work is producing appropriate outputs.

Data validation is a systematic process for reviewing a body of data against a pre-established set of acceptance criteria defined in this QAPP and in the FSP. Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond data verification and is performed to determine the analytical quality of a specific data set. Validation involves a detailed examination of the data package for precision, accuracy, and sensitivity. The Phase II ESA Summary Report will be evaluated to ensure that:

- QC data are scientifically sound, appropriate to the method, and completely documented;
- QC samples yield results within established guidelines;
- Data are appropriately flagged by the laboratory and data validator;
- Anomalies in sample preparation and analysis are completely and accurately documented;
- Preservations were documented;
- Data are properly incorporated into the final Summary Report; and,
- The final Summary Report is complete and ready for release.

Data verification, validation, and review are done to ensure that environmental programs and decisions are supported by data of a type and quality needed and expected for their intended use. This section describes the procedures that are planned to review, verify, and validate field and laboratory data.

5.2 VERIFICATION AND VALIDATION METHODS

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Inconsistencies that are discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in the FSP and QAPP documents so that defensible and justifiable data are obtained.

The steps for verifying/validating field activities include:

1. Evaluate field records for completeness and consistency;
2. Review field QC information;
3. Summarize deviations and determine effects on data quality; and,
4. Summarize number and type of samples collected.

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformance to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; and, outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package. All analytical data generated for this project are to be verified by the laboratory prior to submittal. The Data Management Coordinator will also perform data verification and data validation.

During verification, data are checked for a variety of topics including transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct usage of conversion factors, among others. Verified data may have laboratory qualifiers.

The steps for verifying laboratory data include:

1. Assemble planning documents and data to be verified;
2. Review method, procedural, and contractual QC compliance or noncompliance; and,
3. Review data set for completeness as a whole, including laboratory qualifiers.

The steps for validating laboratory data include:

1. Review results for all blanks, spikes, and duplicates and compare to the control limits for each parameter;
2. Review reporting limits against the maximum allowable reporting limits;
3. Assign validated data qualifiers, which supersede laboratory qualifiers although both sets of qualifiers are retained in the database; and,
4. Prepare a data validation summary for inclusion in the Phase II ESA Summary Report.

5.3 RECONCILIATION WITH USER REQUIREMENTS

In general there are five steps that will be used during the process of reconciling the data collected during the Phase II ESA Subsurface Investigation:

1. Review the FSP and make sure the final Phase II ESA Summary Report answers the required questions. In general, is there a presence or absence of the COPC that were investigated during the Phase II ESA? If contamination was encountered has the extent of that contamination been identified?
2. Conduct a preliminary data review or exploratory data analysis to understand the character and structure of the data set and to evaluate whether there are any anomalies in the data that may not have been noticed during data verification and validation. Are there outliers or other anomalies that should be further investigated (i.e., conduct a focused data validation) before continuing with Step 3?
3. Plot data on Site maps and identify data gaps;
4. Verify that areas of the Site have been properly tested and have followed the testing designs outlined in the FSP; and,
5. Draw conclusions from the data. Using multiple lines of evidence and professional experience, the data analyst should be able to provide conclusions and recommendations for the Site. In some cases, the conclusion may be that more data are needed to answer the primary study questions.

6.0 LIMITATIONS

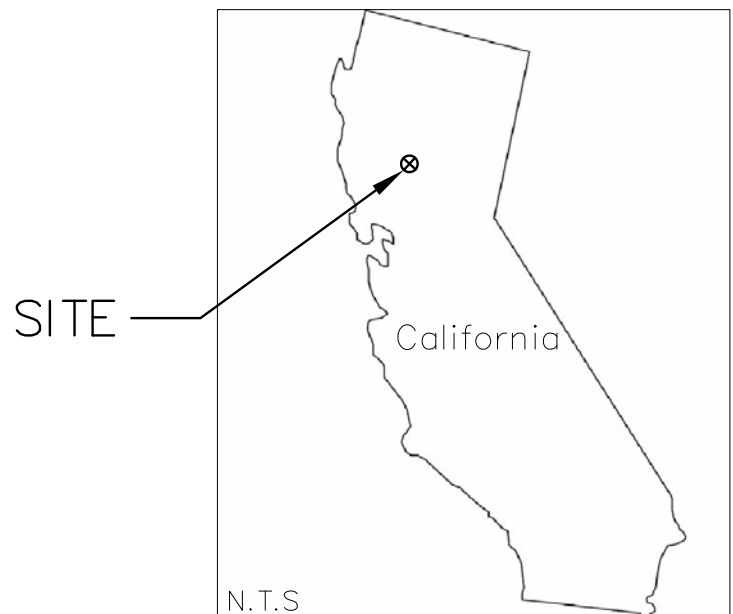
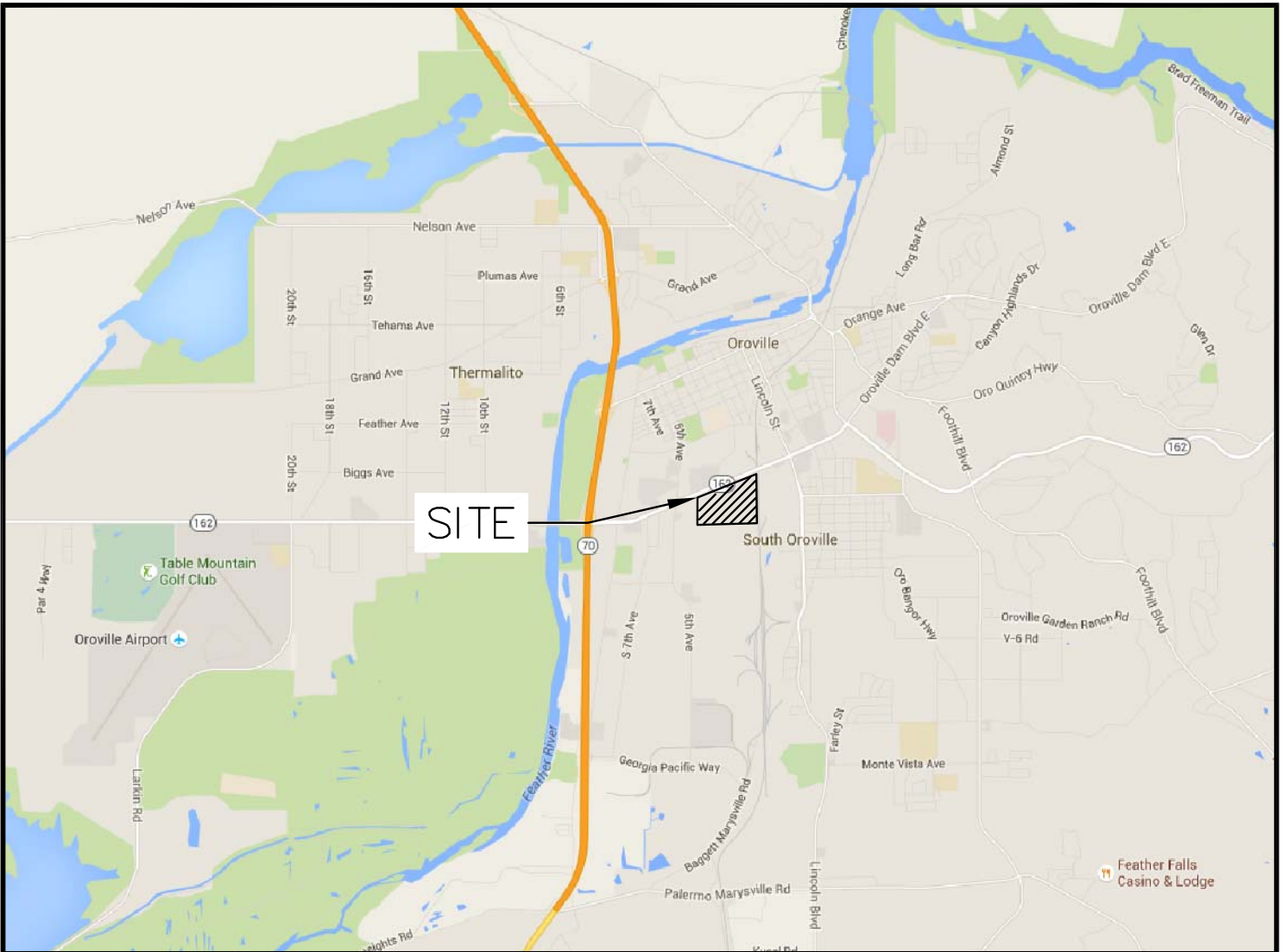
6.1 REPORT LIMITATIONS

This document was prepared solely for City of Oroville in accordance with professional standards at the time the services were performed. This document is governed by the specific scope of work authorized by City of Oroville. It is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by City of Oroville and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

7.0 REFERENCES

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- EPA, 2010. EPA Region 9 Requirements for Quality Assurance Program Plans R9QA/03.2, Draft. March.
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- SCS, 2016. SCS Engineers (SCS) Work Plan for Phase II Subsurface Investigation, Seidenglanz Property, 1245 Oro Dam Boulevard, Oroville, Butte County, California, including Field Sampling Plan, Quality Assurance Project Plan, Health and Safety Plan, and Unanticipated Discovery Plan, July.
- SFRWQCB, 2016. San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). Environmental Screening Levels. February 2016 (Rev. 3).

FIGURES



SOURCE OF BASE MAP: GOOGLE MAPS

SCS ENGINEERS

ENVIRONMENTAL CONSULTANTS

3843 BRICKWAY BOULEVARD SUITE 208
SANTA ROSA, CALIFORNIA 95403
PH. (707) 546-9461 FAX. (707) 544-5769

PROJ. NO.	01215033.00	DWN. BY:	JH	ACAD. FILE:	01215033.00_ESA-5-15
DATE	7/22/15	CHK. BY:	PAW	APP. BY:	J. RITCHIE

SHEET TITLE:

SITE LOCATION MAP

PROJECT TITLE:

APN: 035-270-016
1245 ORO DAM BOULEVARD
OROVILLE, CALIFORNIA

SCALE:

N.T.S

FIGURE NO.

1

APPENDIX A

ANALYTICAL METHODS, REPORTING LIMITS AND REGULATORY COMPARISON VALUES FOR SOIL VAPOR SOIL, AND GROUNDWATER



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Method Detection and Reporting Limits
for PCB Congeners by USEPA Method 1668A

Congener	IUPAC #	Waters		Soils		Tissue		Control limits		
		MDL (pg/L)	PRL (pg/L)	MDL (ng/Kg)	PRL (ng/Kg)	MDL (ng/Kg)	PRL (ng/Kg)	Lower	Upper	RPD
2-Chlorobiphenyl	PCB-1	21.0	250	2.29	25	1.52	50	50	150	20
3-Chlorobiphenyl	PCB-2	12.6	250	3.25	25	1.87	50	50	150	20
4-Chlorobiphenyl	PCB-3	16.8	250	2.54	25	1.88	50	50	150	20
2,2'-Dichlorobiphenyl	PCB-4	39.6	250	6.99	25	9.30	25	50	150	20
2,6-Dichlorobiphenyl	PCB-10	28.2	250	3.23	25	2.96	50	50	150	20
2,5-Dichlorobiphenyl	PCB-9	22.8	250	3.35	25	3.24	50	50	150	20
2,4-Dichlorobiphenyl	PCB-7	20.1	250	3.05	25	3.43	50	50	150	20
2,3'-Dichlorobiphenyl	PCB-6	37.2	250	3.68	25	3.83	50	50	150	20
2,3-Dichlorobiphenyl	PCB-5	24.1	250	1.95	25	5.63	50	50	150	20
2,4'-Dichlorobiphenyl	PCB-8	39.8	250	4.39	25	14.3	50	50	150	20
3,5-Dichlorobiphenyl	PCB-14	81.1	250	2.84	25	2.83	50	50	150	20
3,3'-Dichlorobiphenyl	PCB-11	201	1600	18.8	174	174.00	348	50	150	20
PCB-(13/12)	PCB-(13/12)	50.9	500	4.79	50	3.15	100	50	150	20
4,4'-Dichlorobiphenyl	PCB-15	23.3	250	7.16	50	7.36	50	50	150	20
2,2',6-Trichlorobiphenyl	PCB-19	27.5	250	3.17	50	14.7	50	50	150	20
PCB-(30/18)	PCB-(30/18)	62.8	500	25.0	50	33.3	100	50	150	20
2,2',4-Trichlorobiphenyl	PCB-17	51.7	250	1.77	25	18.0	50	50	150	20
2,3',6-Trichlorobiphenyl	PCB-27	27.0	250	2.21	25	3.53	50	50	150	20
2,3,6-Trichlorobiphenyl	PCB-24	18.7	250	3.03	25	2.91	50	50	150	20
2,2',3-Trichlorobiphenyl	PCB-16	57.1	250	1.97	25	20.2	50	50	150	20
2,4',6-Trichlorobiphenyl	PCB-32	21.8	250	5.39	25	12.2	50	50	150	20
2',3,5-Trichlorobiphenyl	PCB-34	24.0	250	1.74	25	2.16	50	50	150	20
2,3,5-Trichlorobiphenyl	PCB-23	36.5	250	2.03	25	1.28	50	50	150	20
PCB-(26/29)	PCB-(26/29)	45.2	500	3.95	100	6.28	100	50	150	20
2,3',4-Trichlorobiphenyl	PCB-25	16.4	250	2.46	25	3.07	50	50	150	20
2,4',5-Trichlorobiphenyl	PCB-31	41.1	1160	17.2	130	57.9	260	50	150	20
PCB-(28/20)	PCB-(28/20)	60.4	1030	20.9	130	74.7	260	50	150	20
PCB-(21/33)	PCB-(21/33)	62.9	1140	12.6	270	54.1	270	50	150	20
2,3,4'-Trichlorobiphenyl	PCB-22	72.9	770	8.59	190	44.5	190	50	150	20
3,3',5-Trichlorobiphenyl	PCB-36	23.8	250	2.70	25	2.35	50	50	150	20
3,4',5-Trichlorobiphenyl	PCB-39	29.1	250	1.95	25	2.02	50	50	150	20
3,4,5-Trichlorobiphenyl	PCB-38	34.8	250	1.41	25	2.37	50	50	150	20
3,3',4-Trichlorobiphenyl	PCB-35	34.4	250	3.28	25	3.46	50	50	150	20
3,4,4'-Trichlorobiphenyl	PCB-37	79.9	390	5.74	106	29.7	106	50	150	20
2,2',6,6'-Tetrachlorobiphenyl	PCB-54	47.5	500	2.67	50	3.32	100	50	150	20
PCB-(50/53)	PCB-(50/53)	56.6	1000	8.55	100	5.51	200	50	150	20
PCB-(45/51)	PCB-(45/51)	63.3	1000	6.52	100	9.33	200	50	150	20
2,2',3,6'-Tetrachlorobiphenyl	PCB-46	21.7	500	3.47	50	4.22	100	50	150	20
2,2',5,5'-Tetrachlorobiphenyl	PCB-52	50.0	1490	18.2	123	12.4	246	50	150	20
2,3',5',6-Tetrachlorobiphenyl	PCB-(73/43)	64.1	1000	8.27	100	6.54	200	50	150	20
PCB-(69/49)	PCB-(69/49)	84.7	1000	8.45	100	9.29	200	50	150	20
2,2',4,5-Tetrachlorobiphenyl	PCB-48	23.4	500	3.57	100	5.34	100	50	150	20
PCB-(44/47/65)	PCB-(44/47/65)	53.4	1500	14.4	300	15.8	300	50	150	20
PCB-(59/62/75)	PCB-(59/62/75)	37.2	1500	8.58	150	48.0	300	50	150	20
2,2',3,4'-Tetrachlorobiphenyl	PCB-42	56.9	500	5.25	100	9.08	100	50	150	20
PCB-(41/40/71)	PCB-(41/40/71)	56.2	1500	9.88	150	12.4	300	50	150	20
2,3,4',6-Tetrachlorobiphenyl	PCB-64	29.9	500	7.02	50	25.6	100	50	150	20
2,3',5,5'-Tetrachlorobiphenyl	PCB-72	30.3	500	2.60	50	18.7	100	50	150	20
2,3',4,5'-Tetrachlorobiphenyl	PCB-68	18.0	500	3.44	50	2.91	100	50	150	20
2,3,3',5-Tetrachlorobiphenyl	PCB-57	21.0	500	4.67	50	17.9	100	50	150	20
2,3,3',5'-Tetrachlorobiphenyl	PCB-58	36.5	500	1.35	50	12.9	100	50	150	20
2,3',4,5-Tetrachlorobiphenyl	PCB-67	33.0	500	3.78	50	15.2	100	50	150	20



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2,3,4',5-Tetrachlorobiphenyl	PCB-63	30.6	500	2.92	50	3.65	100	50	150	20
PCB-(61/70/74/76)	PCB-(61/70/74/76)	88.9	2000	24.5	200	26.9	400	50	150	20
2,3',4,4'-Tetrachlorobiphenyl	PCB-66	74.3	760	10.5	84	51.1	168	50	150	20
2,3,3',4-Tetrachlorobiphenyl	PCB-55	46.8	500	3.73	50	15.8	100	50	150	20
2,3,3',4'-Tetrachlorobiphenyl	PCB-56	44.3	500	5.66	50	9.00	100	50	150	20
2,3,4,4'-Tetrachlorobiphenyl	PCB-60	49.0	500	5.69	50	5.45	100	50	150	20
3,3',5,5'-Tetrachlorobiphenyl	PCB-80	28.7	500	3.11	50	3.62	50	50	150	20
3,3',4,5'-Tetrachlorobiphenyl	PCB-79	33.1	500	3.06	50	2.79	100	50	150	20
3,3',4,5-Tetrachlorobiphenyl	PCB-78	34.9	500	3.93	50	4.41	100	50	150	20
3,4,4',5-Tetrachlorobiphenyl	PCB-81	19.1	500	4.94	50	4.59	100	50	150	20
3,3',4,4'-Tetrachlorobiphenyl	PCB-77	33.5	500	4.40	50	4.07	100	50	150	20
2,2',4,6,6'-Pentachlorobiphenyl	PCB-104	42.3	500	7.31	50	4.96	50	50	150	20
2,2',3,6,6'-Pentachlorobiphenyl	PCB-96	32.5	500	5.15	50	33.4	100	50	150	20
2,2',4,5',6-Pentachlorobiphenyl	PCB-103	25.6	500	5.05	50	2.68	100	50	150	20
2,2',3,5,6'-Pentachlorobiphenyl	PCB-94	45.6	500	3.30	50	3.36	100	50	150	20
2,2',3,5',6-Pentachlorobiphenyl	PCB-95	34.6	950	11.3	95	12.8	190	50	150	20
PCB-(100/93/102/98)	PCB-(100/93/102/98)	109	2000	10.5	200	102	400	50	150	20
PCB-(88/91)	PCB-(88/91)	48.3	1000	13.0	100	5.97	200	50	150	20
2,2',3,3',6-Pentachlorobiphenyl	PCB-84	27.3	500	6.32	50	3.81	100	50	150	20
2,2',3,4,6'-Pentachlorobiphenyl	PCB-89	32.9	500	4.06	50	30.8	100	50	150	20
2,3',4,5',6-Pentachlorobiphenyl	PCB-121	16.7	500	4.74	50	24.7	100	50	150	20
2,2',3,5,5'-Pentachlorobiphenyl	PCB-92	30.3	500	5.92	50	4.92	100	50	150	20
PCB-(113/90/101)	PCB-(113/90/101)	61.5	1500	14.4	300	16.7	300	50	150	20
2,2',3,3',5-Pentachlorobiphenyl	PCB-83	35.8	500	10.8	50	4.04	100	50	150	20
2,2',4,4',5-Pentachlorobiphenyl	PCB-99	54.7	500	10.1	100	8.75	100	50	150	20
2,3,3',5,6-Pentachlorobiphenyl	PCB-112	35.0	500	4.50	50	4.88	100	50	150	20
PCB-(108/119/86/97/125/87)	PCB-(108/119/86/97/125/87)	123	3000	26.7	300	173	600	50	150	20
PCB-(117/116/85)	PCB-(117/116/85)	50.4	1500	11.5	150	9.99	300	50	150	20
PCB-(110/115)	PCB-(110/115)	64.1	1000	8.90	200	15.7	200	50	150	20
2,2',3,3',4-Pentachlorobiphenyl	PCB-82	28.8	500	12.1	50	4.05	100	50	150	20
2,3,3',5,5'-Pentachlorobiphenyl	PCB-111	33.7	500	3.48	50	27.3	100	50	150	20
2,3',4,5,5'-Pentachlorobiphenyl	PCB-120	26.8	500	2.54	50	5.76	50	50	150	20
PCB-(107/124)	PCB-(107/124)	68.7	1000	5.47	100	32.1	200	50	150	20
2,3,3',4,6-Pentachlorobiphenyl	PCB-109	48.7	500	2.83	50	5.56	50	50	150	20
2,3',4,4',5'-Pentachlorobiphenyl	PCB-123	28.2	500	5.94	50	2.88	100	50	150	20
2,3,3',4,5-Pentachlorobiphenyl	PCB-106	33.4	500	3.25	50	4.35	100	50	150	20
2,3',4,4',5-Pentachlorobiphenyl	PCB-118	43.4	500	9.46	50	7.60	100	50	150	20
2,3,3',4',5'-Pentachlorobiphenyl	PCB-122	33.9	500	2.78	50	10.4	100	50	150	20
2,3,4,4',5-Pentachlorobiphenyl	PCB-114	36.7	500	4.80	50	2.55	50	50	150	20
2,3,3',4,4'-Pentachlorobiphenyl	PCB-105	55.8	500	3.89	100	6.37	100	50	150	20
3,3',4,5,5'-Pentachlorobiphenyl	PCB-127	27.3	500	3.29	50	2.87	100	50	150	20
3,3',4,4',5-Pentachlorobiphenyl	PCB-126	31.6	500	2.98	50	15.1	100	50	150	20
2,2',4,4',6,6'-Hexachlorobiphenyl	PCB-155	29.0	500	4.80	50	5.62	50	50	150	20
2,2',3,5,6,6'-Hexachlorobiphenyl	PCB-152	39.9	500	7.95	50	3.22	100	50	150	20
2,2',3,4',6,6'-Hexachlorobiphenyl	PCB-150	26.0	500	7.31	50	3.07	100	50	150	20
2,2',3,3',6,6'-Hexachlorobiphenyl	PCB-136	24.4	500	7.74	50	8.11	100	50	150	20
2,2',3,4,6,6'-Hexachlorobiphenyl	PCB-145	47.5	500	6.22	50	12.5	100	50	150	20
2,2',3,4',5,6'-Hexachlorobiphenyl	PCB-148	34.2	500	11.6	50	3.78	50	50	150	20
PCB-(151/135)	PCB-(151/135)	40.0	1000	15.1	100	10.2	200	50	150	20
2,2',4,4',5,6'-Hexachlorobiphenyl	PCB-154	31.3	500	8.05	50	4.78	50	50	150	20
2,2',3,4,5',6-Hexachlorobiphenyl	PCB-144	47.6	500	15.5	50	3.27	100	50	150	20
PCB-(147/149)	PCB-(147/149)	78.0	1000	28.1	200	16.2	200	50	150	20
PCB-(134/143)	PCB-(134/143)	36.8	1000	9.43	100	73.1	200	50	150	20
PCB-(139/140)	PCB-(139/140)	45.8	1000	7.83	100	5.50	100	50	150	20
2,2',3,3',4,6-Hexachlorobiphenyl	PCB-131	50.4	500	7.49	50	2.99	100	50	150	20
2,2',3,4,5,6-Hexachlorobiphenyl	PCB-142	34.3	500	2.54	50	2.79	100	50	150	20



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2,2',3,3',4,6'-Hexachlorobiphenyl	PCB-132	53.7	500	10.8	100	5.90	100	50	150	20
2,2',3,3',5,5'-Hexachlorobiphenyl	PCB-133	55.5	500	3.99	50	3.01	100	50	150	20
2,3,3',5,5',6-Hexachlorobiphenyl	PCB-165	38.0	500	4.84	50	3.07	100	50	150	20
2,2',3,4',5,5'-Hexachlorobiphenyl	PCB-146	34.8	500	6.06	50	5.42	100	50	150	20
2,3,3',4,5',6-Hexachlorobiphenyl	PCB-161	17.5	500	3.94	50	2.71	100	50	150	20
PCB-(153/168)	PCB-(153/168)	37.4	1000	12.9	200	13.0	200	50	150	20
2,2',3,4,5,5'-Hexachlorobiphenyl	PCB-141	59.2	500	5.42	50	7.39	100	50	150	20
2,2',3,3',4,5'-Hexachlorobiphenyl	PCB-130	54.1	500	4.48	50	2.64	100	50	150	20
2,2',3,4,4',5-Hexachlorobiphenyl	PCB-137	57.2	500	4.56	50	5.26	100	50	150	20
2,3,3',4',5',6-Hexachlorobiphenyl	PCB-164	59.5	500	3.42	50	3.55	100	50	150	20
PCB-(138/163/129)	PCB-(138/163/129)	102	1500	27.3	300	14.3	300	50	150	20
2,3,3',4,5,6-Hexachlorobiphenyl	PCB-160	30.4	500	5.11	50	6.08	100	50	150	20
2,3,3',4,4',6-Hexachlorobiphenyl	PCB-158	44.5	500	3.75	50	2.59	100	50	150	20
PCB-(128/166)	PCB-(128/166)	45.8	1000	6.80	100	29.1	200	50	150	20
2,3,3',4,5,5'-Hexachlorobiphenyl	PCB-159	37.2	500	5.98	50	16.8	100	50	150	20
2,3,3',4',5,5'-Hexachlorobiphenyl	PCB-162	33.2	500	3.83	50	3.38	100	50	150	20
2,3',4,4',5,5'-Hexachlorobiphenyl	PCB-167	19.9	500	4.42	50	20.0	100	50	150	20
PCB-(156/157)	PCB-(156/157)	63.7	1000	7.79	100	50.0	100	50	150	20
3,3',4,4',5,5'-Hexachlorobiphenyl	PCB-169	40.1	500	4.95	50	4.15	100	50	150	20
2,2',3,4',5,6,6'-Heptachlorobiphenyl	PCB-188	20.6	500	3.66	50	3.46	50	50	150	20
2,2',3,3',5,6,6'-Heptachlorobiphenyl	PCB-179	31.2	500	9.67	50	4.43	100	50	150	20
2,2',3,4,4',6,6'-Heptachlorobiphenyl	PCB-184	18.9	500	7.62	50	3.67	100	50	150	20
2,2',3,3',4,6,6'-Heptachlorobiphenyl	PCB-176	37.0	500	6.74	50	3.47	100	50	150	20
2,2',3,4,4',5,6'-Heptachlorobiphenyl	PCB-186	25.3	500	3.88	50	3.09	100	50	150	20
2,2',3,4,5,6,6'-Heptachlorobiphenyl	PCB-178	19.4	500	4.51	50	3.68	100	50	150	20
2,2',3,3',5,5',6-Heptachlorobiphenyl	PCB-175	28.1	500	3.94	50	4.30	100	50	150	20
2,2',3,3',4,5',6-Heptachlorobiphenyl	PCB-187	23.3	500	8.30	50	4.92	100	50	150	20
2,2',3,4',5,5',6-Heptachlorobiphenyl	PCB-182	33.0	500	5.46	50	4.88	100	50	150	20
PCB-(183/185)	PCB-(183/185)	47.4	1000	6.95	100	6.99	200	50	150	20
2,2',3,3',4,5,6'-Heptachlorobiphenyl	PCB-174	30.6	500	4.22	50	5.75	100	50	150	20
2,2',3,3',4,5',6'-Heptachlorobiphenyl	PCB-177	34.7	500	9.21	50	4.84	100	50	150	20
2,2',3,4,4',5,6-Heptachlorobiphenyl	PCB-181	42.4	500	1.83	50	3.74	100	50	150	20
PCB-(171/173)	PCB-(171/173)	55.7	1000	7.93	100	50.0	100	50	150	20
2,2',3,3',4,5,5'-Heptachlorobiphenyl	PCB-172	25.5	500	2.63	50	21.1	100	50	150	20
2,3,3',4,5,5',6-Heptachlorobiphenyl	PCB-192	31.6	500	2.84	50	2.85	100	50	150	20
PCB-(180/193)	PCB-(180/193)	55.3	1000	7.46	100	50.2	200	50	150	20
2,3,3',4,4',5',6-Heptachlorobiphenyl	PCB-191	38.7	500	5.48	50	2.92	100	50	150	20
2,2',3,3',4,4',5-Heptachlorobiphenyl	PCB-170	32.5	500	5.96	50	17.9	100	50	150	20
2,3,3',4,4',5,6-Heptachlorobiphenyl	PCB-190	38.9	500	6.37	50	5.83	50	50	150	20
2,3,3',4,4',5,5'-Heptachlorobiphenyl	PCB-189	42.4	500	2.72	50	4.21	50	50	150	20
2,2',3,3',5,5',6,6'-Octachlorobiphenyl	PCB-202	31.6	750	3.91	75	4.32	75	50	150	20
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	PCB-201	44.7	750	7.29	75	4.73	150	50	150	20
2,2',3,4,4',5,6,6'-Octachlorobiphenyl	PCB-204	24.5	750	5.95	75	5.43	150	50	150	20
PCB-(197/200)	PCB-(197/200)	51.5	1500	16.0	150	8.80	300	50	150	20
PCB-(198/199)	PCB-(198/199)	100	1500	15.4	150	9.84	300	50	150	20
2,2',3,3',4,4',5,6'-Octachlorobiphenyl	PCB-196	32.0	750	4.32	75	6.95	150	50	150	20
2,2',3,4,4',5,5',6-Octachlorobiphenyl	PCB-203	27.2	750	5.16	75	8.85	150	50	150	20
2,2',3,3',4,4',5,6-Octachlorobiphenyl	PCB-195	31.0	750	6.50	75	4.95	150	50	150	20
2,2',3,3',4,4',5,5'-Octachlorobiphenyl	PCB-194	45.1	750	5.19	75	7.55	150	50	150	20
2,3,3',4,4',5,5',6-Octachlorobiphenyl	PCB-205	44.0	750	4.81	75	4.67	75	50	150	20
2,2',3,3',4,4',5,5',6,6'-Nonachlorobiphenyl	PCB-208	48.0	750	7.31	75	7.61	75	50	150	20
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl	PCB-207	33.6	750	5.76	75	4.79	75	50	150	20
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	PCB-206	74.8	750	7.79	75	7.52	75	50	150	20
Decachlorobiphenyl	PCB-209	49.6	750	5.73	75	4.26	75	50	150	20



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 6010B Solid

BV/AU

Analyte	CAS#	MDL (ug/Kg)	PRL (ug/Kg)	LCS/LCSD			MS/MSD			DUP
				Lower	Upper	RPD	Lower	Upper	RPD	RPD
Aluminum	7429-90-5	1200.00	2500	80	120	20	75	125	20	20
Antimony	7440-36-0	116.000	750	80	120	20	75	125	20	20
Arsenic	7440-38-2	123.000	7500	80	120	20	75	125	20	20
Barium	7440-39-3	250.000	500	80	120	20	75	125	20	20
Beryllium	7440-41-7	9.260	250	80	120	20	75	125	20	20
Boron	7440-42-8	190.000	1000	80	120	20	75	125	20	20
Cadmium	7440-43-9	17.9000	500	80	120	20	75	125	20	20
Calcium	7740-70-2	942.00	5000	80	120	20	75	125	20	20
Chromium	7440-47-3	12.8000	250	80	120	20	75	125	20	20
Cobalt	7440-48-4	28.5000	250	80	120	20	75	125	20	20
Copper	7440-50-8	207.0000	500	80	120	20	75	125	20	20
Iron	7439-86-6	1190.00	5000	80	120	20	75	125	20	20
Lead	7439-92-1	115.000	500	80	120	20	75	125	20	20
Magnesium	7439-95-4	2500.00	5000	80	120	20	75	125	20	20
Manganese	7439-96-5	33.700	250	80	120	20	75	125	20	20
Molybdenum	7439-98-7	22.000	250	80	120	20	75	125	20	20
Nickel	7440-02-0	30.4000	250	80	120	20	75	125	20	20
Potassium	7440-70-2	3910.00	25000	80	120	20	75	125	20	20
Selenium	7782-49-2	271.000	5000	80	120	20	75	125	20	20
Silver	7440-22-4	63.400	250	80	120	20	75	125	20	20
Sodium	7740-23-5	4060.00	25000	80	120	20	75	125	20	20
Strontium	7440-24-6	250.00	500	80	120	20	75	125	20	20
Thallium	7440-28-0	127.000	750	80	120	20	75	125	20	20
Titanium	7440-32-6	130.0000	1500	80	120	20	75	125	20	20
Vanadium	7440-62-2	52.6000	25000	80	120	20	75	125	20	20
Zinc	7440-66-6	500.000	1000	80	120	20	75	125	20	20



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 6010B-3010A Water

BV/as

Analyte	CAS#	MDL (ug/L)	PRL (ug/L)	LCS/LCSD			MS/MSD			DUP
				Lower	Upper	RPD	Lower	Upper	RPD	RPD
Aluminum	7429-90-5	13.1	50	80	120	20	75	125	20	20
Antimony	7440-36-0	2.09	15	80	120	20	75	125	20	20
Arsenic	7440-38-2	3.45	15	80	120	20	75	125	20	20
Barium	7440-39-3	0.51	10	80	120	20	75	125	20	20
Beryllium	7440-41-7	0.244	1	80	120	20	75	125	20	20
Boron	7440-42-8	2.63	20	80	120	20	75	125	20	20
Cadmium	7440-43-9	0.406	1	80	120	20	75	125	20	20
Calcium	7740-70-2	11.9	100	80	120	20	75	125	20	20
Chromium	7440-47-3	0.540	5	80	120	20	75	125	20	20
Cobalt	7440-48-4	0.627	5	80	120	20	75	125	20	20
Copper	7440-50-8	1.29	5	80	120	20	75	125	20	20
Iron	7439-86-6	18.1	100	80	120	20	75	125	20	20
Lead	7439-92-1	1.72	5	80	120	20	75	125	20	20
Magnesium	7439-95-4	50.0	100	80	120	20	75	125	20	20
Manganese	7439-96-5	0.888	5	80	120	20	75	125	20	20
Molybdenum	7439-98-7	0.29	5	80	120	20	75	125	20	20
Nickel	7440-02-0	0.58	5	80	120	20	75	125	20	20
Potassium	7440-70-2	49.3	500	80	120	20	75	125	20	20
Selenium	7782-49-2	5.84	15	80	120	20	75	125	20	20
Silver	7440-22-4	0.74	5	80	120	20	75	125	20	20
Silicon		7.81	100	80	120	20	75	125	20	20
Sodium	7740-23-5	14.4	500	80	120	20	75	125	20	20
Strontium	7440-24-6	5.0	10	80	120	20	75	125	20	20
Thallium	7440-28-0	2.98	15	80	120	20	75	125	20	20
Tin	7440-31-5	1.88	100	80	120	20	75	125	20	20
Titanium	7440-32-6	3.16	10	80	120	20	75	125	20	20
Vanadium	7440-62-2	0.752	5	80	120	20	75	125	20	20
Zinc	7440-66-6	1.21	10	80	120	20	75	125	20	20
Hardness		331	662							

APPENDIX B

LABORATORY QA/QC AND ANALYTICAL METHOD DOCUMENTATION



Pace Analytical Services, Inc.
Method Detection Limit and Reporting Limit
for Dioxin/Furans by USEPA Method 8290/8290A

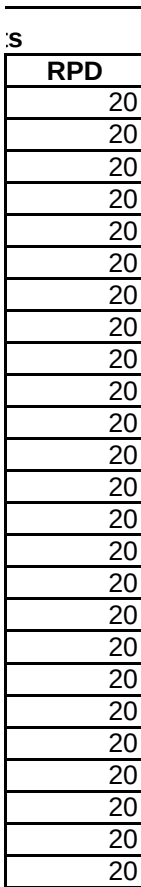
Analyte	CAS#	Solids by SW3540		Wipes by SW3540		Tissues		Waters		Control limit	
		MDL (ng/Kg)	PRL (ng/Kg)	MDL (ng/m2)	PRL (ng/m2)	MDL (ng/Kg)	PRL (ng/Kg)	MDL (pg/L)	PRL (pg/L)	Lower	Upper
2,3,7,8-TCDF	51207-31-9	0.278	1.0	0.278	1.0	0.243	1.0	1.84	10	70	130
2,3,7,8-TCDD	1746-01-6	0.202	1.0	0.202	1.0	0.239	1.0	1.67	10	70	130
1,2,3,7,8-PeCDF	57117-41-6	0.601	5.0	0.601	5.0	0.180	5.0	2.21	50	70	130
2,3,4,7,8-PeCDF	57117-31-4	0.583	5.0	0.583	5.0	0.103	5.0	2.77	50	70	130
1,2,3,7,8-PeCDD	40321-76-4	0.584	5.0	0.584	5.0	0.161	5.0	2.89	50	70	130
1,2,3,4,7,8-HxCDF	70648-26-9	0.624	5.0	0.624	5.0	0.108	5.0	3.42	50	70	130
1,2,3,6,7,8-HxCDF	57117-44-9	0.536	5.0	0.536	5.0	0.324	5.0	3.04	50	70	130
2,3,4,6,7,8-HxCDF	60851-34-5	0.655	5.0	0.655	5.0	0.261	5.0	4.05	50	70	130
1,2,3,7,8,9-HxCDF	72918-21-9	0.761	5.0	0.761	5.0	0.274	5.0	4.20	50	70	130
1,2,3,4,7,8-HxCDD	39227-28-6	0.776	5.0	0.776	5.0	0.279	5.0	4.46	50	70	130
1,2,3,6,7,8-HxCDD	57653-85-7	0.663	5.0	0.663	5.0	0.551	5.0	2.68	50	70	130
1,2,3,7,8,9-HxCDD	19408-74-3	0.723	5.0	0.723	5.0	0.184	5.0	4.09	50	70	130
1,2,3,4,6,7,8-HpCDF	67562-39-4	0.792	5.0	0.792	5.0	0.438	5.0	3.37	50	70	130
1,2,3,4,7,8,9-HpCDF	55673-89-7	0.726	5.0	0.726	5.0	0.56	5.0	3.61	50	70	130
1,2,3,4,6,7,8-HpCDD	35822-46-9	0.692	5.0	0.692	5.0	0.348	5.0	3.92	50	70	130
OCDF	39001-02-0	1.95	10.0	1.95	10.0	1.22	10.0	7.71	100	70	130
OCDD	3268-87-9	1.40	10.0	1.40	10.0	1.30	10.0	6.61	100	70	130
Total TCDF	55722-27-5	0.278	1.0	0.278	1.0	0.243	1.0	1.84	10	70	130
Total TCDD	41903-57-5	0.202	1.0	0.202	1.0	0.239	1.0	1.67	10	70	130
Total PeCDF	30402-15-4	1.18	10.0	1.18	10.0	0.283	10.0	4.98	100	70	130
Total PeCDD	36088-22-9	0.584	5.0	0.584	5.0	0.161	5.0	2.89	50	70	130
Total HxCDF	55684-94-1	2.58	20.0	2.58	20.0	0.97	20.0	14.71	200	70	130
Total HxCDD	34465-46-8	2.16	15.0	2.16	15.0	1.01	15.0	11.23	150	70	130
Total HpCDF	38998-75-3	1.52	10.0	1.52	10.0	1.00	10.0	6.98	100	70	130
Total HpCDD	37871-00-4	0.692	5.0	0.692	5.0	0.348	5.0	3.92	50	70	130

Labelled Analyte	Control limits	
	Lower	Upper
¹³ C ₁₂ -2,3,7,8-TCDF	40	135
¹³ C ₁₂ -2,3,7,8-TCDD	40	135
¹³ C ₁₂ -1,2,3,7,8-PeCDF	40	135
¹³ C ₁₂ -2,3,4,7,8-PeCDF	40	135
¹³ C ₁₂ -1,2,3,7,8-PeCDD	40	135
¹³ C ₁₂ -1,2,3,4,7,8-HxCDF	40	135
¹³ C ₁₂ -1,2,3,6,7,8-HxCDF	40	135
¹³ C ₁₂ -2,3,4,6,7,8-HxCDF	40	135



Pace Analytical Services, Inc.
Method Detection Limit and Reporting Limit
for Dioxin/Furans by USEPA Method 8290/8290A

¹³ C ₁₂ -1,2,3,7,8,9-HxCDF		40	135
¹³ C ₁₂ -1,2,3,4,7,8-HxCDD		40	135
¹³ C ₁₂ -1,2,3,6,7,8-HxCDD		40	135
¹³ C ₁₂ -1,2,3,7,8,9-HxCDD		40	135
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDF		40	135
¹³ C ₁₂ -1,2,3,4,7,8,9-HpCDF		40	135
¹³ C ₁₂ -1,2,3,4,6,7,8-HpCDD		40	135
¹³ C ₁₂ -OCDD		40	135
³⁷ Cl ₄ -2,3,7,8-TCDD		40	135



LRM 04.22.15

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Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8270 Solid

Method/Prep Code ck/78
KC/78

Solid-3550

Analyte	CAS #	MDL (ug/kg) (Prep 3550)	PRL (ug/kg)	LCS/LCSD			MS/MSD			DUP RPD
				Lower	Upper	RPD	Lower	Upper	RPD	
1,2,4-Trichlorobenzene	120-82-1	54.4	330	41	125	20	43	125	30	30
1,2-Dichlorobenzene	95-50-1	21.3	330	38	125	20	36	125	30	30
1,2-Diphenylhydrazine	122-66-7	165.0	330	58	125	20	30	125	30	30
1,3-Dichlorobenzene	541-73-1	20.8	330	36	125	20	34	125	30	30
1,4-Dichlorobenzene	106-46-7	22.0	330	36	125	20	33	125	30	30
1-Methylnaphthalene	90-12-0	56.9	330	49	125	20	48	125	30	30
2,4,5-Trichlorophenol	95-95-4	39.4	330	56	125	20	30	141	30	30
2,4,6-Trichlorophenol	88-06-2	42.5	330	57	125	20	30	143	30	30
2,4-Dichlorophenol	120-83-2	62.1	330	51	125	20	30	139	30	30
2,4-Dimethylphenol	105-67-9	61.8	330	48	125	20	47	125	30	30
2,4-Dinitrophenol	51-28-5	165.0	330	30	125	20	30	125	30	30
2,4-Dinitrotoluene	121-14-2	165.0	330	58	125	20	50	125	30	30
2,6-Dinitrotoluene	606-20-2	28.2	330	58	125	20	48	125	30	30
2-Chloronaphthalene	91-58-7	51.7	330	53	125	20	49	125	30	30
2-Chlorophenol	95-57-8	77.0	330	44	125	20	30	125	30	30
2-Methylnaphthalene	91-57-6	59.0	330	49	125	20	47	125	30	30
2-Methylphenol(o-Cresol)	95-48-7	71.4	330	48	125	20	43	125	30	30
2-Nitroaniline	88-74-4	35.8	330	58	125	20	57	125	30	30
2-Nitrophenol	88-75-5	56.4	330	43	125	20	30	150	30	30
3&4-Methylphenol	106-44-5	66.0	660	53	125	20	51	125	30	30
3,3'-Dichlorobenzidine	91-94-1	46.0	330	42	125	20	30	132	30	30
3-Nitroaniline	99-09-2	33.7	330	47	125	20	30	132	30	30
4,6-Dinitro-2-methylphenol	534-52-1	65.6	1700	38	125	20	30	130	30	30
4-Bromophenylphenyl ether	101-55-3	35.1	330	59	125	20	57	125	30	30
4-Chloro-3-methylphenol	59-50-7	165.0	330	58	125	20	30	139	30	30
4-Chloroaniline	106-47-8	50.6	330	30	125	20	30	125	30	30
4-Chlorophenylphenyl ether	7005-72-3	38.0	330	59	125	20	30	130	30	30
4-Nitroaniline	100-01-6	28.9	330	54	125	20	30	150	30	30
4-Nitrophenol	100-02-7	34.6	330	53	125	20	30	145	30	30
Acenaphthene	83-32-9	38.1	330	56	125	20	55	125	30	30
Acenaphthylene	208-96-8	43.2	330	56	125	20	56	125	30	30
Anthracene	120-12-7	165.0	330	58	125	20	57	125	30	30
Benzo(a)anthracene	56-55-3	165.0	330	59	125	20	52	125	30	30
Benzo(a)pyrene	50-32-8	165.0	330	59	125	20	51	125	30	30
Benzo(b)fluoranthene	205-99-2	41.8	330	60	125	20	40	125	30	30
Benzo(g,h,i)perylene	191-24-2	40.1	330	59	125	20	48	125	30	30
Benzo(k)fluoranthene	207-08-9	42.2	330	59	125	20	56	125	30	30
Butylbenzylphthalate	85-68-7	165.0	330	60	125	20	55	125	30	30
Carbazole	86-74-8	165.0	330	59	125	20	56	125	30	30
Chrysene	218-01-9	44.3	330	59	125	20	50	125	30	30
Di-n-butylphthalate	84-74-2	45.8	330	61	125	20	58	125	30	30
Di-n-octylphthalate	117-84-0	165.0	330	60	125	20	59	125	30	30
Dibenz(a,h)anthracene	53-70-3	165.0	330	59	125	20	55	125	30	30
Dibenzofuran	132-64-9	165.0	330	58	125	20	57	125	30	30
Diethylphthalate	84-66-2	165.0	330	60	125	20	58	125	30	30
Dimethylphthalate	131-11-3	165.0	300	60	125	20	59	125	30	30
Fluoranthene	206-44-0	165.0	330	58	125	20	49	125	30	30
Fluorene	86-73-7	165.0	330	58	125	20	57	125	30	30
Hexachloro-1,3-butadiene	87-68-3	27.8	330	38	125	20	39	125	30	30
Hexachlorobenzene	118-74-1	43.4	330	57	125	20	55	125	30	30
Hexachloroethane	67-72-1	21.0	330	54	125	20	30	125	30	30
Indeno(1,2,3-cd)pyrene	193-39-5	165.0	330	59	125	20	51	125	30	30
Isophorone	78-59-1	52.7	330	52	125	20	49	125	30	30
N-Nitroso-di-n-propylamine	621-64-7	44.9	330	48	125	20	30	140	30	30
N-Nitrosodimethylamine	62-75-9	165.0	330	31	125	20	30	125	30	30
N-Nitrosodiphenylamine	86-30-6	165.0	330	59	125	20	57	125	30	30
Naphthalene	91-20-3	61.8	330	44	125	20	44	125	30	30
Nitrobenzene	98-95-3	66.7	330	46	125	20	30	139	30	30
Pentachlorophenol	87-86-5	165.0	670	47	125	20	30	148	30	30
Phenanthrene	85-01-8	47.2	330	59	125	20	50	125	30	30
Phenol	108-95-2	72.1	330	48	125	20	48	125	30	30
Pyrene	129-00-0	41.6	330	60	125	20	56	125	30	30
bis(2-Chloroethoxy)methane	111-91-1	64.5	330	48	125	20	46	125	30	30



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8270 Solid

Method/Prep Code ck/78
KC/78

bis(2-Chloroethyl) ether	111-44-4	23.0	330	39	125	20	34	125	30	30
bis(2-Chloroisopropyl)ether	108-60-1	76.2	330	33	125	20	33	125	30	30
bis(2-Ethylhexyl)phthalate	117-81-7	56.4	330	61	125	20	60	125	30	30

Surrogates		LCS/LCSD								
		Lower	Upper							
2,4,6-Tribromophenol (S)	118-79-6		40	125						
2-Fluorobiphenyl (S)	321-60-8		51	125						
2-Fluorophenol (S)	367-12-4		45	125						
Nitrobenzene-d5 (S)	4165-60-0		34	125						
Phenol-d6 (S)	13127-88-3		44	125						
Terphenyl-d14 (S)	98904-43-9		55	125						



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8270 Water by SW3510

Method/Prep Code ck/cf
KC/cf

Water-3510

Separatory Funnel

Analyte	CAS #	MDL (ug/L)	PRL (ug/L)	LCS/LCSD			MS/MSD			DUP
				Lower	Upper	RPD	Lower	Upper	RPD	RPD
1,2,4-Trichlorobenzene	120-82-1	2.25	10	37	128	20	70	130	30	30
1,2-Dichlorobenzene	95-50-1	2.33	10	30	143	20	70	130	30	30
1,2-Diphenylhydrazine	122-66-7	2.72	10	70	125	20	70	130	30	30
1,3-Dichlorobenzene	541-73-1	2.35	10	30	143	20	70	130	30	30
1,4-Dichlorobenzene	106-46-7	2.15	10	30	144	20	70	130	30	30
1-Methylnaphthalene	90-12-0	2.32	10	59	125	20	70	130	30	30
2,4,5-Trichlorophenol	95-95-4	2.55	10	67	125	20	70	130	30	30
2,4,6-Trichlorophenol	88-06-2	2.49	10	67	125	20	70	130	30	30
2,4-Dichlorophenol	120-83-2	2.42	10	61	125	20	70	130	30	30
2,4-Dimethylphenol	105-67-9	2.06	10	62	125	20	70	130	30	30
2,4-Dinitrotoluene	121-14-2	2.71	10	71	125	20	70	130	30	30
2,4-Dinitrophenol	51-28-5	5.00	10	30	150	20	70	130	30	30
2,6-Dinitrotoluene	606-20-2	2.74	10	70	125	20	70	130	30	30
2-Chloronaphthalene	91-58-7	2.33	10	61	125	20	70	130	30	30
2-Chlorophenol	95-57-8	2.38	10	51	125	20	70	130	30	30
2-Methylnaphthalene	91-57-6	2.40	10	37	136	20	70	130	30	30
2-Methylphenol(o-Cresol)	95-48-7	1.93	10	46	125	20	70	130	30	30
2-Nitroaniline	88-74-4	2.75	10	72	125	20	70	130	30	30
2-Nitrophenol	88-75-5	2.55	50	61	125	20	70	130	30	30
3&4-Methylphenol	108-39-4									
3,3'-Dichlorobenzidine	106-44-5	1.92	10	39	125	20	70	130	30	30
3,3'-Dichlorobenzidine	91-94-1	2.84	50	45	150	20	70	130	30	30
3-Nitroaniline	99-09-2	2.79	10	55	150	20	70	130	30	30
4,6-Dinitro-2-methylphenol	534-52-1	2.11	10	30	150	20	70	130	30	30
4-Bromophenylphenyl ether	101-55-3	2.89	10	68	125	20	70	130	30	30
4-Chloro-3-methylphenol	59-50-7	2.50	10	68	125	20	70	130	30	30
4-Chloroaniline	106-47-8	2.44	10	45	150	20	70	130	30	30
4-Chlorophenylphenyl ether	7005-72-3	2.52	10	65	125	20	70	130	30	30
4-Nitroaniline	100-01-6	2.56	10	71	125	20	70	130	30	30
4-Nitrophenol	100-02-7	5.00	10	30	125	20	70	130	30	30
Acenaphthene	83-32-9	2.45	10	65	125	20	70	130	30	30
Acenaphthylene	208-96-8	2.46	10	65	125	20	70	130	30	30
Anthracene	120-12-7	2.83	10	72	125	20	70	130	30	30
Benzo(a)anthracene	56-55-3	2.77	10	71	125	20	70	130	30	30
Benzo(a)pyrene	50-32-8	2.77	10	70	125	20	70	130	30	30
Benzo(b)fluoranthene	205-99-2	2.80	10	71	125	20	70	130	30	30
Benzo(g,h,i)perylene	191-24-2	2.81	10	71	125	20	70	130	30	30
Benzo(k)fluoranthene	207-08-9	2.83	10	66	125	20	70	130	30	30
bis(2-Chloroethoxy)methane	111-91-1	2.51	10	64	125	20	70	130	30	30
bis(2-Chloroisopropyl)ether	108-60-1	2.86	10	57	125	20	70	130	30	30
bis(2-Ethylhexyl)phthalate	117-81-7	2.96	10	73	125	20	70	130	30	30
bis(2-Chloroethyl) ether	111-44-4	2.48	10	57	125	20	70	130	30	30
Butylbenzylphthalate	85-68-7	2.89	10	75	125	20	70	130	30	30
Carbazole	86-74-8	2.92	10	71	125	20	70	130	30	30
Chrysene	218-01-9	2.78	10	70	125	20	70	130	30	30
Dibenz(a,h)anthracene	53-70-3	2.77	10	70	125	20	70	130	30	30
Dibenzofuran	132-64-9	2.65	10	66	125	20	70	130	30	30
Diethylphthalate	84-66-2	2.77	10	69	125	20	70	130	30	30
Dimethylphthalate	131-11-3	2.63	10	69	125	20	70	130	30	30
Di-n-butylphthalate	84-74-2	2.94	10	73	125	20	70	130	30	30
Di-n-octylphthalate	117-84-0	4.90	10	73	125	20	70	130	30	30
Fluoranthene	206-44-0	2.80	10	70	125	20	70	130	30	30
Fluorene	86-73-7	2.58	10	68	125	20	70	130	30	30
Hexachloro-1,3-butadiene	87-68-3	2.54	10	30	137	20	70	130	30	30
Hexachlorobenzene	118-74-1	3.05	10	66	125	20	70	130	30	30
Hexachloroethane	67-72-1	2.16	10	30	136	20	70	130	30	30
Indeno(1,2,3-cd)pyrene	193-39-5	2.80	10	70	125	20	70	130	30	30
Isophorone	78-59-1	2.68	10	66	125	20	70	130	30	30
Naphthalene	91-20-3	2.32	10	47	125	20	70	130	30	30



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8270 Water by SW3510

Method/Prep Code ck/cf
KC/cf

Nitrobenzene	98-95-3	2.72	10	58	125	20	70	130	30	30
N-Nitrosodimethylamine	62-75-9	5.00	10	32	125	20	70	130	30	30
N-Nitroso-di-n-propylamine	621-64-7	2.63	10	60	125	20	70	130	30	30
N-Nitrosodiphenylamine	86-30-6	2.71	10	71	125	20	70	130	30	30
Pentachlorophenol	87-86-5	1.32	20	57	132	20	70	130	30	30
Phenanthrene	85-01-8	2.71	10	71	125	20	70	130	30	30
Phenol	108-95-2	5.00	10	30	125	20	70	130	30	30
Pyrene	129-00-0	2.85	10	74	125	20	70	130	30	30

Surrogates					LCS/LCSD	
					Lower	Upper
2,4,6-Tribromophenol (S)	118-79-6				64	125
2-Fluorobiphenyl (S)	321-60-8				55	125
2-Fluorophenol (S)	367-12-4				30	125
Nitrobenzene-d5 (S)	4165-60-0				51	125
Phenol-d6 (S)	13127-88-3				12	125
p-Terphenyl-d14 (S)	98904-43-9				73	125



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8270 Water by SW3520

Method/Prep Code ck/ef
KC/ef

Water-3520

Continuous Liquid-Liquid

Analyte	CAS #	MDL (ug/L)	PRL (ug/L)	LCS/LCSD			MS/MSD			DUP
				Lower	Upper	RPD	Lower	Upper	RPD	RPD
1,2,4-Trichlorobenzene	120-82-1	1.89	10	58	125	20	62	125	30	30
1,2-Dichlorobenzene	95-50-1	1.91	10	51	125	20	57	125	30	30
1,2-Diphenylhydrazine	122-66-7	2.43	10	68	125	20	63	125	30	30
1,3-Dichlorobenzene	541-73-1	1.63	10	48	125	20	55	125	30	30
1,4-Dichlorobenzene	106-46-7	1.86	10	49	125	20	56	125	30	30
1-Methylnaphthalene	90-12-0	2.07	10	68	125	20	68	125	30	30
2,4,5-Trichlorophenol	95-95-4	2.14	10	69	125	20	65	125	30	30
2,4,6-Trichlorophenol	88-06-2	2.17	10	70	125	20	66	125	30	30
2,4-Dichlorophenol	120-83-2	2.26	10	67	125	20	62	125	30	30
2,4-Dimethylphenol	105-67-9	6.73	50	40	125	20	31	125	30	30
2,4-Dinitrotoluene	121-14-2	2.11	10	70	125	20	30	139	30	30
2,4-Dinitrophenol	51-28-5	2.73	10	30	125	20	71	125	30	30
2,6-Dinitrotoluene	606-20-2	2.29	10	70	125	20	72	125	30	30
2-Chloronaphthalene	91-58-7	2.21	10	68	125	20	70	125	30	30
2-Chlorophenol	95-57-8	2.18	10	52	125	20	55	125	30	30
2-Methylnaphthalene	91-57-6	2.08	10	66	125	20	69	125	30	30
2-Methylphenol(o-Cresol)	95-48-7	2.15	10	62	125	20	56	125	30	30
2-Nitroaniline	88-74-4	2.75	10	69	125	20	51	125	30	30
2-Nitrophenol	88-75-5	2.22	10	57	125	20	59	125	30	30
3&4-Methylphenol	108-39-4									
3,3'-Dichlorobenzidine	106-44-5	2.25	20	62	125	20	60	125	30	30
3,3'-Dichlorobenzidine	91-94-1	4.90	50	59	125	20	30	150	30	30
3-Nitroaniline	99-09-2	4.98	10	65	125	20	30	144	30	30
4,6-Dinitro-2-methylphenol	534-52-1	3.51	10	37	125	20	30	125	30	30
4-Bromophenylphenyl ether	101-55-3	2.38	10	71	125	20	68	125	30	30
4-Chloro-3-methylphenol	59-50-7	1.56	10	70	125	20	67	125	30	30
4-Chloroaniline	106-47-8	3.59	50	45	125	20	30	126	30	30
4-Chlorophenylphenyl ether	7005-72-3	1.42	10	71	125	20	71	125	30	30
4-Nitroaniline	100-01-6	4.34	10	67	125	20	30	138	30	30
4-Nitrophenol	100-02-7	3.36	10	57	125	20	59	125	30	30
Acenaphthene	83-32-9	1.63	10	70	125	20	72	125	30	30
Acenaphthylene	208-96-8	2.22	10	70	125	20	72	125	30	30
Anthracene	120-12-7	2.43	10	71	125	20	69	125	30	30
Benzo(a)anthracene	56-55-3	5.00	10	70	125	20	70	125	30	30
Benzo(a)pyrene	50-32-8	2.37	10	68	125	20	65	125	30	30
Benzo(b)fluoranthene	205-99-2	2.49	10	70	125	20	69	125	30	30
Benzo(g,h,i)perylene	191-24-2	2.48	10	68	125	20	66	125	30	30
Benzo(k)fluoranthene	207-08-9	2.76	10	68	125	20	66	125	30	30
bis(2-Chloroethoxy)methane	111-91-1	1.52	10	59	125	20	65	125	30	30
bis(2-Chloroisopropyl)ether	108-60-1	2.23	10	54	125	20	39	125	30	30
bis(2-Ethylhexyl)phthalate	117-81-7	2.34	10	44	125	20	56	125	30	30
bis(2-Chloroethyl) ether	111-44-4	2.30	10	56	125	20	49	125	30	30
Butylbenzylphthalate	85-68-7	1.89	10	69	125	20	71	125	30	30
Carbazole	86-74-8	2.63	10	71	125	20	71	125	30	30
Chrysene	218-01-9	2.30	10	70	125	20	69	125	30	30
Dibenz(a,h)anthracene	53-70-3	1.80	10	69	125	20	67	125	30	30
Dibenzofuran	132-64-9	2.30	10	71	125	20	74	125	30	30
Diethylphthalate	84-66-2	2.43	10	70	125	20	73	125	30	30
Dimethylphthalate	131-11-3	2.31	10	71	125	20	72	125	30	30
Di-n-butylphthalate	84-74-2	2.42	10	72	125	20	72	125	30	30
Di-n-octylphthalate	117-84-0	1.70	10	70	125	20	72	125	30	30
Fluoranthene	206-44-0	2.48	10	72	125	20	70	125	30	30
Fluorene	86-73-7	2.33	10	71	125	20	74	125	30	30
Hexachloro-1,3-butadiene	87-68-3	1.67	10	53	125	20	56	125	30	30
Hexachlorobenzene	118-74-1	2.59	10	69	125	20	67	125	30	30
Hexachloroethane	67-72-1	1.65	10	30	125	20	49	125	30	30
Indeno(1,2,3-cd)pyrene	193-39-5	1.77	10	68	125	20	66	125	30	30
Isophorone	78-59-1	1.56	10	66	125	20	70	125	30	30
Naphthalene	91-20-3	2.00	10	58	125	20	64	125	30	30



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8270 Water by SW3520

Method/Prep Code ck/ef
KC/ef

Nitrobenzene	98-95-3	2.47	10	52	125	20	61	125	30	30
N-Nitrosodimethylamine	62-75-9	2.28	10	37	125	20	50	125	30	30
N-Nitroso-di-n-propylamine	621-64-7	2.30	10	59	125	20	65	125	30	30
N-Nitrosodiphenylamine	86-30-6	3.91	10	70	125	20	31	125	30	30
Pentachlorophenol	87-86-5	2.20	20	50	125	20	30	138	30	30
Phenanthrene	85-01-8	2.51	10	72	125	20	71	125	30	30
Phenol	108-95-2	2.21	10	55	125	20	54	125	30	30
Pyrene	129-00-0	2.44	10	71	125	20	72	125	30	30

				LCS/LCSD	
				Lower	Upper
Surrogates					
2,4,6-Tribromophenol (S)	118-79-6			61	125
2-Fluorobiphenyl (S)	321-60-8			35	125
2-Fluorophenol (S)	367-12-4			51	125
Nitrobenzene-d5 (S)	4165-60-0			54	125
Phenol-d6 (S)	13127-88-3			55	125
Terphenyl-d14 (S)	1718-51-0			65	125



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8015 Diesel

Method Codes: GS/CF
GS/gO

Solid

Analyte	MDL (mg/kg)	PRL (mg/kg)	LCS/LCSD			MS/MSD			DUP
			Lower	Upper	RPD	Lower	Upper	RPD	RPD
TPH-Diesel Range Organics (C10-C28)	0.280	1	70	130	25	70	130	25	25
TPH (C10-C40)	0.180	1	70	130	25	70	130	25	25
TPH-Motor Oil	5.000	10	70	130	25	70	130	25	25
TPH-Hydraulic Oil	5.000	10	70	130	25	70	130	25	25
TPH-Jet Fuel	0.500	1	70	130	25	70	130	25	25
TPH-Kerosene	0.320	1	70	130	25	70	130	25	25
TPH-Mineral Oil	5.000	10	70	130	25	70	130	25	25
Surrogate									
n-Octacosane (s)			70	130					

Water

Analyte	MDL (mg/L)	PRL (mg/L)	LCS/LCSD			MS/MSD			DUP
			Lower	Upper	RPD	Lower	Upper	RPD	RPD
TPH-Diesel Range Organics (C10-C28)	14	50	70	130	25	70	130	25	25
TPH (C10-C40)	14	50	70	130	25	70	130	25	25
TPH-Motor Oil	8.1	100	70	130	25	70	130	25	25
TPH-Hydraulic Oil	39	100	70	130	25	70	130	25	25
TPH-Jet Fuel	31	100	70	130	25	70	130	25	25
TPH-Kerosene	25	50	70	130	25	70	130	25	25
TPH-Mineral Oil	50	100	70	130	25	70	130	25	25
Surrogate									
n-Octacosane (s)			70	130					



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260B

Method/Prep Code fl/19

Med Lvl Soil

Analyte	CAS#	MDL (mg/kg)	PRL (mg/kg)	LCS/LCSD			MS/MSD			DUP
				Lower	Upper	RPD	Lower	Upper	RPD	RPD
1,1,1,2-Tetrachloroethane	630-20-6	0.02	0.25	70	130	25	70	130	25	25
1,1,1-Trichloroethane	71-55-6	0.017	0.25	70	130	25	70	130	25	25
1,1,2,2-Tetrachloroethane	79-34-5	0.013	0.25	70	130	25	70	130	25	25
1,1,2-Trichloroethane	79-00-5	0.016	0.25	70	130	25	70	130	25	25
1,1,2-Trichlorotrifluoroethane	76-13-1	0.01	0.25	50	150	25	50	150	25	25
1,1-Dichloroethane	75-34-3	0.0105	0.25	70	130	25	70	130	25	25
1,1-Dichloroethene	75-35-4	0.012	0.25	70	130	25	70	130	25	25
1,1-Dichloropropene	563-58-6	0.0185	0.25	70	130	25	70	130	25	25
1,2,3-Trichlorobenzene	87-61-6	0.0105	0.25	65	130	25	65	130	25	25
1,2,3-Trichloropropane	96-18-4	0.021	0.25	70	130	25	70	130	25	25
1,2,4-Trichlorobenzene	120-82-1	0.024	0.25	70	130	25	70	130	25	25
1,2,4-Trimethylbenzene	95-63-6	0.019	0.25	70	130	25	70	130	25	25
1,2-Dibromo-3-chloropropane	96-12-8	0.05	0.25	70	130	25	70	130	25	25
1,2-Dibromoethane (EDB)	106-93-4	0.0165	0.25	70	130	25	70	130	25	25
1,2-Dichlorobenzene	95-50-1	0.0095	0.25	70	130	25	70	130	25	25
1,2-Dichloroethane	107-06-2	0.0145	0.25	70	130	25	70	130	25	25
1,2-Dichloroethene (Total)	540-59-0	0.0165	0.25	70	130	25	70	130	25	25
1,2-Dichloropropane	78-87-5	0.0145	0.25	70	130	25	70	130	25	25
1,3,5-Trimethylbenzene	108-67-8	0.0095	0.25	70	130	25	70	130	25	25
1,3-Dichlorobenzene	541-73-1	0.0075	0.25	70	130	25	70	130	25	25
1,3-Dichloropropane	142-28-9	0.011	0.25	70	130	25	70	130	25	25
1,4-Dichlorobenzene	106-46-7	0.01	0.25	70	130	25	70	130	25	25
2,2-Dichloropropane	594-20-7	0.0145	0.25	70	130	25	70	130	25	25
2-Butanone (MEK)	78-93-3	0.105	2.5	50	150	25	50	150	25	25
2-Chloroethylvinyl ether	110-75-8	0.049	1	50	150	25	50	150	25	25
2-Chlorotoluene	95-49-8	0.0295	0.25	70	130	25	70	130	25	25
2-Hexanone	591-78-6	0.085	2.5	50	150	25	50	150	25	25
4-Chlorotoluene	106-43-4	0.0295	0.25	70	130	25	70	130	25	25
4-Methyl-2-pentanone (MIBK)	108-10-1	0.065	2.5	50	150	25	50	150	25	25
Acetone	67-64-1	0.125	2.5	50	150	25	50	150	25	25



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Method Detection Limits and Reporting Limits
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Acrolein	107-02-8	0.36	1	50	150	25	50	150	25	25
Acrylonitrile	107-13-1	0.08	2.5	50	150	25	50	150	25	25
Benzene	71-43-2	0.0145	0.25	70	130	25	70	130	25	25
Bromobenzene	108-86-1	0.11	0.25	70	130	25	70	130	25	25
Bromochloromethane	74-97-5	0.012	0.25	70	130	25	70	130	25	25
Bromodichloromethane	75-27-4	0.0165	0.25	70	130	25	70	130	25	25
Bromoform	75-25-2	0.023	0.25	70	140	25	70	140	25	25
Bromomethane	74-83-9	0.25	1	55	130	25	55	130	25	25
Carbon tetrachloride	56-23-5	0.0165	0.25	70	130	25	70	130	25	25
Chlorobenzene	108-90-7	0.0255	0.25	70	130	25	70	130	25	25
Chloroethane	75-00-3	0.0135	0.25	70	130	25	70	130	25	25
Chloroform	67-66-3	0.0155	0.25	70	130	25	70	130	25	25
Chloromethane	74-87-3	0.019	0.25	60	130	25	60	130	25	25
cis-1,2-Dichloroethene	156-59-2	0.15	0.25	70	130	25	70	130	25	25
cis-1,3-Dichloropropene	10061-01-5	0.0135	0.25	70	130	25	70	130	25	25
Dibromochloromethane	124-48-1	0.0175	0.25	70	130	25	70	130	25	25
Dibromomethane	74-95-3	0.013	0.25	70	130	25	70	130	25	25
Dichlorodifluoromethane	75-71-8	0.01	0.25	40	135	25	40	135	25	25
Diisopropyl ether	108-20-3	0.017	0.25	70	130	25	70	130	25	25
Ethanol	64-17-5	0.245	2.5	25	180	25	25	180	25	25
Ethyl-tert-butyl ether	637-92-3	0.014	0.25	65	130	25	65	130	25	25
Ethylbenzene	100-41-4	0.007	0.25	70	130	25	70	130	25	25
Gasoline Range Organics		0.5	50	70	130	25	50	150	25	25
Hexachloro-1,3-butadiene	87-68-3	0.0195	0.25	70	130	25	70	130	25	25
Isopropylbenzene (Cumene)	98-82-8	0.011	0.25	70	130	25	70	130	25	25
m&p-Xylene	179601-23-1	0.021	0.25	70	130	25	70	130	25	25
Methyl-tert-butyl ether	1634-04-4	0.0125	0.25	60	130	25	60	130	25	25
Methylene Chloride	75-09-2	0.0125	0.25	70	130	25	70	130	25	25
Naphthalene	91-20-3	0.0205	0.25	70	130	25	70	130	25	25
n-Butylbenzene	104-51-8	0.0125	0.25	70	130	25	70	130	25	25
n-Propylbenzene	103-65-1	0.015	0.25	70	130	25	70	130	25	25
o-Xylene	95-47-6	0.016	0.25	70	130	25	70	130	25	25
p-Isopropyltoluene	99-87-6	0.008	0.25	70	130	25	70	130	25	25



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Method Detection Limits and Reporting Limits
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sec-Butylbenzene	135-98-8	0.008	0.25	70	130	25	70	130	25	25
Styrene	100-42-5	0.0075	0.25	70	130	25	70	130	25	25
tert-Amylmethyl ether	994-05-8	0.0155	0.25	70	130	25	70	130	25	25
tert-Butyl Alcohol	75-65-0	0.085	0.25	70	130	25	70	130	25	25
tert-Butylbenzene	98-06-6	0.0165	0.25	70	130	25	70	130	25	25
TPH as Gas		0.5	50	70	130	25	50	150	25	25
Tetrachloroethene	127-18-4	0.0105	0.25	70	130	25	70	130	25	25
Tetrahydrofuran	109-99-9	0.135	5	50	150	25	50	150	25	25
Toluene	108-88-3	0.024	0.25	70	130	25	70	130	25	25
trans-1,2-Dichloroethene	156-60-5	0.0165	0.25	70	130	25	70	130	25	25
trans-1,3-Dichloropropene	10061-02-6	0.0165	0.25	70	130	25	70	130	25	25
Trichloroethene	79-01-6	0.016	0.25	70	130	25	70	130	25	25
Trichlorofluoromethane	75-69-4	0.0125	0.25	70	130	25	70	130	25	25
Vinyl acetate	108-05-4	0.0225	1	50	150	25	50	150	25	25
Vinyl chloride	75-01-4	0.0235	0.25	70	130	25	70	130	25	25
Xylene (Total)	1330-20-7	0.25	0.5	70	130	25	70	130	25	25

Surrogates				Lower	Upper
1,2-Dichloroethane-d4 (S)	17060-07-0			50	150
2-Bromochlorobenzene (S)	694-80-4			50	150
4-Bromofluorobenzene (S)	460-00-4			50	150
Toluene-d8 (S)	2037-26-5			50	150



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260B

Method/Prep Code fl/-

Analyte	CAS#	MDL (ug/L)	PRL (ug/L)	Lower	Upper	RPD	Lower	Upper	RPD	RPD
1,1,1,2-Tetrachloroethane	630-20-6	0.26	0.50	70	130	25	70	130	25	25
1,1,1-Trichloroethane	71-55-6	0.17	0.50	70	130	25	70	130	25	25
1,1,2,2-Tetrachloroethane	79-34-5	0.27	0.50	70	130	25	70	130	25	25
1,1,2-Trichloroethane	79-00-5	0.24	0.50	70	130	25	70	130	25	25
1,1,2-Trichlorotrifluoroethane	76-13-1	0.140	0.50	70	140	25	70	140	25	25
1,1-Dichloroethane	75-34-3	0.15	0.50	70	130	25	70	130	25	25
1,1-Dichloroethene	75-35-4	0.210	0.50	70	130	25	70	130	25	25
1,1-Dichloropropene	563-58-6	0.18	0.50	70	130	25	70	130	25	25
1,2,3-Trichlorobenzene	87-61-6	0.23	0.50	70	130	25	70	130	25	25
1,2,3-Trichloropropane	96-18-4	0.17	0.50	70	130	25	70	130	25	25
1,2,4-Trichlorobenzene	120-82-1	0.19	0.50	70	130	25	70	130	25	25
1,2,4-Trimethylbenzene	95-63-6	0.18	0.50	70	130	25	70	130	25	25
1,2-Dibromo-3-chloropropane	96-12-8	0.35	0.50	70	130	25	70	130	25	25
1,2-Dibromoethane (EDB)	106-93-4	0.18	0.50	70	130	25	70	130	25	25
1,2-Dichlorobenzene	95-50-1	0.17	0.50	70	130	25	70	130	25	25
1,2-Dichloroethane	107-06-2	0.16	0.50	70	130	25	70	130	25	25
1,2-Dichloroethene (Total)	540-59-0	0.18	0.50	70	130	25	70	130	25	25
1,2-Dichloropropane	78-87-5	0.19	0.50	70	130	25	70	130	25	25
1,3,5-Trimethylbenzene	108-67-8	0.16	0.50	70	130	25	70	130	25	25
1,3-Dichlorobenzene	541-73-1	0.19	0.50	70	130	25	70	130	25	25
1,3-Dichloropropane	142-28-9	0.23	0.50	70	130	25	70	130	25	25
1,4-Dichlorobenzene	106-46-7	0.2	0.50	70	130	25	70	130	25	25
1,4-Dioxane (p-Dioxane)	123-91-1	1.9	10.0	60	150	25	60	150	25	25
2,2,4-Trimethylpentane	540-84-1	1.25	5.0	70	130	25	70	130	25	25
2,2-Dichloropropane	594-20-7	0.2	0.50	70	130	25	70	130	25	25
2-Butanone (MEK)	78-93-3	0.45	5.0	50	150	25	50	150	25	25
2-Chloroethylvinyl ether	110-75-8	0.22	5.0	50	150	25	50	150	25	25
2-Chlorotoluene	95-49-8	0.48	1.0	70	130	25	70	130	25	25
2-Hexanone	591-78-6	0.34	5.0	50	150	25	50	150	25	25
4-Chlorotoluene	106-43-4	0.48	1.0	70	130	25	70	130	25	25
4-Methyl-2-pentanone (MIBK)	108-10-1	0.33	5.0	50	150	25	50	150	25	25
Acetone	67-64-1	1.100	5.0	70	130	25	70	130	25	25



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260B

Method/Prep Code fl/-

Acrolein	107-02-8	3.500	5.0	50	150	25	50	150	25	25
Acrylonitrile	107-13-1	0.85	5.0	50	150	25	50	150	25	25
Benzene	71-43-2	0.13	0.50	70	130	25	70	130	25	25
Bromobenzene	108-86-1	0.21	0.50	70	130	25	70	130	25	25
Bromochloromethane	74-97-5	0.150	0.50	70	130	25	70	130	25	25
Bromodichloromethane	75-27-4	0.13	0.50	70	130	25	70	130	25	25
Bromoform	75-25-2	0.18	0.50	70	135	25	70	135	25	25
Bromomethane	74-83-9	2.800	20.0	50	135	25	50	135	25	25
Carbon disulfide	75-15-0	0.130	0.50	70	135	25	70	135	25	25
Carbon tetrachloride	56-23-5	0.18	0.50	70	130	25	70	130	25	25
Chlorobenzene	108-90-7	0.19	0.50	70	130	25	70	130	25	25
Chlorodifluoromethane	75-45-6	0.18	5.00	70	130	25	70	130	25	25
Chloroethane	75-00-3	0.360	0.50	70	130	25	70	130	25	25
Chloroform	67-66-3	0.16	0.50	70	130	25	70	130	25	25
Chloromethane	74-87-3	0.380	0.50	70	130	25	70	130	25	25
cis-1,2-Dichloroethene	156-59-2	0.15	0.50	70	130	25	70	130	25	25
cis-1,3-Dichloropropene	10061-01-5	0.2	0.50	70	130	25	70	130	25	25
Dibromochloromethane	124-48-1	0.2	0.50	70	130	25	70	130	25	25
Dibromomethane	74-95-3	0.16	0.50	70	130	25	70	130	25	25
Dichlorodifluoromethane	75-71-8	0.280	0.50	65	140	25	65	140	25	25
Dichlorofluoromethane	75-43-4	0.28	0.50	70	130	25	70	130	25	25
Diisopropyl ether	108-20-3	0.14	0.50	70	130	25	70	130	25	25
Ethanol	64-17-5	3.5	5.00	70	130	25	70	130	25	25
Ethylbenzene	100-41-4	0.13	0.50	70	130	25	70	130	25	25
Ethyl-tert-butyl ether	637-92-3	0.14	0.50	70	130	25	70	130	25	25
Gasoline Range Organics		5.4	50.0	70	130	25	70	130	25	25
Hexachloro-1,3-butadiene	87-68-3	0.25	0.50	70	130	25	70	130	25	25
Isopropylbenzene (Cumene)	98-82-8	0.14	0.50	70	130	25	70	130	25	25
m&p-Xylene	179601-23-1	0.25	0.50	70	130	25	70	130	25	25
Methylene Chloride	75-09-2	0.260	5.0	70	130	25	70	130	25	25
Methyl-tert-butyl ether	1634-04-4	0.150	0.50	70	130	25	70	130	25	25
Naphthalene	91-20-3	0.13	0.50	70	130	25	70	130	25	25
n-Butylbenzene	104-51-8	0.18	0.50	70	130	25	70	130	25	25
n-Propylbenzene	103-65-1	0.19	0.50	70	130	25	70	130	25	25



Pace Analytical Services, Inc.
Method Detection Limits and Reporting Limits
for EPA 8260B

Method/Prep Code fl/-

o-Xylene	95-47-6	0.18	0.50	70	130	25	70	130	25	25
p-Isopropyltoluene	99-87-6	0.13	0.50	70	130	25	70	130	25	25
sec-Butylbenzene	135-98-8	0.17	0.50	70	130	25	70	130	25	25
Styrene	100-42-5	0.15	0.50	70	130	25	70	130	25	25
tert-Amylmethyl ether	994-05-8	0.16	0.50	70	130	25	70	130	25	25
tert-Butyl Alcohol	75-65-0	1.1	5.0	70	130	25	70	130	25	25
tert-Butylbenzene	98-06-6	0.19	0.50	70	130	25	70	130	25	25
Tetrachloroethene	127-18-4	0.23	0.50	70	130	25	70	130	25	25
Tetrahydrofuran	109-99-9	0.9	5.0	50	150	25	50	150	25	25
Toluene	108-88-3	0.18	0.50	70	130	25	70	130	25	25
TPH as Gas		5.4	50.0	70	130	25	70	130	25	25
trans-1,2-Dichloroethene	156-60-5	0.180	0.50	70	130	25	70	130	25	25
trans-1,3-Dichloropropene	10061-02-6	0.17	0.50	70	130	25	70	130	25	25
trans-1,4-Dichloro-2-butene	110-57-6	0.34	5.0	70	130	25	70	130	25	25
Trichloroethene	79-01-6	0.15	0.50	70	130	25	70	130	25	25
Trichlorofluoromethane	75-69-4	0.180	0.50	70	130	25	70	130	25	25
Vinyl acetate	108-05-4	0.26	5.0	50	150	25	50	150	25	25
Vinyl chloride	75-01-4	0.210	0.50	70	130	25	70	130	25	25
Xylene (Total)	1330-20-7	0.43	1.0	70	130	25	70	130	25	25

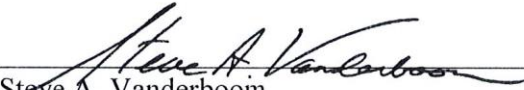
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QUALITY ASSURANCE MANUAL

Quality Assurance/Quality Control Policies and Procedures

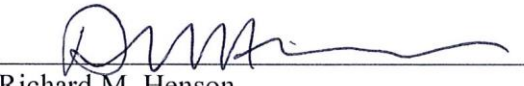
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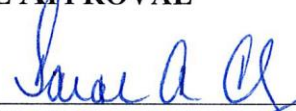
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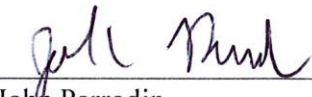
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1.0. INTRODUCTION AND ORGANIZATIONAL STRUCTURE

“Working together to protect our environment and improve our health”

Pace Analytical Services Inc. - Mission Statement

1.1. Introduction to PASI

1.1.1. Pace Analytical Services, Inc. (PASI) is a privately held, full-service analytical testing firm operating a nationwide system of laboratories. PASI offers extensive services beyond standard analytical testing, including: bioassay for aquatic toxicity, air toxics, dioxins and coplanar PCB's by high resolution mass spectroscopy, radiochemical analyses, product testing, pharmaceutical testing, field services and mobile laboratory capabilities. PASI has implemented a consistent Quality System in each of its laboratories and service centers. In addition, the company utilizes an advanced data management system that is highly efficient and allows for flexible data reporting. Together, these systems ensure data reliability and superior on-time performance. This document defines the Quality System and QA/QC protocols.

1.1.2. Our goal is to combine our expertise in laboratory operations with customized solutions to meet the specific needs of our customers.

1.2. Statement of Purpose

1.2.1. To meet the business needs of our customers for high quality, cost-effective analytical measurements and services.

1.3. Quality Policy Statement and Goals of the Quality System

1.3.1. PASI management is committed to maintaining the highest possible standard of service for our customers by following a documented quality system that is fully compliant with the applicable NELAC, TNI, or ISO standards and is in accordance with the stated methods and customer requirements. The overall objective of this quality system is to provide reliable data of known quality through adherence to rigorous quality assurance policies and quality control procedures as documented in this Quality Assurance Manual.

1.3.2. All personnel within the PASI network are required to be familiar with all facets of the quality system relevant to their position and implement these policies and procedures in their daily work. This daily focus on quality is applied with initial project planning, continued through all field and laboratory activities, and is ultimately included in the final report generation.

1.3.3. PASI management demonstrates its commitment to quality by providing the resources, including facilities, equipment, and personnel to ensure the adherence to these documented policies and procedures and to promote the continuous improvement and effectiveness of the quality system. All PASI personnel must comply with all current applicable state, federal, and industry standards (2003 NELAC Standard, 2009 TNI Standard, ISO/IEC 17025 standard, etc.), and are required to perform all tests in accordance with stated methods and customer requirements.

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1.4. Core Values

1.4.1. **Integrity-** Pace personnel are required to abide by the PASI Code of Ethics and all Pace employees must go through Data Integrity/Ethics training upon initial orientation and as an annual refresher.

1.4.2. **Value Employees-** Pace management views employees as our most important asset and communicates to them the relevance and importance of their activities within their job functions and how they contribute to the achievement of the objectives of the quality management system.

1.4.3. **Know Our Customers-** Pace makes every effort to know our customers and address their sampling and analytical needs. More information on this item can be found in section 2.0.

1.4.4. **Honor Commitments-** Pace labs focus on making solid commitments with regards to quality, capacity, and agreed upon turnaround time to our customers.

1.4.5. **Flexible Response To Demand-** Pace labs are equipped with both the material and personnel resources to enable them to be responsive to the demands of customers when situations or projects need change.

1.4.6. **Pursue Opportunities-** Pace is committed to pursuing opportunities for the growth of the company by constantly exploring markets and areas where we can expand.

1.4.7. **Continuously Improve-** Pace has committed much time and effort into establishing a continuous improvement program where company personnel meet on a regular basis to share ideas in cost reduction, production improvement and standardization in order to develop best practices. This information, as well as company financial and production metrics, are tracked, evaluated, and shared with each Pace facility.

1.5. Code of Ethics

1.5.1. PASI's fundamental ethical principles are as follows:

1.5.1.1. Each PASI employee is responsible for the propriety and consequences of his or her actions;

1.5.1.2. Each PASI employee must conduct all aspects of Company business in an ethical and strictly legal manner, and must obey the laws of the United States and of all localities, states and nations where PASI does business or seeks to do business;

1.5.1.3. Each PASI employee must reflect the highest standards of honesty, integrity and fairness on behalf of the Company with customers, suppliers, the public, and one another.

1.5.1.4. Each PASI employee must recognize and understand that our daily activities in environmental laboratories affect public health as well as the environment and that environmental laboratory analysts are a critical part of the system society depends upon to improve and guard our natural resources:

1.5.2. Strict adherence by each PASI employee to this Code of Ethics and to the Standards of Conduct is essential to the continued vitality of PASI and to continue the pursuit of our common mission to protect our environment and improve our health.

1.5.3. Failure to comply with the Code of Ethics and Standards of Conduct will result in disciplinary action up to and including termination and referral for civil or criminal prosecution

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where appropriate. An employee will be notified of an infraction and given an opportunity to explain, as prescribed under current disciplinary procedures.

1.5.4. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.6. Standards of Conduct

1.6.1. Data Integrity

1.6.1.1. The accuracy and integrity of the analytical results and its supporting documentation produced at PASI are the cornerstones of the company. Lack of data integrity is an assault on our most basic values putting PASI and its employees at grave financial and legal risk and will not be tolerated. Therefore, employees are to accurately prepare and maintain all technical records, scientific notebooks, calculations, and databases. Employees are prohibited from making false entries or misrepresentations of data for any reason.

1.6.1.2. Managerial staff must make every effort to ensure that personnel are free from any undue pressures that may affect the quality or integrity of their work including commercial, financial, over-scheduling, and working condition pressures.

1.6.2. Confidentiality

1.6.2.1. PASI employees must not use or disclose confidential or proprietary information except when in connection with their duties at PASI. This is effective over the course of employment and for an additional period of two years thereafter.

1.6.2.2. Confidential or proprietary information, belonging to either PASI and/or its customers, includes but is not limited to test results, trade secrets, research and development matters, procedures, methods, processes and standards, company-specific techniques and equipment, marketing and customer information, inventions, materials composition, etc.

1.6.3. Conflict of Interest

1.6.3.1. PASI employees must avoid situations that might involve a conflict of interest or could appear questionable to others. The employee must be careful in two general areas:

1.6.3.1.1. Participation in activities that conflict or appear to conflict with the employees' PASI responsibilities.

1.6.3.1.2. Offering or accepting anything that might influence the recipient or cause another person to believe that the recipient may be influenced to behave or in a different manner than he would normally. This includes bribes, gifts, kickbacks, or illegal payments.

1.6.3.2. Employees are not to engage in outside business or economic activity relating to a sale or purchase by the Company. Other problematic activities include service on the Board of Directors of a competing or supplier company, significant ownership in a competing or supplier company, employment for a competing or supplier company, or participation in any outside business during the employee's work hours.

1.6.4. Compliance

1.6.4.1. All employees are required to read, understand, and comply with the various components of the standards listed in this document. As confirmation that they understand their responsibility, each

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employee is required to sign an acknowledgment form annually that then becomes part of the employee's permanent record. Employees will be held accountable for complying with the Quality Systems as summarized in the Quality Assurance Manual.

1.7. Laboratory Organization

1.7.1. The PASI Corporate Office centralizes company-wide accounting, business development, financial management, human resources development, information systems, marketing, quality, safety, and training activities. PASI's Director of Quality is responsible for assisting the development, implementation and monitoring of quality programs for the company. See Attachment IIB for the Corporate Organizational structure.

1.7.2. Each laboratory within the system operates with local management, but all labs share common systems and receive support from the Corporate Office.

1.7.3. A Senior General Manager (SGM) oversees all laboratories and service centers in their assigned region. Each laboratory or facility in the company is then directly managed by an SGM, a General Manager (GM), an Assistant General Manager (AGM), or an Operations Manager (OM). Quality Managers (QM) or Senior Quality Managers (SQM) at each laboratory report directly to the highest level of local laboratory management, however named, that routinely makes day-to-day decisions regarding that facility's operations. The QMs and SQMs will also receive guidance and direction from the corporate Director of Quality.

1.7.4. The SGM, GM, AGM or OM, or equivalent functionality in each facility, bears the responsibility for the laboratory operations and serves as the final, local authority in all matters. In the absence of these managers, the SQM/QM serves as the next in command, unless the manager in charge has assigned another designee. He or she assumes the responsibilities of the manager, however named, until the manager is available to resume the duties of their position. In the absence of both the manager and the SQM/QM, management responsibility of the laboratory is passed to the Technical Director, provided such a position is identified, and then to the most senior department manager until the return of the lab manager or SQM/QM. The most senior department manager in charge may include the Client Services Manager or the Administrative Business Manager at the discretion of the SGM/GM/AGM/OM.

1.7.5. A Technical Director who is absent for a period of time exceeding 15 consecutive calendar days shall designate another full-time staff member meeting the qualifications of the technical director to temporarily perform this function. The laboratory SGM/GM/AGM/OM or SQM/QM has the authority to make this designation in the event the existing Technical Director is unable to do so. If this absence exceeds 35 consecutive calendar days, the primary accrediting authority shall be notified in writing.

1.7.6. The SQM/QM has the responsibility and authority to ensure the Quality System is implemented and followed at all times. In circumstances where a laboratory is not meeting the established level of quality or following the policies set forth in this Quality Assurance Manual, the SQM/QM has the authority to halt laboratory operations should he or she deem such an action necessary. The SQM/QM will immediately communicate the halting of operations to the SGM/GM/AGM/OM and keep them posted on the progress of corrective actions. In the event the SGM/GM/AGM/OM and the SQM/QM are not in agreement as to the need for the suspension, the Chief Operating Officer and Director of Quality will be called in to mediate the situation.

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1.7.7. The lab is required to appoint deputies for key managerial personnel. These deputies must be documented for auditing purposes.

1.7.8. The technical staff of the laboratory is generally organized into the following functional groups:

- Organic Sample Preparation
- Wet Chemistry Analysis
- Metals Analysis
- Volatiles Analysis
- Semi-volatiles Analysis
- Radiochemical Analysis
- Microbiology

1.7.9. Appropriate support groups are present in each laboratory. The actual organizational structure for PASI – Davis is listed in Attachment IIA. In the event of a change in SGM/GM/AGM/OM, SQM/QM, or any Technical Director, the laboratory will notify its accrediting authorities and revise the organizational chart in the Quality Assurance Manual (QAM) within 30 days. For changes in Department Managers or Supervisors or other laboratory personnel, no notifications will be sent to the laboratory's accrediting agencies; changes to the organizational chart will be updated during or prior to the annual review process. Changes or additions in these key personnel will also be noted by additional signatures on the QAM, as applicable. In any case, the QAM will remain in effect until the next scheduled revision.

1.8. Laboratory Job Descriptions

1.8.1. Senior General Manager

- Oversees all functions of all the operations within their designated region;
- Oversees the development of local GMs/AGMs/OMs within their designated region;
- Oversees and authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Oversees the preparation of budgets and staffing plans for all operations within their designated region;
- Ensures compliance with all applicable state, federal and industry standards;
- Works closely with Regional Sales Management.

1.8.2. General Manager

- Oversees all functions of their assigned operations;
- Authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation;
- Prepares budgets and staffing plans;
- Monitors the Quality Systems of the laboratory and advises the SQM/QM accordingly;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.3. Assistant General Manager / Operations Manager

- In the absence of the SGM/GM, performs all duties as listed above for the SGM or GM;

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- Oversees the daily production and quality activities of all departments;
- Manages all departments and works with staff to ensure department objectives are met;
- Works with all departments to ensure capacity and customer expectations are accurately understood and met;
- Works with SGM/GM to prepare appropriate budget and staffing plans for all departments;
- Responsible for prioritizing personnel and production activities within all departments;
- Performs formal and informal performance reviews of departmental staff.

1.8.4. Senior Quality Manager

- Provides quality oversight for multiple laboratories where there is not a local quality manager or for labs where there are multiple and separately distinct quality systems in the same facility;
- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality;
- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;
- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;
- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;
- Monitors corrective and preventive actions;
- Maintains the currency of the Quality Manual.

1.8.5. Quality Manager

- Responsible for implementing, maintaining and improving the quality system while functioning independently from laboratory operations. Reports directly to the highest level of local laboratory facility management, however named, that routinely makes day-to-day decisions regarding laboratory operations, but receives direction and assistance from the Corporate Director of Quality. They may also report to a Senior Quality Manager;

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- Ensures that communication takes place at all levels within the lab regarding the effectiveness of the quality system and that all personnel understand their contributions to the quality system;
- Monitors Quality Assurance/Quality Control activities to ensure that the laboratory achieves established standards of quality (as set forth by the Corporate Quality office). The Quality Manager is responsible for reporting the lab's level of compliance to these standards to the Corporate Director of Quality on a quarterly basis;
- Maintains records of quality control data and evaluates data quality;
- Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or customer representatives;
- Reviews and maintains records of proficiency testing results;
- Maintains the document control system;
- Assists in development and implementation of appropriate training programs;
- Provides technical support to laboratory operations regarding methodology and project QA/QC requirements;
- Maintains certifications from federal and state programs;
- Ensures compliance with all applicable state, federal and industry standards;
- Maintains the laboratory training records, including those in the Learning Management System (LMS), and evaluates the effectiveness of training;
- Monitors corrective and preventive actions;
- Maintains the currency of the Quality Manual.

1.8.6. Quality Assurance Analyst

- Assists the SQM/QM in the performance of quality department responsibilities as delegated by the SQM/QM;
- Assists in monitoring QA/QC data;
- Assists in internal audits;
- Assists in maintaining training records;
- Assists in maintaining the document control system;

1.8.7. Technical Director

- Monitors the standards of performance in quality assurance and quality control data;
- Monitors the validity of analyses performed and data generated;
- Reviews tenders, contracts and QAPPs to ensure the laboratory can meet the data quality objectives for any given project;
- Serves as the manager of the laboratory in the absence of the SGM/GM/AGM/OM and SQM/QM;
- Provides technical guidance in the review, development, and validation of new methodologies.

1.8.8. Administrative Business Manager

- Responsible for financial and administrative management for the entire facility;
- Provides input relative to tactical and strategic planning activities;
- Organizes financial information so that the facility is run as a fiscally responsible business;

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- Works with staff to confirm that appropriate processes are put in place to track revenues and expenses;
- Provide ongoing financial information to the SGM/GM/AGM/OM and the management team so they can better manage their business;
- Utilizes historical information and trends to accurately forecast future financial positions;
- Works with management to ensure that key measurements are put in place to be utilized for trend analysis—this will include personnel and supply expenses, and key revenue and expense ratios;
- Works with SGM/GM/AGM/OM to develop accurate budget and track on an ongoing basis;
- Works with entire management team to submit complete and justified capital budget requests and to balance requests across departments;
- Works with project management team and administrative support staff to ensure timely and accurate invoicing.

1.8.9. Client Services Manager

- Oversees all the day to day activities of the Client Services Department which includes Project Management and, possibly, Sample Control;
- Responsible for staffing and all personnel management related issues for Client Services;
- Serves as the primary senior consultant to customers on all project related issues such as set up, initiation, execution and closure;
- Performs or is capable of performing all duties listed for that of Project Manager.

1.8.10. Project Manager

- Coordinates daily activities including taking orders, reporting data and analytical results;
- Serves as the primary technical and administrative liaison between customers and PASI;
- Communicates with operations staff to update and set project priorities;
- Provides results to customers in the requested format (verbal, hardcopy, electronic, etc.);
- Works with customers, laboratory staff, and other appropriate PASI staff to develop project statements of work or resolve problems of data quality;
- Responsible for solicitation of work requests, assisting with proposal preparation and project initiation with customers and maintain customer records;
- Mediation of project schedules and scope of work through communication with internal resources and management;
- Responsible for preparing routine and non-routine quotations, reports and technical papers;
- Interfaces between customers and management personnel to achieve customer satisfaction;
- Manages large-scale complex projects;
- Supervises less experienced project managers and provide guidance on management of complex projects;
- Arranges bottle orders and shipment of sample kits to customers;
- Verifies login information relative to project requirements and field sample Chains-of-Custody.

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1.8.11. Project Coordinator

- Responsible for preparation of project specifications and provides technical/project support;
- Coordinates project needs with other department sections and assists with proposal preparation;
- Prepares routine proposals and invoicing;
- Responsible for scanning, copying, assembling and binding final reports;
- Other duties include filing, maintaining forms, process outgoing mail, maintaining training database and data entry.

1.8.12. Department Manager/Supervisor

- Oversees the day-to-day production and quality activities of their assigned department;
- Ensures that quality assurance and quality control criteria of analytical methods and projects are satisfied;
- Assesses data quality and takes corrective action when necessary;
- Approves and releases technical and data management reports;
- Ensures compliance with all applicable state, federal and industry standards.

1.8.13. Group Supervisor/Leader

- Trains analysts in laboratory operations and analytical procedures;
- Organizes and schedules analyses with consideration for sample holding times;
- Implements data verification procedures by assigning data verification duties to appropriate personnel;
- Evaluates instrument performance and supervises instrument calibration and preventive maintenance programs;
- Reports non-compliance situations to laboratory management including the SQM/QM.

1.8.14. Laboratory Analyst

- Performs detailed preparation and analysis of samples according to published methods and laboratory procedures;
- Processes and evaluates raw data obtained from preparation and analysis steps;
- Generates final results from raw data, performing primary review against method criteria;
- Monitors quality control data associated with analysis and preparation. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks;
- Reports data in LIMS, authorizing for release pending secondary approval;
- Conducts routine and non-routine maintenance of equipment as required;
- Performs or is capable of performing all duties associated with that of Laboratory Technician.

1.8.15. Laboratory Technician

- Prepares standards and reagents according to published methods or in house procedures;
- Performs preparation and analytical steps for basic laboratory methods;
- Works under the direction of a Laboratory Analyst on complex methodologies;

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- Assists Laboratory Analysts on preparation, analytical or data reduction steps for complex methodologies;
- Monitors quality control data as required or directed. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

1.8.16. Sample Management Personnel

- Signs for incoming samples and verifies the data entered on the Chain of custody forms;
- Enters the sample information into the Laboratory Information Management System (LIMS) for tracking and reporting;
- Stages samples according to EPA requirements;
- Assists Project Managers and Coordinators in filling bottle orders and sample shipments.

1.8.17. Systems Administrator or Systems Manager

- Assists with the creation and maintenance of electronic data deliverables (EDDs);
- Coordinates the installation and use of all hardware, software and operating systems;
- Performs troubleshooting on all aforementioned systems;
- Trains new and existing users on systems and system upgrades;
- Maintains all system security passwords;
- Maintains the electronic backups of all computer systems.

1.8.18. Safety/Chemical Hygiene Officer

- Maintains the laboratory Chemical Hygiene Plan;
- Plans and implements safety policies and procedures;
- Maintains safety records;
- Organizes and/or performs safety training;
- Performs safety inspections and provides corrective/preventative actions;
- Assists personnel with safety issues.

1.8.19. Program Director/Hazardous Waste Coordinator (or otherwise named)

- Evaluates waste streams and helps to select appropriate waste transportation and disposal companies;
- Maintains complete records of waste disposal including waste manifests and state reports;
- Assists in training personnel on waste-related issues such as waste handling and storage, waste container labeling, proper satellite accumulation, secondary containment, etc.;
- Conducts a weekly inspection of the waste storage areas of the laboratory.

1.9. Training and Orientation

1.9.1. Training for Pace employees is managed through a web-based Learning Management System. After a new employee has been instructed in matters of human resources, they are given instructional materials for the LMS and a password for access.

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1.9.2. A new hire training checklist is provided to the new employee that lists training items for the employee to work through either independently on LMS or with their supervisor or trainer. The training items that can be completed independently include:

- Reading through applicable Standard Operating Procedures;
- Reviewing the Quality Manual and Chemical Hygiene Plan;
- Core training modules such as quality control indicators, basic laboratory skills, etc.;
- Quality Systems training including traceability of measurements, method calibration, calibration verification, accuracy, precision and uncertainty of measurements, corrective actions, documentation, and root cause analysis;
- Data Integrity/Ethics training.

1.9.3. The new employee's Department Supervisor provides the employee with a basic understanding of the role of the laboratory within the structure of PASI and the basic elements of that individual's position. Supervised training uses the following techniques:

- Hands-on training
- Training checklists/worksheets
- Lectures and training sessions
- Method-specific training
- Conferences and seminars
- Short courses
- Specialized training by instrument manufacturers
- Proficiency testing programs.
- On-line courses

1.9.4. Group Supervisors/Leaders are responsible for providing documentation of training and proficiency for each employee under their supervision. The employee's training file indicates what procedures an analyst or a technician is capable of performing, either independently or with supervision. The files also include documentation of continuing capability, which are fully detailed in Section 3.4. Training documentation files for each person are maintained by the Quality Office either in hardcopy format or within the LMS.

1.9.5. All procedures and training records are maintained and available for review during laboratory audits. These procedures are reviewed/updated periodically by laboratory management. Additional information can be found in SOP S-ALL-Q-020 **Training and Employee Orientation** or its equivalent revision or replacement.

1.10. Data Integrity System

1.10.1. The data integrity system at PASI provides assurances to management that a highly ethical approach is being applied to all planning, training and implementation of methods. Data integrity is crucial to the success of our company and Pace Analytical is committed to creating and maintaining a culture of quality throughout the organization. To accomplish this goal, PASI has implemented a data integrity system that encompasses the following four requirements:

1.10.1.1. A data integrity training program: standardized training is given to each new employee and a yearly refresher is presented to all employees. Key topics addressed by this training include:

- 1.10.1.1.1. Need for honesty and transparency in analytical reporting

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- 1.10.1.1.2. Process for reporting data integrity issues
- 1.10.1.1.3. Specific examples of unethical behavior and improper practices
- 1.10.1.1.4. Documentation of non-conforming data that is still useful to the data user
- 1.10.1.1.5. Consequences and punishments for unethical behavior
- 1.10.1.1.6. Examples of monitoring devices used by management to review data and systems

1.10.1.2. Signed data integrity documentation for all employees: this includes a written quiz following the Ethics training session and written agreement to abide by the Code of Ethics and Standards of Conduct explained in the employee manual.

1.10.1.3. In-depth, periodic monitoring of data integrity including peer data review and validation, internal raw data audits, proficiency testing studies, etc.

1.10.1.4. Documentation of any review or investigation into possible data integrity infractions. This documentation, including any disciplinary actions involved, corrective actions taken, and notifications to customers must be retained for a minimum of five years.

1.10.2. PASI management makes every effort to ensure that personnel are free from any undue pressures that affect the quality of their work including commercial, financial, over scheduling, and working condition pressures.

1.10.3. Corporate management also provides all PASI facilities a mechanism for confidential reporting of data integrity issues that ensures confidentiality and a receptive environment in which all employees are comfortable discussing items of ethical concern. The anonymous message line is monitored by the Corporate Director of Quality who will ensure that all concerns are evaluated and, where necessary, brought to the attention of executive management and investigated. Any Pace employee can contact corporate management to report an ethical concern by calling the anonymous hotline at 612-607-6431.

1.11. Laboratory Safety

1.11.1. It is the policy of PASI to make safety and health an integral part of daily operations and to ensure that all employees are provided with safe working conditions, personal protective equipment, and requisite training to do their work without injury. Each employee is responsible for his/her own safety as well as those working in the immediate area by complying with established company rules and procedures. These rules and procedures as well as a more detailed description of the employees' responsibilities are contained in the corporate Safety Manual and Chemical Hygiene Plan.

1.12. Security and Confidentiality

1.12.1. Security is maintained by controlled access to laboratory buildings. Exterior doors to laboratory buildings remain either locked or continuously monitored by PASI staff. Keyless door lock combinations and computer access codes/logins are changed periodically. Posted signs direct visitors to the reception office and mark all other areas as off limits to unauthorized personnel. All visitors, including PASI staff from other facilities, must sign the Visitor's Logbook maintained by the receptionist. A staff member will accompany them during the duration of their stay on the premises unless the SGM/GM/AGM/OM, SQM/QM, or Technical Director specify otherwise. In this instance, the staff member will escort the visitor back to the reception area at the end of his/her visit where he/she

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signs out. The last staff member to leave their department for the day must ensure that all outside access points to that area are secure.

1.12.2. Additional security is provided where necessary, (e.g., specific secure areas for sample, data, and customer report storage), as requested by customers, or cases where national security is of concern. These areas are lockable within the facilities, or are securely offsite. Access is limited to specific individuals or their designees. Security of sample storage areas is the responsibility of the Client Services Manager or Sample Management Personnel. Security of samples and data during analysis and data reduction is the responsibility of Group Supervisors. Security of customer report archives is the responsibility of the Client Services Manager. These secure areas are locked whenever these individuals or their designees are not present in the facility.

1.12.3. Access to designated laboratory sample storage locations is limited to authorized personnel only. Provisions for lock and key access are provided. No samples are to be removed without proper authorization. If requested by customer or contract, samples are not to be removed from secure storage areas without filling out an associated internal chain of custody.

1.12.4. Standard business practices of confidentiality are applied to all documents and information regarding customer analyses. Specific protocols for handling confidential documents are described in PASI SOPs. Additional protocols for sample identification by internal laboratory identification numbers only are implemented as required under contract specific Quality Assurance Project Plans (QAPPs).

1.12.5. All information pertaining to a particular customer, including national security concerns will remain confidential. Data will be released to outside agencies only with written authorization from the customer or where federal or state law requires the company to do so.

1.13. Communications

1.13.1. Management within each lab bears the responsibility of ensuring that appropriate communication processes are established and that communication takes place regarding the effectiveness of the management/quality system. These communication processes may include email, regular staff meetings, senior management meetings, etc.

1.13.2. Corporate management bears the responsibility of ensuring that appropriate communication processes are established within the network of facilities and that communication takes place at a company-wide level regarding the effectiveness of the management/quality systems of all Pace facilities. These communication processes may include email, quarterly continuous improvement conference calls for all lab departments, and annual continuous improvement meetings for all department supervisors, quality managers, client services managers, and other support positions.

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2.0. SAMPLE CUSTODY

2.1. Sampling Support

2.1.1. Each individual PASI laboratory provides shipping containers, properly preserved sample containers, custody documents, and field quality control samples to support field-sampling events. Guidelines for sample container types, preservatives, and holding times for a variety of methods are listed in Attachment VIII. Note that all analyses listed are not necessarily performed at all PASI laboratories and there may be additional laboratory analyses performed that are not included in these tables. Customers are encouraged to contact their local Pace Project Manager for questions or clarifications regarding sample handling. PASI - Davis may provide pick-up and delivery services to their customers when needed.

2.2. Field Services

2.2.1. Pace Analytical has a large Field Services Division which is based in their Minneapolis facility as well as limited field service capabilities in some of our other facilities. Field Services provides comprehensive nationwide service offerings including:

- Stack Testing
- Ambient Air
- CEM Certification Testing
- Air Quality Monitoring
- Onsite Analytical Services- FTIR and GC
- Real-time Process Diagnostic/Optimization Testing
- Wastewater, Groundwater and Drinking Water Monitoring
- Storm Water and Surface Water Monitoring
- Soil and Waste Sampling
- Mobile Laboratory Services

2.2.2. Field Services operates under the PASI Corporate Quality System, with applicable and necessary provisions to address the activities, methods, and goals specific to Field Services. All procedures and methods used by Field Services are documented in Standard Operating Procedures and Procedure Manuals.

2.3. Project Initiation

2.3.1. Prior to accepting new work, the laboratory reviews its performance capability. The laboratory confirms that sufficient personnel, equipment capacity, analytical method capability, etc., are available to complete the required work. Customer needs, certification requirements, and data quality objectives are defined and the appropriate sampling and analysis plan is developed to meet the project requirements by project managers or sales representatives. Members of the management staff review current instrument capacity, personnel availability and training, analytical procedures capability, and projected sample load. Management then informs the sales and client services personnel whether or not the laboratory can accept the new project via written correspondence, email, and/or daily operations meetings.

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2.3.2. The laboratory maintains records of all such reviews, including discussions with customers. Routine analytical project documentation of quotes, notes, dates, initials, and/or recordings is maintained in a project folder by project management. Conditions for new and more complex contracts are determined by the SGM/GM/AGM/OM and sales representatives. Quality Management is consulted on technical requirements and operations staff provides input on volume capacities. Evidence of these reviews is maintained in the form of awarded Request for Proposals (RFPs), signed quotes or contracts, and a Customer Relationship Management (CRM) database. If a review identifies a potential mismatch between customer requirements and laboratory capabilities and/or capacities, Pace will specify its level of commitment by listing these exceptions to the requirements within the RFP, quote or contract.

2.3.3. Additional information regarding specific procedures for reviewing new work requests can be found in SOP S-MN-Q-270 **Review of Analytical Requests** or its equivalent revision or replacement.

2.4. Chain of Custody

2.4.1. A chain of custody (COC) provides the legal documentation of samples from time of collection to completion of analysis. PASI has implemented Standard Operating Procedures to ensure that sample custody traceability and responsibility objectives are achieved for every project.

2.4.2. Field personnel or client representatives must complete a chain of custody for all samples that are received by the laboratory. The importance of completeness of COCs is stressed to the samplers and is critical to efficient sample receipt and to insure the requested methods are used to analyze the correct samples.

2.4.3. If sample shipments are not accompanied by the correct documentation, the Sample Receiving department notifies a Project Manager. The Project Manager then obtains the correct documentation/information from the customer in order for analysis of samples to proceed.

2.4.4. The sampler is responsible for providing the following information on the chain of custody form:

- Customer project name
- Project location or number
- Field sample number/identification
- Date and time sampled
- Sample matrix
- Preservative
- Requested analyses
- Sampler signature
- Relinquishing signature
- Date and time relinquished
- Sampler remarks as needed
- Custody Seal Number if present
- Regulatory Program Designation
- The state where the samples were collected to ensure all applicable state requirements are met

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- Turnaround time requested
- Purchase order number

2.4.5. The COC is filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through the initial entry and initialing and dating the change. All transfers of samples are recorded on the chain of custody in the “relinquished” and “received by” sections. All information except signatures is printed.

2.4.6. Additional information can be found in S-DAV-C-001 **Sample Management** or its equivalent revision or replacement.

2.5. Sample Acceptance Policy

2.5.1. In accordance with regulatory guidelines, PASI complies with the following sample acceptance policy for all samples received.

2.5.2. If the samples do not meet the sample receipt acceptance criteria outlined below, the laboratory is required to document all non-compliances, contact the customer, and either reject the samples or fully document any decisions to proceed with analyses of samples which do not meet the criteria. Any results reported from samples not meeting these criteria are appropriately qualified on the final report.

2.5.3. All samples must:

- Have unique customer identification that is clearly marked with indelible ink on durable waterproof labels affixed to the sample containers that match the chain of custody.
- Have clear documentation on the chain of custody related to the location of the sampling site with the time and date of sample collection.
- Have the sampler’s name and signature.
- Have all requested analyses clearly designated on the COC.
- Have clear documentation of any special analytical or data reporting requirements.
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be correctly preserved unless the method allows for laboratory preservation.
- Be received within holding time. Any samples with hold times that are exceeded will not be processed without prior customer approval.
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without customer approval.
- Be received within appropriate temperature ranges - not frozen but $\leq 6^{\circ}\text{C}$ ^(See Note 1), unless program requirements or customer contractual obligations mandate otherwise ^(see Note 2). The cooler temperature is recorded directly on the COC and the SCUR. Samples that are delivered to the laboratory immediately after collection are considered acceptable if there is evidence that the chilling process has been started. For example, by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the customer will be notified. The analysis will NOT proceed unless otherwise directed by the customer. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the customer is contacted to avoid missing the hold time. Data associated with any deviations from the above sample acceptance policy requirements will be appropriately qualified.

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Note 1: Temperature will be read and recorded based on the precision of the measuring device. For example, temperatures obtained from a thermometer graduated to 0.1°C will be read and recorded to ±0.1°C. Measurements obtained from a thermometer graduate to 0.5°C will be read to ±0.5°C. Measurements read at the specified precision are not to be rounded down to meet the ≤6°C limit

Note 2: Some microbiology methods allow sample receipt temperatures of up to 10°C. Consult the specific method for microbiology samples received above 6°C prior to initiating corrective action for out of temperature preservation conditions.

Note 3: Biological Tissue Samples must be received at the following temperature based on program and contract: frozen at ≤0°C; frozen at ≤ - 10°C, or cooled ≤6°C. TNI rules also apply if the samples are brought straight from the field; they are acceptable if evidence of cooling is present (i.e., received on ice).

2.5.4. Upon sample receipt, the following items are also checked and recorded:

- Presence of custody seals or tapes on the shipping containers;
- Sample condition: Intact, broken/leaking, bubbles in VOA samples;
- Sample holding time;
- Sample pH and residual chlorine when required;
- Appropriate containers.

2.5.5. Samples for drinking water analysis that are improperly preserved, or are received past holding time, are rejected at the time of receipt, with the exception of VOA samples that are tested for pH at the time of analysis.

2.5.6. Additional information can be found in S-DAV-C-001 **Sample Management** or its equivalent revision or replacement.

2.6. Sample Log-in

2.6.1. After sample inspection, all sample information on the chain of custody is entered into the Laboratory Information Management System (LIMS). This permanent record documents receipt of all sample containers including:

- Customer name and contact
- Customer number
- Pace Analytical project number
- Pace Analytical Project Manager
- Sample descriptions
- Due dates
- List of analyses requested
- Date and time of laboratory receipt
- Field ID code
- Date and time of collection
- Any comments resulting from inspection for sample rejection

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2.6.2. All samples received are logged into the LIMS within one working day of receipt. Sample login may be delayed due to customer clarification of analysis needed, corrective actions for sample receipt non-conformance, or other unusual circumstances. If the time collected for any sample is unspecified and Pace is unable to obtain this information from the customer, the laboratory will use 08:00 as the time sampled. All hold times will be based on this sampling time and qualified accordingly if exceeded.

2.6.3. The LIMS automatically generates a unique identification number for each sample created in the system. The LIMS sample number follows the general convention of BB-XXXXXX-YYY. The BB represents the laboratory identification within Pace's laboratory network. The 5 digit "X" number represents the project number followed by a 3 digit sample number. The project number is a sequential number that is assigned as a new project is created. The sample number corresponds to the number of samples submitted by the client. In addition to the unique sample ID, there is a sample container ID that consists of the sample number, the container type (e.g. BP1U), and bottle 1 of Y, where Y represents the total number of container of that particular type. Together the sample LIMS number and sample container ID number create a unique barcode encryption that can be linked to the sample analysis requested by the client. This unique identification number is placed on the sample container as a durable label and becomes the link between the laboratory's sample management system and the customer's field identification; it will be a permanent reference number for all future interactions.

2.6.4. Sample labels are printed from the LIMS and affixed to each sample container.

2.6.5. Samples with hold times that are near expiration date/time may be sent directly to the laboratory for analysis at the discretion of the Project Manager and/or SGM/GM/AGM/OM.

2.6.6. Additional information can be found in S-DAV-C-001 **Sample Management** or its equivalent revision or replacement.

2.7. Sample Storage

2.7.1. Storage Conditions

2.7.1.1. Samples are stored away from all standards, reagents, or other potential sources of contamination. Samples are stored in a manner that prevents cross contamination. Volatile samples are stored separately from other samples. All sample fractions, extracts, leachates, and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method.

2.7.1.2. Storage blanks are stored with volatile samples and are used to measure cross-contamination acquired during storage. If applicable, laboratories must have documented procedures and criteria for evaluating storage blanks, appropriate to the types of samples being stored.

2.7.1.3. Additional information can be found in S-MN-Q-263 **Monitoring Temperature Controlled Units**.

2.7.2. Temperature Monitoring

2.7.2.1. Samples are taken to the appropriate storage location immediately after sample receipt and check-in procedures are completed. All sample storage areas are located in limited access areas and are monitored to ensure sample integrity.

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2.7.2.2. The temperature of each refrigerated storage area is maintained at $\leq 6^{\circ}\text{C}$ (but above freezing) unless state or program requirements differ. The temperature of each freezer storage area is maintained at $< -10^{\circ}\text{C}$ unless state or program requirements differ. The temperature of each storage area is checked and documented each day of use (each calendar day). If the temperature falls outside the acceptable limits, the following corrective actions are taken and appropriately documented:

- The temperature is rechecked after two hours to verify temperature exceedance. Corrective action is initiated and documented if necessary.
- The SQM/QM and/or laboratory management are notified if the problem persists.
- The samples are relocated to a proper environment if the temperature cannot be maintained after corrective actions are implemented.
- The affected customers are notified.
- Documentation is provided on analytical report.

Additional information can be found in S-MN-Q-263 **Monitoring Temperature Controlled Units**.

2.7.3. Hazardous Materials

2.7.3.1. Pure product or potentially heavily contaminated samples must be tagged as "hazardous" or "lab pack" and stored separately from other samples.

2.7.4. Foreign/Quarantined Soils

2.7.4.1. Depending on the soil disposal practices of the laboratory, foreign soils and soils from USDA regulated areas are adequately segregated to enable proper sample disposal. The USDA requires these samples to be incinerated or sterilized by an approved treatment procedure. Additional information regarding USDA regulations and sample handling can be found in applicable local laboratory SOPs.

2.7.4.2. Additional information on sample storage can be found in S-DAV-C-001 **Sample Management** or its equivalent revision or replacement and in S-DAV-W-001 **Waste Handling and Management**.

2.8. Sample Protection

2.8.1. PASI laboratory facilities are operated under controlled access protocols to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted at all times.

2.8.2. Samples are removed from storage areas by designated personnel and returned to the storage areas, if necessary, immediately after the required sample quantity has been taken.

2.8.3. Upon customer request, additional and more rigorous chain of custody protocols for samples and data can be implemented. For example, some projects may require internal chain-of-custody protocols.

2.8.4. Additional information can be found in S-DAV-C-001 **Sample Management** or its equivalent revision or replacement.

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2.9. Subcontracting Analytical Services

2.9.1. Every effort is made to perform all analyses for PASI customers within the laboratory that receives the samples. When subcontracting to a laboratory other than the receiving laboratory, whether inside or outside the PASI network, becomes necessary, a preliminary verbal communication with that laboratory is undertaken. Customers are notified in writing of the laboratory's intention to subcontract any portion of the testing to another laboratory. Work performed under specific protocols may involve special considerations.

2.9.2. Prior to subcontracting samples to a laboratory outside Pace Analytical, the potential subcontract laboratory will be pre-qualified by verifying that the subcontractor meets the following criteria:

- All certifications required for the proposed subcontract are in effect,
- Sufficient professional liability and other required insurance coverage is in effect, and
- Is not involved in legal action by any federal, state, or local government agency for data integrity issues and has not been convicted in such investigation at any time during the past 5 years.

2.9.3. The contact and preliminary arrangements are made between the PASI Project Manager and the appropriate subcontract laboratory personnel. The specific terms of the subcontract laboratory agreement include:

- Method of analysis
- Number and type of samples expected
- Project specific QA/QC requirements
- Deliverables required
- Laboratory certification requirement
- Price per analysis
- Turn-around time requirements

2.9.4. Chain-of-custody forms are generated for samples requiring subcontracting to other laboratories. Sample receiving personnel re-package the samples for shipment, create a transfer chain of custody form and record the following information:

- Pace Analytical Laboratory Number
- Matrix
- Requested analysis
- Special instructions regarding turnaround, required detection or reporting limits, or any unusual information known about the samples or analytical procedure.
- Signature in "Relinquished By"

2.9.5. All subcontracted sample data reports are sent to the PASI Project Manager. Pace will provide a copy of the subcontractor's report to the client when requested.

2.9.6. Any Pace Analytical work sent to other labs within the PASI network is handled as subcontracted work and all final reports are labeled clearly with the name of the laboratory performing the work. Any non-TNI work is clearly identified. PASI will not be responsible for analytical data if the subcontract laboratory was designated by the customer.

2.9.7. Additional information can be found in S-DAV-C-002 **Subcontracting Samples** or its equivalent revision or replacement.

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2.10. Sample Retention and Disposal

2.10.1. Samples, extracts, digestates, and leachates must be retained by the laboratory for the period of time necessary to protect the interests of the laboratory and the customer.

2.10.2. Unused portions of samples are retained by each laboratory based on program or customer requirements for sample retention and storage. The minimum sample retention time is 45 days from receipt of the samples. Samples requiring thermal preservation may be stored at ambient temperature when the hold time is expired, the report has been delivered, and/or allowed by the customer, program, or contract. Samples requiring storage beyond the minimum sample retention time due to special requests or contractual obligations may be stored at ambient temperature unless the laboratory has sufficient capacity and their presence does not compromise the integrity of other samples.

2.10.3. After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste. The preferred method for disposition of hazardous samples is to return the excess sample to the customer. If it is not feasible to return samples, or the customer requires PASI to dispose of excess samples, proper arrangements will be made for disposal by an approved contractor.

2.10.4. Additional information can be found in S-DAV-W-001 **Waste Handling and Management** and S-DAV-C-001 **Sample Management** or their equivalent revisions or replacements.

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3.0. ANALYTICAL CAPABILITIES

3.1. Analytical Method Sources

3.1.1. PASI laboratories are capable of analyzing a full range of environmental samples from a variety of matrices, including air, surface water, wastewater, groundwater, soil, sediment, biota, and other waste products. The latest valid editions of methodologies are applied from regulatory and professional sources including EPA, ASTM, USGS, NIOSH, Standard Methods, and State Agencies. Section 11 is a representative listing of general analytical protocol references. PASI discloses in writing to its customers and regulatory agencies any instances in which modified methods are being used in the analysis of samples.

3.1.2. In the event of a customer-specific need, instrumentation constraint or regulatory requirement, PASI laboratories reserve the right to use valid versions of methods that may not be the most recent edition available.

3.2. Analytical Method Documentation

3.2.1. The primary form of PASI laboratory documentation of analytical methods is the Standard Operating Procedure (SOP). SOPs contain pertinent information as to what steps are required by an analyst to successfully perform a procedure. The required contents for the SOPs are specified in the company-wide SOP template for Preparation of SOPs (SOT-ALL-Q-001).

3.2.2. The SOPs may be supplemented by other training materials that further detail how methods are specifically performed. This training material will undergo periodic, documented review along with the other Quality System documentation.

3.3. Analytical Method Validation and Instrument Validation

3.3.1. In some situations, PASI develops and validates methodologies that may be more applicable to a specific problem or objective. When non-standard methods are required for specific projects or analytes of interest, or when the laboratory develops or modifies a method, the laboratory validates the method prior to applying it to customer samples. Method validity is established by meeting criteria for precision and accuracy as established by the data quality objectives specified by the end user of the data. The laboratory records the validation procedure, the results obtained and a statement as to the usability of the method. The minimum requirements for method validation include evaluation of sensitivity, quantitation, precision, bias, and selectivity of each analyte of interest.

3.3.2. Additional information can be found in SOP S-MN-Q-252 **Method Validation and Modification Studies**, or equivalent replacement.

3.4. Demonstration of Capability (DOC)

3.4.1. Analysts complete an initial demonstration of capability (IDOC) study prior to performing a method or when there is a change in instrument type, personnel, or test method, or at any time that a method has not been performed by the laboratory or analyst in a 12-month period. The mean recovery and standard deviation of each analyte, taken from 4 replicates of a quality control standard is calculated and compared to method criteria (if available) or established laboratory criteria for

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evaluation of acceptance. Each laboratory maintains copies of all demonstrations of capability, including those that fail acceptance criteria and corresponding raw data for future reference and must document the acceptance criteria prior to the analysis of the DOC. Demonstrations of capability are verified on an annual basis.

3.4.2. For Continuing Demonstrations of Capability, the laboratories may use Performance Testing (PT) samples in lieu of the 4-replicate approach listed above. For methods or procedures that do not lend themselves to the “4-replicate” approach, the demonstration of capability requirements will be specified in the applicable SOP. Drinking Water DOCs must be done at or below the MCL.

3.4.3. Additional information can be found in SOP S-ALL-Q-020 **Training and Employee Orientation** or its equivalent revision or replacement.

3.5. Regulatory and Method Compliance

3.5.1. PASI understands that expectations of our customers commonly include the assumption that laboratory data will satisfy specific regulatory requirements. Therefore PASI attempts to ascertain, prior to beginning a project, what applicable regulatory jurisdiction, agency, or protocols apply to that project. This information is also required on the chain of custody submitted with samples.

3.5.2. PASI makes every effort to detect regulatory or project plan inconsistencies, based upon information from the customer, and communicate them immediately to the customer in order to aid in the decision making process. PASI will not be liable if the customer chooses not to follow PASI recommendations.

3.5.3. It is PASI policy to disclose in a forthright manner any detected noncompliance affecting the usability of data produced by our laboratories. The laboratory will notify customers within 30 days of fully characterizing the nature of the nonconformance, the scope of the nonconformance and the impact it may have on data usability.

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4.0. QUALITY CONTROL PROCEDURES

Quality control data is analyzed and where they are found to be outside pre-defined criteria, planned action is taken to correct the problem in order to prevent incorrect results from being reported. Quality control samples are to be processed in the same manner as client samples.

4.1. Method Blank

4.1.1. A method blank is used to evaluate contamination in the preparation/analysis system and is processed through all preparation and analytical steps with its associated samples.

4.1.2. A method blank is processed at a minimum frequency of one per preparation batch (see glossary section of this document for further clarification of the definition of batch). In the case of a method that has no separate preparation step, a method blank is processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.1.3. The method blank consists of a matrix similar to the associated samples that is known to be free of analytes of interest. Method blanks are not applicable for certain analyses, such as pH, conductivity, flash point and temperature.

4.1.4. Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater than 1/10 of the amount of that analyte found in any associated sample. Some labs, due to client requirements, etc., may have to evaluate their method blanks down to ½ the reporting limit or down to the method detection limit as opposed to the reporting limit itself. Corrective actions for blank contamination may include the re-preparation and re-analysis of all samples (where possible) and quality control samples. Data qualifiers must be applied to results that are considered affected by contamination in a method blank.

4.1.5. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.2. Laboratory Control Sample

4.2.1. The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis.

4.2.2. An LCS is processed at a minimum frequency of one per preparation batch. In the case of a method that has no separate preparation step, an LCS will be processed with no more than 20 samples of a specific matrix performed by the same analyst, using the same method, standards, and reagents.

4.2.3. The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes.

4.2.4. The LCS contains **all** analytes specified by a specific method or by the customer or regulatory agency, which may include full list of target compounds, with certain exceptions. These exceptions may include analyzing only specific Aroclors when PCB analysis is requested or not spiking with all EPA Appendix IX compounds when a full Appendix IX list of compounds is requested. However, the lab must ensure that all target components in its scope of accreditation are included in the spike

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mixture for the LCS over a two (2) year period. In the absence of specified components, the laboratory will spike the LCS with the following compounds:

- For multi-peak analytes (e.g. PCBs, technical chlordane, toxaphene), a representative standard will be processed.
- For methods with long lists of analytes, a representative number of target analytes may be chosen. The following criteria is used to determine the number of LCS compounds used:
 - For methods with 1-10 target compounds, the laboratory will spike with all compounds;
 - For methods with 11-20 target compounds, the laboratory will spike with at least 10 compounds or 80%, whichever is greater;
 - For methods with greater than 20 compounds, the laboratory will spike with at least 16 compounds.

4.2.5. The LCS is evaluated against the method default or laboratory-derived acceptance criteria. For those methods that require laboratory-derived limits, method default control limits may be used until the laboratory has a minimum of 20, but preferably greater than 30, data points from which to derive internal acceptance criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Any associated sample containing an 'out-of-control' compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier. When the acceptance criteria for the LCS are exceeded high, and there are associated samples that are non-detects, then those non-detects can be reported with data qualifiers, or when the acceptance criteria are exceeded low, those associated sample results may be reported if they exceed the maximum regulatory limit/decision level with data qualifiers.

4.2.6. For LCSs containing a large number of analytes, it is statistically likely that a few recoveries will be outside of control limits. This does not necessarily mean that the system is out of control, and therefore no corrective action would be necessary (except for proper documentation). TNI has allowed for a minimum number of marginal exceedances, defined as recoveries that are beyond the LCS control limits (3X the standard deviation) but less than the marginal exceedance limits (4X the standard deviation). The number of allowable exceedances depends on the number of compounds in the LCS. If more analyte recoveries exceed the LCS control limits than is allowed (see below) or if any one analyte exceeds the marginal exceedance limits, then the LCS is considered non-compliant and corrective actions are necessary. The number of allowable exceedances is as follows:

- >90 analytes in the LCS- 5 analytes
- 71-90 analytes in the LCS- 4 analytes
- 51-70 analytes in the LCS- 3 analytes
- 31-50 analytes in the LCS- 2 analytes
- 11-30 analytes in the LCS- 1 analyte
- <11 analytes in the LCS- no analytes allowed out)

Note: the use of marginal exceedances is not approved for work from the state of South Carolina.

4.2.7. A matrix spike (MS) can be used in place of a non-compliant LCS in a batch as long as the MS passes the LCS acceptance criteria (this is a TNI allowance). Note: the use of the MS to replace a non-compliant LCS is not approved for work from the state of South Carolina. When this happens, full documentation must be made available to the data user. If this is not allowed by a customer or regulatory body, the associated samples must be rerun with a compliant LCS (if possible) or reported with appropriate data qualifiers.

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4.2.8. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.3. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

4.3.1. A matrix spike (MS) is used to determine the effect of the sample matrix on compound recovery for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch unless the MS is actually used as the LCS.

4.3.2. A **Matrix Spike/Matrix Spike Duplicate** (MS/MSD) set is processed at a frequency specified in a particular method or as determined by a specific customer request. This frequency will be specified in the applicable method SOP or customer QAPP. In the absence of such requirements, an MS/MSD set is routinely analyzed once per every 20 samples per matrix per method.

4.3.3. The MS and MSD consist of the sample matrix that is then spiked with known concentrations of target analytes. Laboratory personnel spike customer samples that are specifically designated as MS/MSD samples or, when no designated samples are present in a batch, randomly select samples to spike that have adequate sample volume or weight. Spiked samples are prepared and analyzed in the same manner as the original samples and are selected from different customers if possible.

4.3.4. The MS and MSD contain all analytes specified by a specific method or by the customer or regulatory agency. In the absence of specified components, the laboratory will spike the MS/MSD with the same number of compounds as previously discussed in the LCS section. However, the lab must ensure that all targeted components in its scope of accreditation are included in the spike mixture for the MS/MSD over a two (2) year period.

4.3.5. The MS and MSD are evaluated against the method or laboratory derived criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site specific information.

4.3.6. A matrix spike and sample duplicate will be performed instead of a matrix spike and matrix spike duplicate when specified by the customer or method.

4.3.7. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.4. Sample Duplicate

4.4.1. A sample duplicate is a second portion of sample that is prepared and analyzed in the laboratory along with the first portion. It is used to measure the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific customer.

4.4.2. The sample and duplicate are evaluated against the method or laboratory derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

4.4.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

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4.5. Surrogates

4.5.1. Surrogates are compounds that reflect the chemistry of target analytes and are typically added to samples for organic analyses to monitor the effect of the sample matrix on compound recovery.

4.5.2. Surrogates are added to each customer sample (for applicable organics), method blank, LCS, MS, and calibration standard prior to extraction or analysis. The surrogates are evaluated against the method or laboratory derived acceptance criteria or against project-specific acceptance criteria specified by the client, if applicable. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures are typically re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error. An exception to this would be samples that have high surrogate values but no reportable hits for target compounds. These samples would be reported, with a qualifier, because the implied high bias would not affect the final results. For methods with multiple surrogates, documentation regarding acceptance and associated compounds will be found in the individual method SOPs.

4.5.3. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.6. Internal Standards

4.6.1. Internal Standards are method-specific analytes added to every standard, method blank, laboratory control sample, matrix spike, matrix spike duplicate, sample, and calibration standard at a known concentration, prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. At a minimum, the laboratory will follow method specific guidelines for the treatment of internal standard recoveries as they are related to the reporting of data. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.6.2. Deviations made from this policy must be approved by the SQM/QM prior to release of the data.

4.7. Field Blanks

4.7.1. Field blanks are blanks prepared at the sampling site in order to monitor for contamination that may be present in the environment where samples are collected. These field quality control samples are often referenced as field blanks, rinsate blanks, or equipment blanks. The laboratory analyzes these field blanks as normal samples and informs the customer if there are any target compounds detected above the reporting limits.

4.8. Trip Blanks

4.8.1. Trip blanks are blanks that originate from the laboratory as part of the sampling event and are used to monitor for contamination of samples during transport. These blanks accompany the empty sample containers to the field and then accompany the collected samples back to the laboratory. These blanks are routinely analyzed for volatile methods where ambient background contamination is likely to occur.

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4.9. Limit of Detection (LOD)

4.9.1. PASI laboratories are required to use a documented procedure to determine a limit of detection for each analyte of concern in each matrix reported. All sample processing steps of the preparation and analytical methods are included in this determination including any clean ups. For any test that does not have a valid LOD, sample results below the limit of quantitation (LOQ) cannot be reported.

4.9.2. The LOD is initially established for the compounds of interest for each method in a clean matrix with no target analytes present and no interferences at a concentration that would impact the results. The LOD is then determined every time there is a change in the test method that affects how the test is performed or when there has been a change in the instrument that affects the sensitivity. If required by customer, method or accreditation body, the LOD will be re-established annually for all applicable methods.

4.9.3. Unless otherwise noted, the method used by PASI laboratories to determine LODs is based on the Method Detection Limit (MDL) procedure outlined in 40 CFR Part 136, Appendix B. Where required by regulatory program or customer, the above referenced procedure will be followed.

4.9.4. Where specifically stated in the published method, LODs or MDLs will be performed at the listed frequency.

4.9.5. The validity of the LOD must be shown by detection (a value above zero) of the analytes in a QC sample in each quality system matrix. The QC sample must contain the analyte at no more than 3X the LOD for a single analyte test and 4X the LOD for multiple analyte tests. This verification must be performed on each instrument used for sample analysis and reporting of data. The validity of the LOD must be verified as part of the LOD determination process. This verification must be done prior to the use of the LOD for sample analysis.

4.9.6. An LOD study is not required for any analyte for which spiking solutions or quality control samples are not available such as temperature.

4.9.7. The LOD, if required, shall be verified annually for each quality system matrix, technology and analyte. In lieu of performing full LOD (MDL) studies annually, the laboratory can verify the LOD (MDL) on an annual basis, providing this verification is fully documented and does not contradict other customer or program requirements that the laboratory must follow. The requirements of this verification are:

- The spike concentration of the verification must be no more than 3X times the LOD for single analyte tests and 4X the LOD for multiple analyte tests.
- The laboratory must verify the LOD on each instrument used for the reporting of sample data.
- The laboratory must be able to identify all target analytes in the verification standard (distinguishable from noise).

4.9.8. Additional information can be found in SOP S-MN-Q-269 **Determination of LOD and LOQ** or its equivalent revision or replacement.

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4.10. Limit of Quantitation (LOQ)

4.10.1. A limit of quantitation (LOQ) for every analyte of concern must be determined. For PASI laboratories, this LOQ is referred to as the RL, or Reporting Limit. This RL is based on the lowest calibration standard concentration that is used in each initial calibration. Results below this level are not allowed to be reported without qualification since the results would not be substantiated by a calibration standard. For methods with a determined LOD, results can be reported out below the LOQ but above the LOD if they are properly qualified (e.g., J flag).

4.10.2. The LOQ must be higher than the LOD.

4.10.3. To verify the LOQ, the laboratory will prepare a sample in the same matrix used for the LCS. The sample will be spiked with each target analyte at a concentration equivalent to the RL or 2X the RL. This sample must undergo the routine sample preparation procedure including any routine sample cleanup steps. The sample is then analyzed and the recovery of each target analyte determined. The recovery for each target analyte must meet the laboratories current control limits for an LCS. The annual LOQ verification is not required if the LOD was determined or verified annually on that instrument.

4.10.4. Additional information can be found in SOP S-MN-Q-269 **Determination of LOD and LOQ** or its equivalent revision or replacement.

4.11. Estimate of Analytical Uncertainty

4.11.1. PASI laboratories can provide an estimation of uncertainty for results generated by the laboratory. The estimate quantifies the error associated with any given result at a 95% confidence interval. This estimate does not include bias that may be associated with sampling. The laboratory has a procedure in place for making this estimation. In the absence of a regulatory or customer-specific procedure, PASI laboratories base this estimation on the recovery data obtained from the Laboratory Control Spikes. The uncertainty is a function of the standard deviation of the recoveries multiplied by the appropriate Student's t Factor at 95% confidence. Additional information pertaining to the estimation of uncertainty and the exact manner in which it is derived are contained in the SOP S-MN-Q-255 **Estimation of Measurement Uncertainty** or its equivalent revision or replacement.

4.11.2. The measurement of uncertainty is provided only on request by the customer, as required by specification or regulation and when the result is used to determine conformance within a specification limit.

4.12. Proficiency Testing (PT) Studies

4.12.1. PASI laboratories participate in the TNI defined proficiency testing program. PT samples are obtained from NIST approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix.

4.12.2. The laboratory initiates an investigation whenever PT results are deemed 'unacceptable' by the PT provider. All findings and corrective actions taken are reported to the SQM/QM or their designee. A corrective action plan is initiated and this report is sent to the appropriate state accreditation agencies for their review. Additional PTs will be analyzed and reported as needed for certification purposes.

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4.12.3. PT samples are treated as typical customer samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

4.12.4. Comparison of analytical results with anyone participating in the same PT study is prohibited prior to the close of the study.

4.12.5. Additional information can be found in SOP S-MN-Q-258 **Proficiency Testing Program** or its equivalent revision or replacement.

4.13. Rounding and Significant Figures

4.13.1. In general, the PASI laboratories report data to no more than three significant digits. Therefore, all measurements made in the analytical process must reflect this level of precision. In the event that a parameter that contributes to the final result has less than three significant figures of precision, the final result must be reported with no more significant figures than that of the parameter in question. The rounding rules listed below are descriptive of the LIMS and not necessarily of any supporting program such as Excel.

4.13.2. Data is compared to the reporting limits and MDLs to determine if qualifiers are needed before the rounding step occurs.

4.13.3. **Rounding:** PASI-Davis follows the odd / even guidelines for rounding numbers:

- If the figure following the one to be retained is less than five, that figure is dropped and the retained ones are not changed (with three significant figures, 2.544 is rounded to 2.54).
- If the figure following the ones to be retained is greater than five, that figure is dropped and the last retained one is rounded up (with three significant figures, 2.546 is rounded to 2.55).
- If the figure following the ones to be retained is five and if there are no figures other than zeros beyond that five, then the five is dropped and the last figure retained is unchanged if it is even and rounded up if it is odd (with three significant figures, 2.525 is rounded to 2.52 and 2.535 is rounded to 2.54).

4.13.4. Significant Digits

4.13.4.1. PASI-Davis follows the following convention for reporting to a specified number of significant figures. Unless specified by federal, state, or local requirements or on specific request by a customer, the laboratory reports:

Values > 10 – Reported to 3 significant digits
 Values ≤ 10 – Reported to 2 significant digits

4.14. Retention Time Windows

4.14.1. When chromatographic conditions are changed, retention times and analytical separations are often affected. As a result, two critical aspects of any chromatographic method are the determination and verification of retention times and analyte separation. Retention time windows must be established for the identification of target analytes. The retention times of all target analytes

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in all calibration verification standards must fall within the retention time windows. If an analyte falls outside the retention time window in an ICV or CCV, new absolute retention time windows must be calculated, unless instrument maintenance fixes the problem. When a new column is installed, a new retention time window study must be performed.

4.14.2. One process for the production of retention time windows: Make 3 injections of all single component or multi-component analytes over a 72-hour period. Record the retention time in minutes for each analyte and surrogate to 3 decimal places. Calculate the mean and standard deviation of the three absolute retention times for each target analyte and surrogate. For multi-component analytes, choose 3-5 major peaks and calculate the mean and standard deviation for each of the peaks. If the standard deviation of the retention times of a target analyte is 0.000, the lab may use a default standard deviation of 0.01. The width of the retention time window for each analyte and surrogate and major peak in a multi-component analyte is defined as +/- 3 times the standard deviation of the mean absolute retention time established during that 72-hour period or 0.03 minutes, whichever is greater.

4.14.3. The center of the retention time window is established for each analyte and surrogate by using the absolute retention times from the CCV at the beginning of the analytical shift. For samples run with an initial calibration, use the retention time of the mid-point standard of the initial calibration curve.

4.14.4. For more information, please reference the local facility's analytical SOPs.

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5.0. DOCUMENT MANAGEMENT AND CHANGE CONTROL

5.1. Document Management

5.1.1. Additional information can be found in SOP S-MN-Q-258 **Document Control and Management** or its equivalent revision or replacement. Information on Pace's policy for electronic signatures can also be found in this SOP.

5.1.2. Pace Analytical Services, Inc. has an established procedure for managing documents that are part of the quality system. The list of managed documents includes, but is not limited to, Standard Operating Procedures (both technical and non-technical), Quality Assurance Manuals, quality policy statements, training documents, work-processing documents, charts, posters, memoranda, notices, forms, software, and any other procedures, tables, plans, etc. that have a direct bearing on the quality system (including applicable data records and non-technical documents).

5.1.3. A master list of all managed documents is maintained at each facility identifying the current revision status and distribution of the controlled documents. This establishes that there are no invalid or obsolete documents in use in the facility. All documents are reviewed periodically and revised if necessary. Obsolete documents are systematically discarded or archived for audit or knowledge preservation purposes.

5.1.4. Each managed document is uniquely identified to include the date of issue, the revision identification, page numbers, the total number of pages and the issuing authorities. For complete information on document numbering, refer to SOP S-ALL-Q-003 **Document Numbering**.

5.1.5. SOPs, specifically, are available to all laboratory staff via the Learning Management System (LMS) which is a secure repository that is accessed through an internet portal. As a local alternative to the hard copy system of controlled documents, secured electronic copies of controlled documents may be maintained on the laboratory's local server. These document files must be read-only for all personnel except the Quality Department and system administrator. Other requirements for this system are as follows:

- Electronic documents must be readily accessible to all facility employees.
- Electronic documents must be locked from printing. All hardcopy SOPs must be obtained from the Quality Department.

5.1.6. **Quality Assurance Manual (QAM):** The Quality Assurance Manual is the company-wide document that describes all aspects of the quality system for PASI. The base QAM template is distributed by the Corporate Quality Department to each of the SQMs/QMs. The local management personnel modify the necessary and permissible sections of the base template and submit those modifications to the Corporate Director of Quality for review. Once approved and signed by both the CEO and the Director of Quality; the SGM/GM/AGM/OM, the SQM/QM, and any Technical Directors sign the Quality Assurance Manual. Each SQM/QM is then in charge of distribution to employees, external customers or regulatory agencies and maintaining a distribution list of controlled document copies. The Quality Assurance Manual template is reviewed on an annual basis by all of the PASI SQMs/QMs and revised accordingly by the Director of Quality.

5.1.7. **Standard Operating Procedures (SOPs)**

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5.1.7.1. SOPs fall into two categories: company-wide documents and facility specific documents. Company-wide SOPs start with the prefix S-ALL- and local SOPs start with the individual facility prefix.

5.1.7.2. The purpose of the company-wide SOPs is to establish policies and procedure that are common and applicable to all PASI facilities. Company-wide SOPs are document-controlled by the corporate quality office and signed copies are distributed to all of the SQMs/QMs. The local management personnel sign the company-wide SOPs. The SQM/QM is then in charge of distribution to employees, external customers, or regulatory agencies and maintaining a distribution list of controlled document copies.

5.1.7.3. Local PASI facilities are responsible for developing facility-specific SOPs applicable to their respective facility. The local facility develops these facility-specific SOPs based on the corporate-wide SOP template. This template is written to incorporate a set of minimum method requirements and PASI best practice requirements. The local facilities may add to or modify the corporate-wide SOP template provided there are no contradictions to the minimum method or best practice requirements. Facility-specific SOPs are controlled by the applicable SQM/QM according to the corporate document management policies.

5.1.7.4. SOPs are reviewed every two years at a minimum although a more frequent review may be required by some state or federal agencies or customers. If no revisions are made based on this review, documentation of the review itself is made by the addition of new signatures on the cover page. If revisions are made, documentation of the revisions is made in the revisions section of each SOP and a new revision number is applied to the SOP. This provides a historical record of all revisions.

5.1.7.5. All copies of superseded SOPs are removed from general use and the original copy of each SOP is archived for audit or knowledge preservation purposes. This ensures that all PASI employees use the most current version of each SOP and provides the SQM/QM with a historical record of each SOP.

5.1.7.6. Additional information can be found in SOP S-MN-Q-273 **Preparation of SOPs** or its equivalent revision or replacement.

5.2. Document Change Control

5.2.1. Changes to managed documents are reviewed and approved in the same manner as the original review. Any revision to a document requires the approval of the applicable signatories. After revisions are approved, a revision number is assigned and the previous version of the document is officially retired. Copies may be kept for audit or knowledge preservation purposes.

5.2.2. All controlled copies of the previous document are replaced with controlled copies of the revised document and the superseded copies are destroyed or archived. All affected personnel are advised that there has been a revision and any necessary training is scheduled.

5.3. Management of Change

5.3.1. The process for documenting necessary changes within the laboratory network are not typically handled using the corrective or preventive action system as outlined in section 9.0. Management of Change is a proactive approach to dealing with change to minimize the potential

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negative impact of systematic change in the laboratory and to ensure that each change has a positive desired outcome. This process will primarily be used for the implementation of large scale projects and information system changes as a means to apply consistent systems or procedures within the laboratory network. The request for change is submitted by the initiator and subsequently assigned to an individual or team for development and planning. The final completion of the process culminates in final approval and verification that the procedure was effectively implemented. Additional information can be found in SOP S-MN-Q-257 **Management of Change** or its equivalent revision or replacement.

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6.0. EQUIPMENT AND MEASUREMENT TRACEABILITY

Each PASI facility is equipped with sufficient instrumentation and support equipment to perform the relevant analytical testing or field procedures performed by each facility. Support equipment includes chemical standards, thermometers, balances, disposable and mechanical pipettes, etc. This section details some of the procedures necessary to maintain traceability and to perform proper calibration of instrumentation and support equipment. See Attachment III for a list of equipment currently used at the (Davis) PASI facility.

6.1. Standards and Traceability

6.1.1. Each PASI facility retains all pertinent information for standards, reagents, and chemicals to assure traceability to a national standard. This includes documentation of purchase, receipt, preparation, and use.

6.1.2. Upon receipt, all purchased standard reference materials are recorded into a standard logbook or database and assigned a unique identification number. The entries include the facility's unique identification number, the chemical name, manufacturer name, manufacturer's identification numbers, receipt date, and expiration date. Vendor's certificates of analysis for all standards, reagents, or chemicals are retained for future reference.

6.1.3. Subsequent preparations of intermediate or working solutions are also documented in a standard logbook or database. These entries include the stock standard name and lot number, the manufacturer name, the solvents used for preparation, the solvent lot number and manufacturer, the preparation steps, preparation date, expiration dates, preparer's initials, and a unique PASI identification number. This number is used in any applicable sample preparation or analysis logbook so the standard can be traced back to the standard preparation record. This process ensures traceability back to the national standard.

6.1.4. All prepared standard or reagent containers include the PASI identification number, the standard or chemical name, the date of preparation, the date of expiration, the concentration with units, and the preparer's initials. This ensures traceability back to the standard preparation logbook or database.

6.1.5. For containers that are too small to accommodate labels that list all of the above information associated with a standard, the minimum required information will be PASI standard ID, concentration, and expiration date. This assures that no standard will be used past its assigned expiration date.

6.1.6. If a second source standard is required to verify an existing calibration or spiking standard, this standard must be obtained from a different manufacturer or from a different lot unless client specific QAPP requirements state otherwise.

6.1.7. Additional information concerning the procurement of standards and reagent and their traceability can be found in the SOP S-MN-Q-275 **Standard and Reagent Management and Traceability** or its equivalent revision or replacement.

6.2. General Analytical Instrument Calibration Procedures (Organic and Inorganic)

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6.2.1. All support equipment and instrumentation are calibrated or checked before use to ensure proper functioning and verify that the laboratory's requirements are met. All calibrations are performed by, or under the supervision of, an experienced analyst at scheduled intervals against either certified standards traceable to recognized national standards or reference standards whose values have been statistically validated.

6.2.2. Calibration standards for each parameter are chosen to establish the linear range of the instrument and must bracket the concentrations of those parameters measured in the samples. The lowest calibration standard is the lowest concentration for which quantitative data may be reported. Data reported below this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in a narrative. The highest calibration standard is the highest concentration for which quantitative data may be reported. Data reported above this level is considered to have less certainty and must be reported using appropriate data qualifiers or explained in the narrative. Any specific method requirement for number and type of calibration standards supersedes the general requirement. Instrument and method specific calibration criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.3. Results from all calibration standards analyzed must be included in constructing the calibration curve with the following exceptions:

6.2.3.1. The lowest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done on an individual analyte basis. The reporting limit must be adjusted to the lowest concentration included in the calibration curve;

6.2.3.2. The highest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done on an individual analyte basis. The upper limit of quantitation must be adjusted to the highest concentration included in the calibration curve;

6.2.3.3. Multiple points from either the high end or the low end of the calibration curve may be excluded as long as the remaining points are contiguous in nature and the minimum number of levels remains as established by method or standard operating procedure. The reporting limit or quantitation range, whichever is appropriate, must be adjusted accordingly;

6.2.3.4. Results from a concentration level between the lowest and highest calibration levels can only be excluded from an initial calibration curve for a documentable and acceptable cause with approval from the responsible department supervisor and the local SQM/QM or their designee. An acceptable cause is defined as an obvious sample introduction issue that resulted in no response, documentation of an incorrectly prepared standard, or a documented response of a single standard that is greater than 2X the difference from the expected value of that standard. The results for all analytes are to be excluded and the point must be replaced by re-analysis. Re-analysis of this interior standard must occur within the same method-specified tune time period for GC/MS methodologies and within 8 hours of the initial analysis of that standard for non-GC/MS methodologies. All samples analyzed prior to the re-analyzed calibration curve point must be re-analyzed after the calibration curve is completed and re-processed against the final calibration curve.

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6.2.4. Instrumentation or support equipment that cannot be calibrated to specification or is otherwise defective is clearly labeled as out-of-service until it has been repaired and tested to demonstrate it meets the laboratory's specifications. All repair and maintenance activities including service calls are documented in the maintenance log. Equipment sent off-site for calibration testing is packed and transported to prevent breakage and is in accordance with the calibration laboratory's recommendations.

6.2.5. In the event that recalibration of a piece of test equipment indicates the equipment may have been malfunctioning during the course of sample analysis, an investigation is performed. The results of the investigation along with a summary of the information reviewed are documented and maintained by the quality manager. Customers must be notified within 30 days after the data investigation is completed and the impact to final results is assessed. This allows for sufficient investigation and review of documentation to determine the impact on the analytical results. Instrumentation found to be consistently out of calibration is either repaired and positively verified or taken out of service and replaced.

6.2.6. Raw data records are retained to document equipment performance. Sufficient raw data is retained to reconstruct the instrument calibration and explicitly connect the continuing calibration verification to the initial calibration.

6.2.7. **General Organic Calibration Procedures**

6.2.7.1. Calibration standards are prepared at a minimum of five concentrations for organic analyses (unless otherwise stipulated in the method).

6.2.7.2. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Curves that do not meet the appropriate criteria require corrective action that may include re-running the initial calibration curve. Rounding to meet initial calibration criteria is not allowed, that is, 15.3 cannot be rounded down to meet a $\leq 15\%$ RSD requirement. This also applies to linear and non-linear fit requirements. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if that lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.7.3. The calibration curve is periodically verified by the analysis of a mid-level continuing calibration verification (CCV) standard during the course of sample analysis. This standard is from the same source as the initial calibration unless otherwise specified in the source method to be from an alternate source material. Rounding to meet continuing calibration criteria is not allowed. Continuing calibration verification is performed at the beginning and end of each analytical batch except if an internal standard is used, then only one verification at the beginning of the batch is needed, whenever it is expected that the analytical system may be out of calibration, if the time period for calibration has expired, or for analytical systems that have specific calibration verification requirements. This verification standard must meet acceptance criteria in order for sample analysis to proceed.

6.2.7.4. In the event that the CCV does not meet the acceptance criteria, a second CCV may be injected as part of the diagnostic evaluation and corrective action investigation. If the second CCV is acceptable, the analytical sequence may be continued. If both CCVs fail, the analytical sequence is terminated and corrective action is initiated. Sample analysis cannot begin until after documented corrective action has been completed and either two consecutive passing CCVs have been analyzed

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or the instrument has successfully passed a new initial calibration. All samples analyzed since the last compliant CCV are re-analyzed for methodologies utilizing external calibration.

6.2.7.5. When instruments are operating unattended, autosamplers may be programmed to inject consecutive CCVs as a preventative measure against CCV failure with no corrective action. In this case, both CCVs must be evaluated to determine potential impact to the results. A summary of the decision tree and necessary documentation are listed below:

- If both CCVs meet the acceptance criteria, the analytical sequence is allowed to continue without corrective action. The method-specified clock begins with the injection of the second CCV.
- If the first CCV does not meet the acceptance criteria and the second CCV is acceptable, the analytical sequence is continued and the results are reported.
- If the first CCV meets the acceptance criteria and the second CCV is out of control, the samples after the out of control CCV must be re-analyzed in a compliant analytical sequence.
- If both CCVs are out of control, all samples since the last acceptable CCV must be re-analyzed in a compliant analytical sequence.

6.2.7.6. Some analytical methods require that samples be bracketed by passing CCVs analyzed both before and after the samples. This is specific to each method but, as a general rule, all external calibration methods require bracketing CCVs. Most internal standard calibrations do not require bracketing CCVs.

6.2.7.7. Some analytical methods require verification based on a time interval; some methods require a frequency based on an injection interval. The type and frequency of the calibration verifications is dependent on both the analytical method and possibly on the quality program associated with the samples. The type and frequency of calibration verification will be documented in the method specific SOP employed by each laboratory.

6.2.8. General Inorganic Calibration Procedures

6.2.8.1. The instrument is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. A calibration blank is also included. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Rounding to meet initial calibration criteria is not allowed. This also applies to linear and non-linear fit requirements. The number of calibration standards used depends on the specific method criteria or customer project requirements, although normally a minimum of three standards is used.

6.2.8.2. The ICP and ICP/MS can be standardized with a zero point and a single point calibration if:

- Prior to analysis, the zero point and the single point calibration are analyzed and a linear range has been established,
- Zero point and single point calibration standards are analyzed with each batch
- A standard corresponding to the LOQ is analyzed with the batch and meets the established acceptance criteria
- The linearity is verified at the frequency established by the method or manufacturer.

6.2.8.3. All initial calibrations are verified with an initial calibration verification standard (ICV) obtained from a second manufacturer or second lot from the same manufacturer if the lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample

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results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

6.2.8.4. During the course of analysis, the calibration curve is periodically verified by the analysis of calibration verification standards (CCV). A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid. The CCV is also analyzed at the end of the analytical batch.

6.2.8.5. A calibration blank is also run with each calibration verification standard to verify the cleanliness of the system. All reported results must be bracketed by acceptable CCVs. Instrument and method specific calibration acceptance criteria are explained within the specific analytical standard operating procedures for each facility.

6.2.8.6. Interference check standards are also analyzed per method requirements and must meet acceptance criteria for metals analyses.

6.3. Support Equipment Calibration Procedures

6.3.1. All support equipment is calibrated or verified at least annually using NIST traceable references over the entire range of use. The results of calibrations or verifications must be within the specifications required or the equipment will be removed from service until repaired. The laboratory maintains records to demonstrate the correction factors applied to working thermometers.

6.3.2. On each day the equipment is used, balances, ovens, refrigerators (those used to keep samples and standards at required temperatures), freezers, and water baths are checked in the expected use range with NIST traceable references in order to ensure the equipment meets laboratory specifications and these checks are documented appropriately.

6.3.3. Analytical Balances

6.3.3.1. Each analytical balance is calibrated or verified at least annually by a qualified service technician. The calibration of each balance is verified each day of use with weights traceable to NIST bracketing the range of use. Calibration weights are ASTM Class 1 or other class weights that have been calibrated against a NIST standard weight and are re-certified every 5 years at a minimum against a NIST traceable reference. Some accrediting agencies may require more frequent checks. If balances are calibrated by an external agency, verification of their weights must be provided. All information pertaining to balance maintenance and calibration is recorded in the individual balance logbook and/or is maintained on file in the Quality department.

6.3.4. Thermometers

6.3.4.1. Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are re-certified, at a minimum, every 3 years with equipment directly traceable to NIST.

6.3.4.2. Working thermometers are compared with the reference thermometers annually according to corporate metrology procedures. Each thermometer is individually numbered and assigned a correction factor based on the NIST reference source. In addition, working thermometers are visually inspected by laboratory personnel prior to use and temperatures are documented.

6.3.4.3. Laboratory thermometer inventory and calibration data are maintained in the Quality department.

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6.3.5. pH/Electrometers

6.3.5.1. The meter is calibrated before use each day, using fresh buffer solutions. See the analytical method SOP S-DAV-I-001 **Measurement of pH** for more specific information.

6.3.6. Spectrophotometers

6.3.6.1. During use, spectrophotometer performance is checked at established frequencies in analysis sequences against initial calibration verification (ICV) and continuing calibration verification (CCV) standards.

6.3.7. Mechanical Volumetric Dispensing Devices

6.3.7.1. Mechanical volumetric dispensing devices including bottle top dispensers (those that are critical in measuring a required amount of reagent), pipettes, and burettes, excluding Class A volumetric glassware, are checked for accuracy on a quarterly basis.

6.3.7.2. Additional information regarding calibration and maintenance of laboratory support equipment can be found in SOP S-MN-Q-264 **Support Equipment** or its equivalent revision or replacement.

6.4. Instrument/Equipment Maintenance

6.4.1. The objectives of the Pace Analytical maintenance program are twofold: to establish a system of instrument care that maintains instrumentation and equipment at required levels of calibration and sensitivity, and to minimize loss of productivity due to repairs.

6.4.2. The Operations Manager and/or department manager/supervisors are responsible for providing technical leadership to evaluate new equipment, solve equipment problems, and coordinate instrument repair and maintenance. Analysts have the primary responsibility to perform routine maintenance.

6.4.3. To minimize downtime and interruption of analytical work, preventative maintenance is routinely performed on each analytical instrument. Up-to-date instructions on the use and maintenance of equipment are available to staff in the department where the equipment is used.

6.4.4. Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that are subject to frequent failure, have limited lifetimes, or cannot be obtained in a timely manner should a failure occur.

6.4.5. All major equipment and instrumentation items are uniquely identified to allow for traceability. Equipment/instrumentation is, unless otherwise stated, identified as a system and not as individual pieces. The laboratory maintains equipment records that include the following:

- The name of the equipment and its software
- The manufacturer's name, type, and serial number
- Approximate date received and date placed into service
- Current location in the laboratory
- Condition when received (new, used, etc.)
- Copy of any manufacturer's manuals or instructions
- Dates and results of calibrations and next scheduled calibration (if known)
- Details of past maintenance activities, both routine and non-routine

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- Details of any damage, modification or major repairs

6.4.6. All instrument maintenance is documented in maintenance logbooks that are assigned to each particular instrument or system.

6.4.7. The maintenance log entry must include a summary of the results of that analysis and verification by the analyst that the instrument has been returned to an in-control status. In addition, each entry must include the initials of the analyst making the entry, the dates the maintenance actions were performed, and the date the entry was made in the maintenance logbook, if different from the date(s) of the maintenance.

6.4.8. Any equipment that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown to be defective, is taken out of service and clearly identified. The equipment shall not be used to analyze customer samples until it has been repaired and shown to perform satisfactorily. In the event of instrumentation failure, to avoid hold time issues, the lab may subcontract the necessary samples to another Pace lab or to an outside subcontract lab if possible.

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7.0. CONTROL OF DATA

Analytical results processing, verification, and reporting are procedures employed that result in the delivery of defensible data. These processes include, but are not limited to, calculation of raw data into final concentration values, review of results for accuracy, evaluation of quality control criteria and assembly of technical reports for delivery to the data user.

All analytical data undergo a well-defined, well-documented multi-tier review process prior to being reported to the customer. This section describes procedures used by PASI for translating raw analytical data into accurate final sample reports as well as PASI data storage policies.

7.1. Analytical Results Processing

7.1.1. When analytical, field, or product testing data is generated, it is either recorded in a bound laboratory logbook (e.g., Run log or Instrument log) or copies of computer-generated printouts that are appropriately labeled and filed. These logbooks and other laboratory records are kept in accordance with each facility's Standard Operating Procedure for documentation storage and archival. If the laboratory chooses to minimize or eliminate its paper usage, these records can be kept on electronic media. In this case, the laboratory must ensure that there are sufficient redundant electronic copies so no data is lost due to unforeseen computer issues.

7.1.2. The primary analyst is responsible for initial data reduction and review. This includes confirming compliance with required methodology, verifying calculations, evaluating quality control data, noting non-conformances in logbooks or as footnotes or narratives, and uploading analytical results into the LIMS. The primary analyst must be clearly identified in all applicable logbooks, spreadsheets and LIMS fields.

7.1.3. The primary analyst then compiles the initial data package for verification. This compilation must include sufficient documentation for data review. It may include standard calibrations, chromatograms, manual integration documentation, electronic printouts, chain of custody forms, and logbook copies.

7.1.4. Some agencies or customers require different levels of data reporting. For these special levels, the primary analyst may need to compile additional project information, such as initial calibration data or extensive spectral data, before the data package proceeds to the verification step.

7.2. Data Verification

7.2.1. Data verification is the process of examining data and accepting or rejecting it based on pre-defined criteria. This review step is designed to ensure that reported data are free from calculation and transcription errors, that quality control parameters are evaluated, and that any non-conformances are properly documented.

7.2.2. Analysts performing the analysis and subsequent data reduction have primary responsibility for quality of the data produced. The primary analyst initiates the data verification process by reviewing and accepting the data, provided QC criteria have been met for the samples being reported. Data review checklists, either hardcopy or electronic, are used to document the data review process. The primary analyst is responsible for the initial input of the data into the LIMS. The primary analyst and reviewer must be clearly identified on all applicable data review checklists.

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7.2.3. The completed data package is then sent to a designated qualified reviewer (this cannot be the primary analyst). The following criteria have been established to qualify someone as a data reviewer. To perform secondary data review, the reviewer must:

7.2.3.1. Have a current Demonstration of Capability (DOC) study on file and have an SOP acknowledgement form on file for the method/procedure being reviewed; or, ^{See Note}

7.2.3.2. Have a DOC on file for a similar method/technology (i.e., GC/MS) and have an SOP acknowledgment form on file for the method/procedure being reviewed; or, ^{See Note}

7.2.3.3. Supervise or manage a Department and have an SOP acknowledgment form on file for the method/procedure being reviewed; or,

7.2.3.4. Have significant background in the department/methods being reviewed through education or experience and have an SOP acknowledgment form on file for the method/procedure being reviewed.

7.2.4. **Note:** Secondary reviewer status must be approved personally by the SQM/QM or SGM/GM/AGM/OM in the event that this person has no prior experience on the specific method or general technology.

7.2.5. This reviewer provides an independent technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. This assessment involves a quality control review for use of the proper methodology and detection limits, compliance to quality control protocol and criteria, presence and completeness of required deliverables, and accuracy of calculations and data quantitation. The reviewer validates the data entered into the LIMS and documents approval of manual integrations.

7.2.6. Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise initialing and dating the data (or designating the review of data electronically). The Operations or Project Manager examines the report for method appropriateness, detection limits and QC acceptability. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution. Alternately, final reports can be set to auto email to the client after the analytical results are final and have been run through the Data Checker program for errors. These are set up on a case-by-case basis.

7.2.7. Additional information regarding data review procedures can be found in SOP S-MN-L-132 **Data Review** or its equivalent revision or replacement, as well as in SOP S-MN-Q-214 **Manual Integration** or its equivalent revision or replacement.

7.2.8. The Data Checker program will process validated data for a given project against a set of pre-determined requirements and known chemistry relationships. The program creates a report that includes a series of warnings and errors for any requirement or condition determined to be suspect or incorrect. These warnings and error counts are displayed on the "Project Inquiry by Client" screen and on the final Data Checker reports. For projects that have any number of warnings or errors, the Data Checker report will provide a message that identifies the source and condition of the error or warning.

7.2.9. Some reports and/or data packages may be reviewed by the QM or SQM or designee based on program requirements (e.g., DoD) or client requirements. In this case a thorough review for completeness and accuracy may include a compilation of raw data and QC summaries in addition to the final report to produce a full deliverable package. See S-MN-Q-271 (or equivalent replacement), **Audits and Inspections**, for full Quality department final report and raw data review requirements.

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7.3. Data Reporting

7.3.1. Data for each analytical fraction pertaining to a particular PASI project number are delivered to the Project Manager for assembly into the final report. All points mentioned during technical and QC reviews are included in data qualifiers on the final report or in a separate case narrative if there is potential for data to be impacted.

7.3.2. Final reports are prepared according to the level of reporting required by the customer and can be transmitted to the customer via hardcopy or electronic deliverable. A standard PASI final report consists of the following components:

7.3.2.1. A title which designates the report as “Final Report”, “Laboratory Results”, “Certificate of Results”, etc.;

7.3.2.2. Name and address of laboratory (or subcontracted laboratories, if used);

7.3.2.3. Phone number and name of laboratory contact to where questions can be referred;

7.3.2.4. A unique identification number for the report. The pages of the report shall be numbered and a total number of pages shall be indicated;

7.3.2.5. Name and address of customer and name of project;

7.3.2.6. Unique identification of samples analyzed as well as customer sample IDs;

7.3.2.7. Identification of any sample that did not meet acceptable sampling requirements of the relevant governing agency, such as improper sample containers, holding times missed, sample temperature, etc.;

7.3.2.8. Date and time of collection of samples, date of sample receipt by the laboratory, dates of sample preparation and analysis, and times of sample preparation and analysis when the holding time for either is 72 hours or less;

7.3.2.9. Identification of the test methods used;

7.3.2.10. Identification of sampling procedures if sampling was conducted by the laboratory;

7.3.2.11. Deviations from, additions to, or exclusions from the test methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc., and can be shown as a case narrative or as defined footnotes to the analytical data;

7.3.2.12. Identification of whether calculations were performed on a dry or wet-weight basis;

7.3.2.13. Reporting limits used;

7.3.2.14. Final results or measurements, supported by appropriate chromatograms, charts, tables, spectra, etc.;

7.3.2.15. A signature and title, electronic or otherwise, of person accepting responsibility for the content of the report;

7.3.2.16. Date report was issued;

7.3.2.17. A statement clarifying that the results of the report relate only to the samples tested or to the samples as they were received by the laboratory;

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7.3.2.18. If necessary, a statement indicating that the report must not be reproduced except in full, without the written approval of the laboratory;

7.3.2.19. Identification of all test results provided by a subcontracted laboratory or other outside source;

7.3.2.20. Identification of results obtained outside of quantitation levels.

In addition to the requirements listed above, final reports shall also contain the following items when necessary for the interpretation of results:

7.3.2.21. Deviations from, additions to, or exclusions from the test method, and information on specific test conditions, such as environmental conditions;

7.3.2.22. Where relevant, a statement of compliance/non-compliance with requirements and/or specifications (e.g., the TNI standard);

7.3.2.23. Where applicable, a statement on the estimated uncertainty of measurement; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a customer's instruction so requires, or when the uncertainty affects compliance to a specification limit;

7.3.2.24. Where appropriate and needed, opinions and interpretations, which may include opinions on the compliance/non-compliance of the results with requirements, fulfillment of contractual requirements, recommendations on how to use the results, and guidance to be used for improvement;

7.3.3. Any changes made to a final report shall be designated as "Revised" or equivalent wording. The laboratory must keep sufficient archived records of all laboratory reports and revisions. For higher levels of data deliverables, a copy of all supporting raw data is sent to the customer along with a final report of results. When possible, the PASI facility will provide electronic data deliverables (EDD) as required by contracts or upon customer request.

7.3.4. Customer data that requires transmission by telephone, telex, facsimile or other electronic means undergoes appropriate steps to preserve confidentiality.

7.3.5. The following positions are the only approved signatories for PASI final reports:

- Senior General Manager
- General Manager
- Assistant General Manager
- Senior Quality Manager
- Quality Manager
- Client Services Manager
- Project Manager
- Project Coordinator

7.4. Data Security

7.4.1. All data including electronic files, logbooks, extraction/digestion/distillation worksheets, calculations, project files and reports, and any other information used to produce the technical report are maintained secured and retrievable by the PASI facility.

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7.5. Data Archiving

7.5.1. All records compiled by PASI are maintained legible and retrievable and stored secured in a suitable environment to prevent loss, damage, or deterioration by fire, flood, vermin, theft, and/or environmental deterioration. Records are retained for a minimum of five years unless superseded by federal, state, contractual, and/or accreditation requirements. These records may include, but are not limited to, customer data reports, calibration and maintenance of equipment, raw data from instrumentation, quality control documents, observations, calculations, and logbooks. These records are retained in order to provide for possible historical reconstruction including sampling, receipt, preparation, analysis, and personnel involved. TNI-related records will be made readily available to accrediting authorities. Access to archived data is documented and controlled by the SQM/QM or a designated Data Archivist.

7.5.2. Records that are computer generated have either a hard copy or electronic write protected backup copy. Hardware and software necessary for the retrieval of electronic data is maintained with the applicable records. Archived electronic records are stored protected against electronic and/or magnetic sources.

7.5.3. In the event of a change in ownership, accountability or liability, reports of analyses performed pertaining to accreditation will be maintained by the acquiring entity for a minimum of five years. In the event of bankruptcy, laboratory reports and/or records will be transferred to the customer and/or the appropriate regulatory entity upon request.

7.6. Data Disposal

7.6.1. Data that has been archived for the facility's required storage time may be disposed of in a secure manner by shredding, returning to customer, or utilizing some other means that does not jeopardize data confidentiality. Records of data disposal will be archived for a minimum of five years unless superseded by federal, contractual, and/or accreditation requirements. Data disposal includes any preliminary or final reports that are disposed..

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8.0. QUALITY SYSTEM AUDITS AND REVIEWS

8.1. Internal Audits

8.1.1. Responsibilities

8.1.1.1. The SQM/QM is responsible for managing and/or conducting internal audits in accordance with a predetermined schedule and procedure. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be trained, qualified, and familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation. The SQM/QM evaluates audit observations and verifies the completion of corrective actions. In addition, a periodic corporate audit will be conducted. The corporate audits will focus on the effectiveness of the Quality System as outlined in this manual but may also include other quality programs applicable to an individual laboratory.

8.1.2. Scope and Frequency of Internal Audits

8.1.2.1. The complete internal audit process consists of the following four sections:

- Raw Data Review audits- conducted according to a schedule per local SQM/QM. A certain number of these data review audits are conducted per quarter to accomplish this yearly schedule;
- Quality System audits- considered the traditional internal audit function and includes analyst interviews to help determine whether practice matches method requirements and SOP language;
- Final Report reviews;
- Corrective Action Effectiveness Follow-up.

8.1.2.2. Internal systems audits are conducted yearly at a minimum. The scope of these audits includes evaluation of specific analytical departments or a specific quality related system as applied throughout the laboratory.

8.1.2.3. Where the identification of non-conformities or departures cast doubt on the laboratory's compliance with its own policies and procedures, the lab must ensure that the appropriate areas of activity are audited as soon as possible. Examples of system-wide elements that can be audited include:

- Quality Systems documents, such as Standard Operating Procedures, training documents, Quality Assurance Manual, and all applicable addenda
- Data records and non-technical documents
- Personnel and training files.
- General laboratory safety protocols.
- Chemical handling practices, such as labeling of reagents, solutions, and standards as well as all associated documentation.
- Documentation concerning equipment and instrumentation, calibration/maintenance records, operating manuals.
- Sample receipt and management practices.

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- Analytical documentation, including any discrepancies and corrective actions.
- General procedures for data security, review, documentation, reporting, and archiving.
- Data integrity issues such as proper manual integrations.

8.1.2.4. When the operations of a specific department are evaluated, a number of additional functions are reviewed including:

- Detection limit studies
- Internal chain of custody documentation
- Documentation of standard preparations
- Quality Control limits and Control charts

8.1.2.5. Certain projects may require an internal audit to ensure laboratory conformance to site work plans, sampling and analysis plans, QAPPs, etc.

8.1.2.6. A representative number of data audits are completed annually. Findings from these data audits are handled in the same manner as those from other internal and external audits.

8.1.2.7. The laboratory, as part of their overall internal audit program, ensures that a review is conducted with respect to any evidence of inappropriate actions or vulnerabilities related to data integrity. Discovery and reporting of potential data integrity issues are handled in a confidential manner. All investigations that result in findings of inappropriate activity are fully documented, including the source of the problem, the samples and customers affected the impact on the data, the corrective actions taken by the laboratory, and which final reports had to be re-issued. Customers must be notified within 30 days after the data investigation is completed and the impact to final results is assessed.

8.1.3. Internal Audit Reports and Corrective Action Plans

8.1.3.1. Additional information can be found in SOP S-MN-Q-271 **Internal and External Audits** or its equivalent revision or replacement.

8.1.3.2. A full description of the audit, including the identification of the operation audited, the date(s) on which the audit was conducted, the specific systems examined, and the observations noted are summarized in an internal audit report. Although other personnel may assist with the performance of the audit, the SQM/QM writes and issues the internal audit report identifying which audit observations are deficiencies that require corrective action.

8.1.3.3. When audit findings cast doubt on the effectiveness of the operations or on the correctness of validity of the laboratory's environmental test results, the laboratory will take timely corrective action and notify the customer in writing within three business days, if investigations show that the laboratory results may have been affected.

8.1.3.4. Once completed, the internal audit report is issued jointly to the SGM/GM/AGM/OM and the manager(s)/supervisor(s) of the audited operation at a minimum. The responsible manager(s)/supervisor(s) responds within 14 days with a proposed plan to correct all of the deficiencies cited in the audit report. The SQM/QM may grant additional time for responses to large or complex deficiencies (not to exceed 30 days). Each response must include timetables for completion of all proposed corrective actions.

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8.1.3.5. The SQM/QM reviews the audit responses. If the response is accepted, the SQM/QM uses the action plan and timetable as a guideline for verifying completion of the corrective action(s). If the SQM/QM determines that the audit response does not adequately address the correction of cited deficiencies, the response will be returned for modification.

8.1.3.6. To complete the audit process, the SQM/QM performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been audited and verified. This is usually within 60-90 days after implementation. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

8.2. External Audits

8.2.1. PASI laboratories are audited regularly by regulatory agencies to maintain laboratory certifications and by customers to maintain appropriate specific protocols.

8.2.2. Audit teams external to the company review the laboratory to assess the effectiveness of systems and degree of technical expertise. The SQM/QM and other QA staff host the audit team and assist in facilitation of the audit process. Generally, the auditors will prepare a formalized audit report listing deficiencies observed and follow-up requirements for the laboratory. In some cases, items of concern are discussed during a debriefing convened at the end of the on-site review process.

8.2.3. The laboratory staff and supervisors develop corrective action plans to address any deficiencies with the guidance of the SQM/QM. The SGM/GM/AGM/OM provides the necessary resources for staff to develop and implement the corrective action plans. The SQM/QM collates this information and provides a written response to the audit team. The response contains the corrective action plan and expected completion dates for each element of the plan. The SQM/QM follows-up with the laboratory staff to ensure corrective actions are implemented and that the corrective action was effective.

8.3. Quarterly Quality Reports

8.3.1. The SQM/QM is responsible for preparing a quarterly report to management summarizing the effectiveness of the laboratory Quality Systems. This status report will include:

- Overview of quality activities for the quarter
- Certification status
- Proficiency Testing study results
- SOP revision activities
- Internal audit (method/system) findings
- Manual integration audit findings (Mintminer)
- Raw Data and Final Report review findings
- MDL activities
- Other significant Quality System items

8.3.2. The Corporate Director of Quality utilizes the information from each laboratory to make decisions impacting the quality program compliance of the company as a whole. Each

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SGM/GM/AGM/OM utilizes the quarterly report information to make decisions impacting Quality Systems and operational systems at a local level.

8.3.3. Additional information can be found in SOP S-ALL-Q-014 **Quality System Review** or its equivalent revision or replacement.

8.4. Annual Managerial Review

8.4.1. A managerial review of Management and Quality Systems is performed on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

8.4.2. The managerial review must include the following topics of discussion:

- Suitability of quality management policies and procedures
- Manager/Supervisor reports
- Internal audit results
- Corrective and preventive actions
- External assessment results
- Proficiency testing studies
- Sample capacity and scope of work changes
- Customer feedback, including complaints
- Recommendations for improvement,
- Other relevant factors, such as quality control activities, resources, and staffing.

8.4.3. This managerial review must be documented for future reference by the SQM/QM and copies of the report are distributed to laboratory staff. Results must feed into the laboratory planning system and must include goals, objectives, and action plans for the coming year. The laboratory shall ensure that any actions identified during the review are carried out within an appropriate and agreed upon timescale.

8.5. Customer Service Reviews

8.5.1. As part of the annual managerial review listed previously, the sales staff is responsible for reporting on customer feedback, including complaints. The acquisition of this information is completed by performing surveys.

8.5.2. The sales staff continually receives customer feedback, both positive and negative, and reports this feedback to the laboratory management in order for them to evaluate and improve their management system, testing activities and customer service.

8.5.3. In addition, the labs must be willing to cooperate with customers or their representatives to clarify customer requests and to monitor the laboratory's performance in relation to the work being performed for the customers. This cooperation may include providing the customer reasonable access to relevant areas of the lab for the witnessing of tests being performed; or the preparation of samples or data deliverables to be used for verification purposes. If the lab has a customer feedback SOP, please refer to that SOP for more details.

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8.5.4. Customer service is an important aspect to Pace's overall objective of providing a quality product. Good communication should be provided to the customer's throughout projects. The lab should inform the customer of any delay or major deviations in the performance of analytical tests.

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9.0. CORRECTIVE ACTION

Additional information can be found in SOP S-MN-Q-262 **Corrective and Preventive Actions** or its equivalent revision or replacement.

During the process of sample handling, preparation, and analysis, or during review of quality control records, or during reviews of non-technical portions of the lab, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The Quality System of PASI provides systematic procedures for the documentation, monitoring, completion of corrective actions, and follow-up verification of the effectiveness of these corrective actions. This can be done using PASI's LabTrack system or other system that lists among at a minimum, the deficiency by issue number, the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

9.1. Corrective Action Documentation

9.1.1. The following items are examples of sources of laboratory deviations or non-conformances that warrant some form of documented corrective action:

- Internal Laboratory Non-Conformance Trends
- PE/PT Sample Results
- Internal and External Audits
- Data or Records Review (including non-technical records)
- Client Complaints
- Client Inquiries
- Holding Time violations

9.1.2. Documentation of corrective actions may be in the form of a comment or footnote on the final report that explains the deficiency (e.g., matrix spike recoveries outside of acceptance criteria) or it may be a more formal documentation (either paper system or computerized spreadsheet). This depends on the extent of the deficiency, the impact on the data, and the method or customer requirements for documentation.

9.1.3. The person who discovers the deficiency or non-conformance initiates the corrective action documentation on the Non-Conformance Corrective/ Preventive Action report and/or LabTrack. The documentation must include the affected projects and sample numbers, the name of the applicable Project Manager, the customer name, and the sample matrix involved. The person initiating the corrective action documentation must also list the known causes of the deficiency or non-conformance as well as any corrective/preventative actions that they have taken. Preventive actions must be taken in order to prevent or minimize the occurrence of the situation.

9.1.4. In the event that the laboratory is unable to determine the cause, laboratory personnel and management staff will start a root cause analysis by going through an investigative process. During this process, the following general steps must be taken into account: defining the non-conformance, assigning responsibilities, determining if the condition is significant, and investigating the root cause of the nonconformance. General non-conformance investigative techniques follow the path of the sample through the process looking at each individual step in detail. The root cause must be documented within LabTrack or on the Corrective/Preventive Action Report.

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9.1.5. After all the documentation is completed, the routing of the Corrective/Preventive Action Report and /or LabTrack will continue from the person initiating the corrective action, to their immediate supervisor or the applicable Project Manager and finally to the SQM/QM, if applicable, who may be responsible for final review and signoff of corrective/preventive actions.

9.1.6. In the event that analytical testing or results do not conform to documented laboratory policies or procedures, customer requirements, or standard specifications, the laboratory shall investigate the significance of the non-conformance and document appropriate corrective actions. The proper level of laboratory management will review any departure from these requirements for technical suitability. These departures are permitted only with the approval of the SGM/GM/AGM/OM or the SQM/QM. Where necessary, Project Management will notify the customer of the situation and will advise of any ramifications to data quality (with the possibility of work being recalled). The procedures for handling non-conforming work are detailed in SOP S-MN-Q-262 **Corrective and Preventive Actions** or its equivalent revision or replacement.

9.2. Corrective Action Completion

9.2.1. Internal Laboratory Non-Conformance Trends

9.2.1.1. There are several types of non-conformance trends that may occur in the laboratory that would require the initiation of a corrective action report. Laboratories may choose to initiate a corrective action for all instances of one or more of these categories if they so choose, however the intent is that each of these would be handled according to its severity; one time instances could be handled with a footnote or qualifier whereas a systemic problem with any of these categories may require an official corrective action process. These categories, as defined in the Corrective Action SOP are as follows:

- Login error
- Preparation Error
- Contamination
- Calibration Failure
- Internal Standard Failure
- LCS Failure
- Laboratory accident
- Spike Failure
- Instrument Failure
- Final Reporting error

9.2.2. PE/PT Sample Results

9.2.2.1. Any PT result assessed as “not acceptable” requires an investigation and applicable corrective actions. The operational staff is made aware of the PT failures and they are responsible for reviewing the applicable raw data and calibrations and list possible causes for error. The SQM/QM reviews their findings and initiates another external PT sample or an internal PT sample to try and correct the previous failure. Replacement PT results must be monitored by the SQM/QM and reported to the applicable regulatory authorities.

9.2.2.2. Additional information, such as requirements regarding time frames for reporting failures to states, makeup PTs, and notifications of investigations, can be found in SOP template S-MN-Q-258 **Proficiency Testing Program** or its equivalent revision or replacement.

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9.2.3. Internal and External Audits

9.2.3.1. The SQM/QM is responsible for documenting all audit findings and their corrective actions. This documentation must include the initial finding, the persons responsible for the corrective action, the due date for responding to the auditing body, the root cause of the finding, and the corrective actions needed for resolution. The SQM/QM is also responsible for providing any back-up documentation used to demonstrate that a corrective action has been completed.

9.2.4. Data Review

9.2.4.1. In the course of performing primary and secondary review of data or in the case of raw data reviews (e.g., by the SQM/QM), errors may be found which require corrective actions. Any finding that affects the quality of the data requires some form of corrective action, which may include revising and re-issuing of final reports.

9.2.5. Client Complaints

9.2.5.1. Project Managers are responsible for issuing corrective action forms, when warranted, for customer complaints. As with other corrective actions, the possible causes of the problem are listed and the form is passed to the appropriate analyst or supervisor for investigation. After potential corrective actions have been determined, the Project Manager reviews the corrective action form to ensure all customer needs or concerns are being adequately addressed.

9.2.6. Client Inquiries

9.2.6.1. When an error on the customer report is discovered, the Project Manager is responsible for initiating a formal corrective action form that describes the failure (e.g., incorrect analysis reported, reporting units are incorrect, or reporting limits do not meet objectives). The Project Manager is also responsible for revising the final report if necessary and submitting it to the customer.

9.2.7. Holding Time Violations

9.2.7.1. In the event that a holding time has been missed, the analyst or supervisor must complete a formal corrective action form. The Project Manager and the SQM/QM must be made aware of all holding time violations.

9.2.7.2. The Project Manager must contact the customer in order that appropriate decisions are made regarding the hold time excursion and the ultimate resolution is then documented and included in the customer project file.

9.3. Preventive Action Documentation

9.3.1. Pace laboratories can take advantage of several available information sources in order to identify needed improvements in all of their systems including technical, managerial, and quality. These sources may include:

- Management Continuous Improvement Plan (CIP) metrics which are used by all production departments within Pace. When groups compare performance across the company, ways to improve systems may be discovered. These improvements can be made within a department or laboratory-wide.
- Annual managerial reviews- part of this TNI-required and NVLAP-required review is to look at all processes and procedures used by the laboratory over the past year and to determine ways to improve these processes in the future.

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- Quality systems reviews- any frequent checks of quality systems (monthly logbook reviews, etc.) can uncover issues that can be corrected or adjusted before they become a larger issue.

9.3.2. When improvement opportunities are identified or if preventive action is required, the laboratory can develop, implement, and monitor preventive action plans.

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10.0. GLOSSARY

The source of some of the definitions is indicated previous to the actual definition (e.g., TNI, DoD).

Terms and Definitions	
3P Program	The Pace Analytical continuous improvement program that focuses on Process, Productivity, and Performance. Best Practices are identified that can be used by all PASI labs.
Acceptance Criteria	TNI- Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation	TNI- The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.
Accreditation Body	The AB must be a signatory, in good standing, to the International Laboratory Accreditation Cooperation (ILAC) mutual recognition arrangement (MRA) that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that its accredited laboratories comply with ISO/IEC 17025.
Accuracy	TNI- The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Aliquot	A discrete, measured, representative portion of a sample taken for analysis.
Analysis	A combination of sample preparation and instrument determination.
Analysis Code (Acode)	All the set parameters of a test, such as Analytes, Method, Detection Limits and Price.
Analysis Sequence	A compilation of all samples, standards and quality control samples run during a specific amount of time on a particular instrument in the order they are analyzed.
Analyst	TNI- The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.
Analyte	The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family and are analyzed together.
Analytical Uncertainty	TNI- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
Assessment	TNI - The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its system to defined criteria (to the standards and requirements of laboratory accreditation).
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Atomization	A process in which a sample is converted to free atoms.

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Audit	TNI- A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.
Batch	TNI- Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same quality systems matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples.
Bias	TNI- The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
Blank	TNI and DoD- A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.
Blind Sample	A sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.
BNA (Base Neutral Acid compounds)	A list of semi-volatile compounds typically analyzed by mass spectrometry methods. Named for the way they can be extracted out of environmental samples in an acidic, basic or neutral environment.
BOD (Biochemical Oxygen Demand)	Chemical procedure for determining how fast biological organisms use up oxygen in a body of water.
Calibration	TNI- A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. 1) In calibration of support equipment, the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI); 2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.
Calibration Curve	TNI- The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Method	A defined technical procedure for performing a calibration.

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Calibration Range	The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.
Calibration Standard	TNI- A substance or reference material used for calibration.
Certified Reference Material (CRM)	TNI- Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute.
Chain of Custody	An unbroken trail of accountability that verifies the physical security of samples, data, and records.
Chain of custody Form (COC)	TNI- Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and type of containers; the mode of collection, the collector, time of collection; preservation; and requested analyses.
Chemical Oxygen Demand (COD)	A test commonly used to indirectly measure the amount of organic compounds in water.
Client (referred to by ISO as Customer)	Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by agencies of the federal government.
Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.
Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: $\% \text{ Completeness} = (\text{Valid Data Points} / \text{Expected Data Points}) * 100$
Confirmation	TNI- Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: second-column confirmation; alternate wavelength; derivatization; mass spectral interpretation; alternative detectors; or additional cleanup procedures.
Conformance	An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.
Congener	A member of a class of related chemical compounds (e.g., PCBs, PCDDs).
Consensus Standard	A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof.
Continuing Calibration Blank (CCB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Continuing Calibration Check Compounds (CCC)	Compounds listed in mass spectrometry methods that are used to evaluate an instrument calibration from the standpoint of the integrity of the system. High variability would suggest leaks or active sites on the instrument column.

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Continuing Calibration Verification	The verification of the initial calibration. Required prior to sample analysis and at periodic intervals. Continuing calibration verification applies to both external and internal standard calibration techniques, as well as to linear and non-linear calibration models.
Continuing Calibration Verification (CCV) Standard	Also referred to as a CVS in some methods, it is a standard used to verify the initial calibration of compounds in an analytical method. CCVs are analyzed at a frequency determined by the analytical method.
Continuous Emission Monitor (CEM)	A flue gas analyzer designed for fixed use in checking for environmental pollutants.
Contract Laboratory Program (CLP)	A national network of EPA personnel, commercial labs, and support contractors whose fundamental mission is to provide data of known and documented quality.
Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of non-conforming data.
Correction	Action taken to eliminate a detected non-conformity.
Corrective Action	The action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence. A root cause analysis may not be necessary in all cases.
Corrective and Preventative Action (CAPA)	The primary management tools for bringing improvements to the quality system, to the management of the quality system's collective processes, and to the products or services delivered which are an output of established systems and processes.
Customer	Any individual or organization for which products or services are furnished or work performed in response to defined requirements and expectations.
Data Quality Objective (DQO)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	TNI- The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more usable form.
Definitive Data	Analytical data of known quantity and quality. The levels of data quality on precision and bias meet the requirements for the decision to be made. Data that is suitable for final decision-making.
Demonstration of Capability	TNI- A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision.

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Detection Limit (DL)	The smallest analyte concentration that can be demonstrated to be different than zero or a blank concentration at the 99% confidence. At the DL, the false positive rate (Type 1 error) is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific analyte in a specific matrix with a specific method with 99% confidence.
Diesel Range Organics (DRO)	A range of compounds that denote all the characteristic compounds that make up diesel fuel (range can be state or program specific).
Digestion	A process in which a sample is treated (usually in conjunction with heat and acid) to convert the sample to a more easily measured form.
Document Control	The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.
Documents	Written components of the laboratory management system (e.g., policies, procedures, and instructions).
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate (also known as Replicate or Laboratory Duplicate)	The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results of duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.
Electron Capture Detector (ECD)	Device used in GC methods to detect compounds that absorb electrons (e.g., PCB compounds).
Electronic Data Deliverable (EDD)	A summary of environmental data (usually in spreadsheet form) which clients request for ease of data review and comparison to historical results.
Eluent	A solvent used to carry the components of a mixture through a stationary phase.
Elute	To extract, specifically, to remove (absorbed material) from an absorbent by means of a solvent.
Elution	A process in which solutes are washed through a stationary phase by movement of a mobile phase.
Environmental Data	Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology.
Environmental Monitoring	The process of measuring or collecting environmental data.

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Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Non Potable Water (Includes surface water, ground water, effluents, water treatment chemicals, and TCLP leachates or other extracts) • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Facility	A distinct location within the company that has unique certifications, personnel and waste disposal identifications.
False Negative	A result that fails to identify (detect) an analyte or reporting an analyte to be present at or below a level of interest when the analyte is actually above the level of interest.
False Positive	A result that erroneously identifies (detects) an analyte or reporting an analyte to be present above a level of interest when the analyte is actually present at or below the level of interest.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Field of Accreditation	TNI- Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.
Finding	TNI- An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement.
Flame Atomic Absorption Spectrometer (FAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the fact that ground state metals absorb light at different wavelengths. Metals in a solution are converted to the atomic state by use of a flame.
Flame Ionization Detector (FID)	A type of gas detector used in GC analysis where samples are passed through a flame which ionizes the sample so that various ions can be measured.

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Gas Chromatography (GC)	Instrumentation which utilizes a mobile carrier gas to deliver an environmental sample across a stationary phase with the intent to separate compounds out and measure their retention times.
Gas Chromatograph/Mass Spectrometry (GC/MS)	In conjunction with a GC, this instrumentation utilizes a mass spectrometer which measures fragments of compounds and determines their identity by their fragmentation patterns (mass spectra).
Gasoline Range Organics (GRO)	A range of compounds that denote all the characteristic compounds that make up gasoline (range can be state or program specific).
Graphite Furnace Atomic Absorption Spectrometry (GFAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the absorption of light at different wavelengths that are characteristic of different analytes.
High Pressure Liquid Chromatography (HPLC)	Instrumentation used to separate, identify and quantitate compounds based on retention times which are dependent on interactions between a mobile phase and a stationary phase.
Holding Time	TNI- The maximum time that can elapse between two specified activities. 40 CFR Part 136- The maximum time that samples may be held prior to preparation and/or analysis as defined by the method and still be considered valid or not compromised. For sample prep purposes, hold times are calculated using the time of the start of the preparation procedure.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Homologue	One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, methanol, ethanol, propanol, butanol, etc., form a homologous series.
Improper Actions	Intentional or unintentional deviations from contract-specified or method-specified analytical practices that have not been authorized by the customer (e.g., DoD or DOE).
Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	Analytical technique used for the detection of trace metals which uses plasma to produce excited atoms that emit radiation of characteristic wavelengths.
Inductively Coupled Plasma- Mass Spectrometry (ICP/MS)	An ICP that is used in conjunction with a mass spectrometer so that the instrument is not only capable of detecting trace amounts of metals and non-metals but is also capable of monitoring isotopic speciation for the ions of choice.
Infrared Spectrometer (IR)	An instrument that uses infrared light to identify compounds of interest.
Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.

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Initial Calibration Blank (ICB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method. This blank is specifically run in conjunction with the Initial Calibration Verification (ICV) where applicable.
Initial Calibration Verification (ICV)	Verifies the initial calibration with a standard obtained or prepared from a source independent of the source of the initial calibration standards to avoid potential bias of the initial calibration.
Instrument Blank	A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination.
Instrument Detection Limits (IDLs)	Limits determined by analyzing a series of reagent blank analyses to obtain a calculated concentration. IDLs are determined by calculating the average of the standard deviations of three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day.
Interference, spectral	Occurs when particulate matter from the atomization scatters incident radiation from the source or when the absorption or emission from an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible.
Interference, chemical	Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte.
Internal Standards	TNI- A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
International System of Units (SI)	The coherent system of units adopted and recommended by the General Conference on Weights and Measures.
Ion Chromatography (IC)	Instrumentation or process that allows the separation of ions and molecules based on the charge properties of the molecules.
Isomer	One of two or more compounds, radicals, or ions that contain the same number of atoms of the same element but differ in structural arrangement and properties. For example, hexane (C ₆ H ₁₄) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	A body that calibrates and/or tests.
Laboratory Control Sample (LCS)	TNI- (however named, such as laboratory fortified blank (LFB), spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to evaluate the performance of all or a portion of the measurement system.
Laboratory Duplicate	Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.
Laboratory Information Management System (LIMS)	The entirety of an electronic data system (including hardware and software) that collects, analyzes, stores, and archives electronic records and documents.

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LabTrack	Database used by Pace Analytical to store and track corrective actions and other laboratory issues.
Learning Management System (LMS)	A web-based database used by the laboratories to track and document training activities. The system is administered by the corporate training department and each laboratory's learn centers are maintained by a local administrator.
Legal Chain-of-Custody Protocols	TNI- Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and include the use of a Chain-of-Custody (COC) Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.
Limit(s) of Detection (LOD)	TNI- A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility.
Limit(s) of Quantitation (LOQ)	TNI- The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.
Linear Dynamic Range	Concentration range where the instrument provides a linear response.
Liquid chromatography/tandem mass spectrometry (LC/MS/MS)	Instrumentation that combines the physical separation techniques of liquid chromatography with the mass analysis capabilities of mass spectrometry.
Lot	A quantity of bulk material of similar composition processed or manufactured at the same time.
Management	Those individuals directly responsible and accountable for planning, implementing, and assessing work.
Management System	System to establish policy and objectives and to achieve those objectives.
Manager (however named)	The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual.
Matrix	TNI- The substrate of a test sample.
Matrix Duplicate	TNI- A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.
Matrix Spike (MS) (spiked sample or fortified sample)	TNI- A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.
Matrix Spike Duplicate (MSD) (spiked sample or fortified sample duplicate)	TNI- A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

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Measurement Performance Criteria (MPC)	Criteria that may be general (such as completion of all tests) or specific (such as QC method acceptance limits) that are used by a project to judge whether a laboratory can perform a specified activity to the defined criteria.
Measurement System	TNI - A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the sample preparation, test and the operator(s).
Measurement Uncertainty	An estimate of the error in a measurement often stated as a range of values that contain the true value, within a certain confidence level. The uncertainty generally includes many components which may be evaluated from experimental standard deviations based on repeated observations or by standard deviations evaluated from assumed probability distributions based on experience or other information. For DoD/DOE, a laboratory's Analytical Uncertainty (such as use of LCS control limits) can be reported as the minimum uncertainty.
Method	TNI- A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.
Method Blank	TNI- A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
Method Detection Limit (MDL)	One way to establish a Detection Limit; defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Method of Standard Additions	A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration.
MintMiner	Program used by Pace Analytical to review large amounts of chromatographic data to monitor for errors or data integrity issues.
Mobile Laboratory	TNI- A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans, and skid-mounted structures configured to house testing equipment and personnel.
National Institute of Standards and Technology (NIST)	TNI- A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States national metrology institute (or NMI).
National Pollutant Discharge Elimination System (NPDES)	A permit program that controls water pollution by regulating point sources that discharge pollutants into U.S. waters.
Negative Control	Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

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Nitrogen Phosphorus Detector (NPD)	A detector used in GC analyses that utilizes thermal energy to ionize an analyte. With this detector, nitrogen and phosphorus can be selectively detected with a higher sensitivity than carbon.
Nonconformance	An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also the state of failing to meet the requirements.
Not Detected (ND)	The result reported for a compound when the detected amount of that compound is less than the method reporting limit.
Operator Aid	A technical posting (such as poster, operating manual, or notepad) that assists workers in performing routine tasks. All operator aids must be controlled documents (i.e., a part of the laboratory management system).
Performance Based Measurement System (PBMS)	An analytical system wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Photo-ionization Detector (PID)	An ion detector which uses high-energy photons, typically in the ultraviolet range, to break molecules into positively charged ions.
Polychlorinated Biphenyls (PCB)	A class of organic compounds that were used as coolants and insulating fluids for transformers and capacitors. The production of these compounds was banned in the 1970's due to their high toxicity.
Positive Control	Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.
Post-Digestion Spike	A sample prepared for metals analyses that has analytes spike added to determine if matrix effects may be a factor in the results.
Power of Hydrogen (pH)	The measure of acidity or alkalinity of a solution.
Practical Quantitation Limit (PQL)	Another term for a method reporting limit. The lowest reportable concentration of a compound based on parameters set up in an analytical method and the laboratory's ability to reproduce those conditions.
Precision	TNI- The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation	TNI - Any conditions under which a sample must be kept in order to maintain chemical, physical, and/or biological integrity prior to analysis.
Procedure	TNI- A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing	TNI- A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Proficiency Testing Program	TNI- The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.
Proficiency Testing Sample (PT)	TNI- A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.

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Protocol	TNI- A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed.
Qualitative Analysis	Analysis designed to identify the components of a substance or mixture.
Quality Assurance (QA)	TNI- An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.
Quality Assurance Manual (QAM)	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality Assurance Project Plan (QAPP)	A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.
Quality Control (QC)	TNI- The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality.
Quality Control Sample (QCS)	TNI- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control.
Quality Manual	TNI- A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality System	TNI - A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance and quality control activities.

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Quality System Matrix	TNI - These matrix definitions are to be used for purposes of batch and quality control requirements: • Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device • Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts. • Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish or plant material. Such samples shall be grouped according to origin. • Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined. • Drinking Water: Any aqueous sample that has been designated a potable or potentially potable water source. • Non-aqueous liquid: Any organic liquid with <15% settleable solids • Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake. • Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.
Quantitation Range	The range of values (concentrations) in a calibration curve between the LOQ and the highest successively analyzed initial calibration standard. The quantitation range lies within the calibration range.
Quantitative Analysis	Analysis designed to determine the amounts or proportions of the components of a substance.
Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.
Raw Data	TNI- The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.
Reagent Blank (method reagent blank)	A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.
Records	The output of implementing and following management system documents (e.g., test data in electronic or hand-written forms, files, and logbooks).
Reference Material	TNI- Material or substance one or more of whose property values are sufficiently homogenized and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

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Reference Standard	TNI- Standard used for the calibration of working measurement standards in a given organization or at a given location.
Relative Percent Difference (RPD)	A measure of precision defined as the difference between two measurements divided by the average concentration of the two measurements.
Reporting Limit (RL)	The level at which method, permit, regulatory and customer-specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e., statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL.
Reporting Limit Verification Standard (or otherwise named)	A standard analyzed at the reporting limit for an analysis to verify the laboratory's ability to report to that level.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Requirement	Denotes a mandatory specification; often designated by the term "shall".
Retention Time	The time between sample injection and the appearance of a solute peak at the detector.
Sample	Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.
Sample Condition Upon Receipt Form (SCURF)	Form used by Pace Analytical sample receiving personnel to document the condition of sample containers upon receipt to the laboratory (used in conjunction with a COC).
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.
Sample Receipt Form (SRF)	Letter sent to the client upon login to show the tests requested and pricing.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain of custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.
Sampling	TNI- Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.
Selected Ion Monitoring (SIM)	A mode of analysis in mass spectrometry where the detector is set to scan over a very small mass range, typically one mass unit. The narrower the range, the more sensitive the detector.
Selectivity	TNI- The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.

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Sensitivity	TNI- The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.
Serial Dilution	The stepwise dilution of a substance in a solution.
Shall	Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification as long as the requirement is fulfilled.
Should	Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.
Signal-to-Noise Ratio (S/N)	S/N is a measure of signal strength relative to background noise. The average strength of the noise of most measurements is constant and independent of the magnitude of the signal. Thus, as the quantity being measured (producing the signal) decreases in magnitude, S/N decreases and the effect of the noise on the relative error of a measurement increases.
Spike	A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.
Standard (Document)	TNI- The document describing the elements of a laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.
Standard (Chemical)	Standard samples are comprised of a known amount of standard reference material in the matrix undergoing analysis. A standard reference material is a certified reference material produced by US NIST and characterized for absolute content, independent of analytical test method.
Standard Blank (or Reagent Blank)	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Method	A test method issued by an organization generally recognized as competent to do so.
Standard Operating Procedure (SOP)	TNI- A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.
Standard Reference Material (SRM)	A certified reference material produced by the US NIST or other equivalent organization and characterized for absolute content, independent of analytical method.
Statement of Qualifications (SOQ)	A document that lists information about a company, typically the qualifications of that company to compete on a bid for services.
Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Storage Blank	A sample of analyte-free media prepared by the laboratory and retained in the sample storage area of the laboratory. A storage blank is used to record contamination attributable to sample storage at the laboratory.

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Supervisor	The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.
Surrogate	A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Target Analytes	Analytes or chemicals of primary concern, identified by the customer on a project-specific basis.
Technical Director	Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.
Technology	TNI- A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
Test	A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.
Test Method	A definitive procedure that determines one or more characteristics of a given substance or product.
Test Methods for Evaluating Solid Waste, Physical/ Chemical (SW-846)	EPA Waste's official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with RCRA regulations.
Total Petroleum Hydrocarbons (TPH)	A term used to denote a large family of several hundred chemical compounds that originate from crude oil. Compounds may include gasoline components, jet fuel, volatile organics, etc.
Toxicity Characteristic Leaching Procedure (TCLP)	A solid sample extraction method for chemical analysis employed as an analytical method to simulate leaching of compounds through a landfill.
Traceability	TNI- The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical conditions or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory reagent water and the blank is stored, shipped, and analyzed with its associated samples.

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Tuning	A check and/or adjustment of instrument performance for mass spectrometry as required by the method.
Ultraviolet Spectrophotometer (UV)	Instrument routinely used in quantitative determination of solutions of transition metal ions and highly conjugated organic compounds.
Uncertainty Measurement	The parameter associated with the result of a measurement that characterized the dispersion of the values that could be reasonably attributed to the measurand (i.e. the concentration of an analyte).
Unethical actions	Deliberate falsification of analytical or quality control results, where failed method or contractual requirements are made to appear acceptable.
Unregulated Contaminate Monitoring Rule (UCMR)	EPA program to monitor unregulated contaminants in drinking water.
Validation	The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
Verification	TNI- Confirmation by examination and objective evidence that specified requirements have been met. Note: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.
Whole Effluent Toxicity (WET)	The aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent).

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11.0. REFERENCES

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12.0. REVISIONS

The PASI Corporate Quality Office files both a paper copy and electronic version of a Microsoft Word document with tracked changes detailing all revisions made to the previous version of the Quality Assurance Manual. This document is available upon request. All revisions are summarized in the table below.

Document Number	Reason for Change	Date
Quality Assurance Manual 18.0	Header: Added wording "Effective date of last signature". Sections 1.3.1 and 1.3.3: reworded to match ISO/TNI standards. Section 1.7.7: Added section requiring deputies for key personnel. Section 1.12.2: changed Sample Custodian to titles listed in section 1.8. Section 2.5.3 note 3: clarified the temperature requirements for tissue samples. Removed old section 2.6.5 (LIMS codes): not needed; already appear in an SOP. Sections 4.2.6 and 4.2.7: added red letter text regarding state of SC. Sections 6.2.3.4 and 6.2.7.5: changes "12 hour" to "method-specified". Section 9.2.2.2: added new section referencing the PT SOT. Attachment IIA: updated to current version. Attachment IIB: updated to April 2015 version. Attachment III, V,VI: updated to current version. Attachment VIII (Analyses/Preservatives/etc.): made several updates based on QM input and method requirements.	01Mar2016

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ATTACHMENT I- QUALITY CONTROL CALCULATIONS

PERCENT RECOVERY (%REC)

$$\%REC = \frac{(MSConc - SampleConc)}{TrueValue} * 100$$

NOTE: The SampleConc is zero (0) for theLCS and Surrogate Calculations

PERCENT DIFFERENCE (%D)

$$\%D = \frac{MeasuredValue - TrueValue}{TrueValue} * 100$$

where:

TrueValue = Amount spiked (can also be the $\overline{CF}$ or $\overline{RF}$ of the ICAL Standards)

Measured Value = Amount measured (can also be the CF or RF of the CCV)

PERCENT DRIFT

$$\%Drift = \frac{Calculated\ Concentration - TheoreticalConcentration}{TheoreticalConcentration} * 100$$

RELATIVE PERCENT DIFFERENCE (RPD)

$$RPD = \frac{|(R1 - R2)|}{(R1 + R2) / 2} * 100$$

where:

R1 = Result Sample 1

R2 = Result Sample 2

CORRELATION COEFFICIENT (R)

$$CorrCoeff = \frac{\sum_{i=1}^N W_i * (X_i - \bar{X}) * (Y_i - \bar{Y})}{\sqrt{\left(\sum_{i=1}^N W_i * (X_i - \bar{X})^2 \right) * \left(\sum_{i=1}^N W_i * (Y_i - \bar{Y})^2 \right)}}$$

With: N Number of standard samples involved in the calibration
i Index for standard samples
Wi Weight factor of the standard sample no. i
Xi X-value of the standard sample no. i
X(bar) Average value of all x-values
Yi Y-value of the standard sample no. i
Y(bar) Average value of all y-values

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ATTACHMENT I- QUALITY CONTROL CALCULATIONS (CONTINUED)

STANDARD DEVIATION (S)

$$S = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{(n-1)}}$$

where:

n = number of data points
 X_i = individual data point
 $\bar{X}$ = average of all data points

AVERAGE ($\bar{X}$)

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

where:

n = number of data points
 X_i = individual data point

RELATIVE STANDARD DEVIATION (RSD)

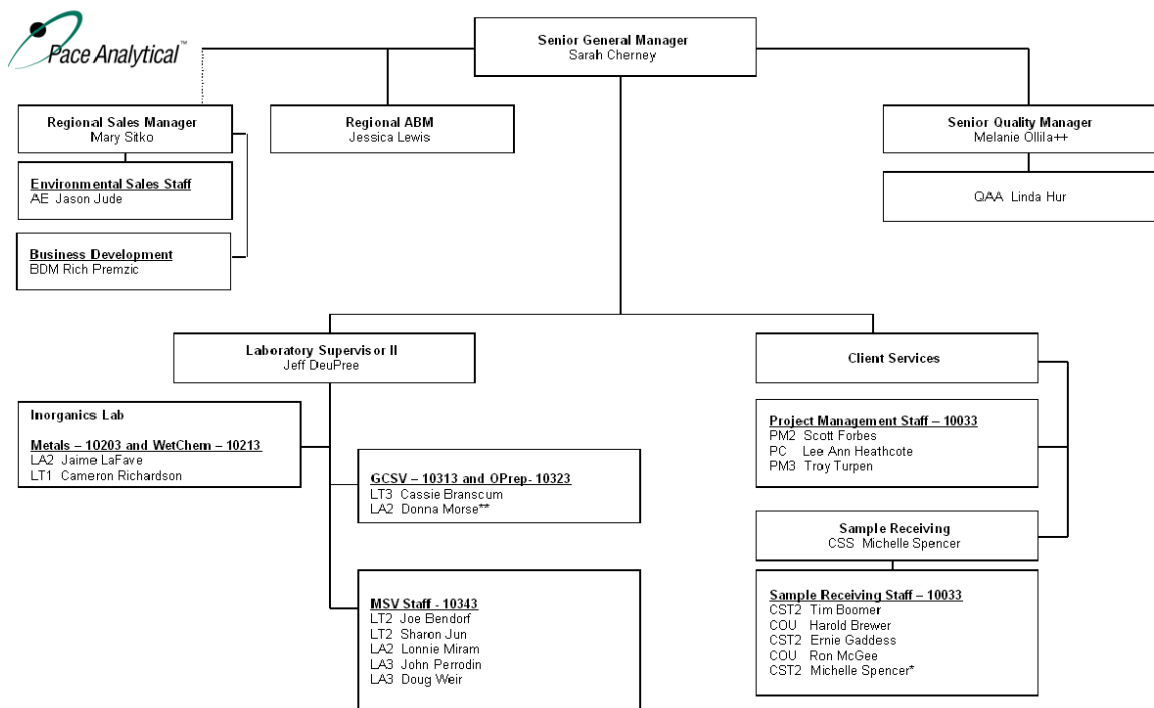
$$RSD = \frac{S}{\bar{X}} * 100$$

where:

S = Standard Deviation of the data points
 $\bar{X}$ = average of all data points

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ATTACHMENT IIA- LABORATORY ORGANIZATIONAL CHART (CURRENT AS OF ISSUE DATE)

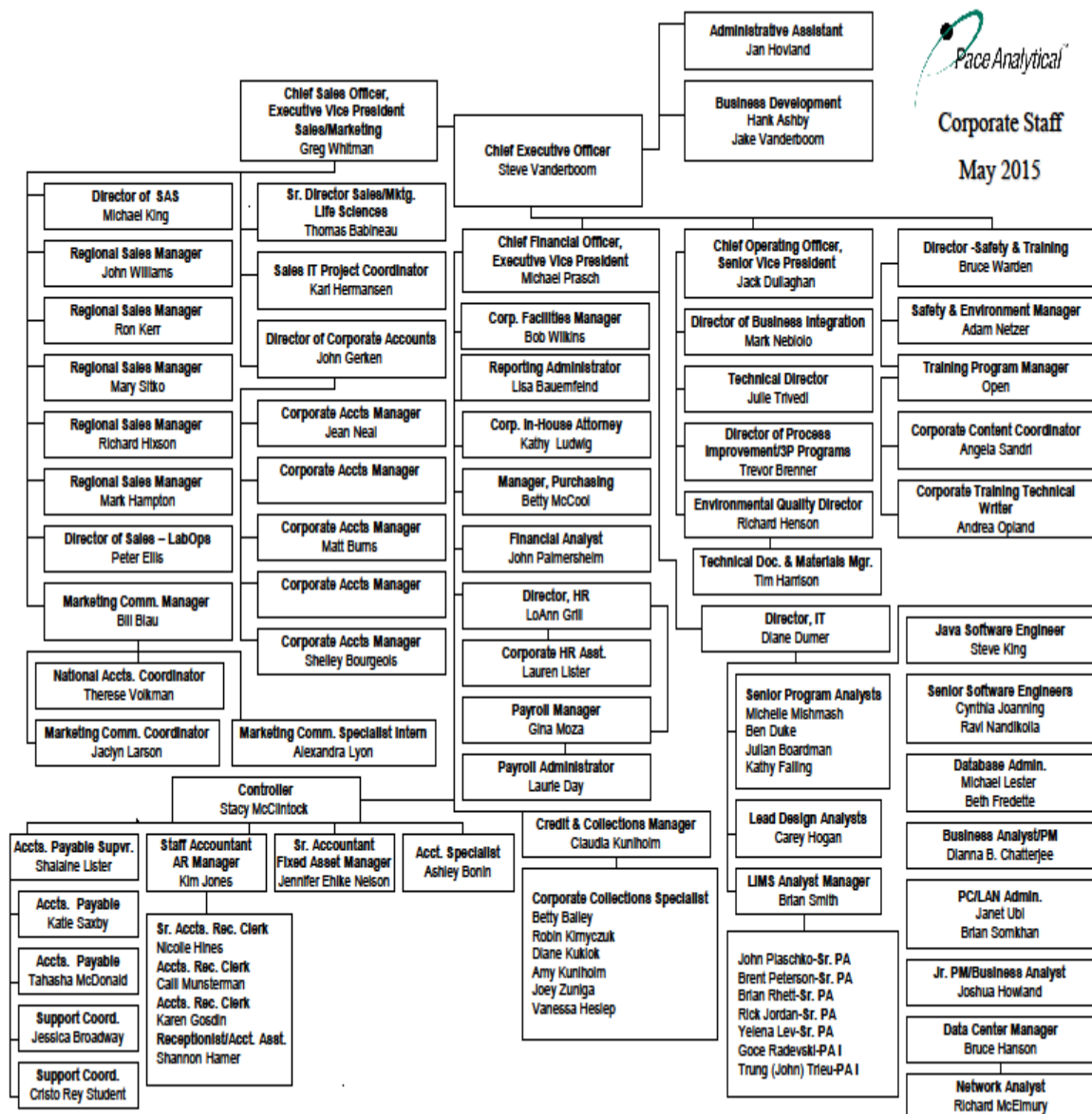


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ATTACHMENT IIB- CORPORATE ORGANIZATIONAL CHART (CURRENT AS OF ISSUE DATE)



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ATTACHMENT III- EQUIPMENT LIST (CURRENT AS OF ISSUE DATE)

Equipment	Manufacturer	Model
Hood	LABCONCO	
Hood	VWR Scientific Products	
Hood	VWR Scientific Products	
Hood	VWR Scientific Products	
Hood	VWR Scientific Products	
Balance	Sartorius	BP410
Balance	Acculabs	VIC-612
Balance	Sartorius	BP121S
Sonicator	VWR Scientific Products	AQUASONIC
Concentrator	Zymark	TurboVap II
Shaker	Glas-Col	Bench Top Shaker
Sonicator	VWR Scientific Products	B5500A-MT
Vortexer	VWR Scientific Products	Touch Vortex
Centrifuge	Damon	IEC HN SII
Centrifuge	Damon	IEC HN SII
Freezer	LAB-LINE	3552-10
Freezer	LAB-LINE	
Concentrator	Caliper Life Sciences	TurboVap II
Sonicator	Kendal	Ultrasonic Cleaner
Oven		
Autosampler	Agilent	7683 Series
Electronic Control Module	APEX Technologies	ProStep 800
Flow Control Module	APEX Technologies	ProStep 800 Plus
GC	Agilent	6890 Series
Software	Chemstation	G1701CA VERSION C.00.00
Autosampler	Agilent	7683
Electronic Control Module	APEX Technologies	ProStep 800
GC	Agilent	6890N
Software	Chemstation	G1701DA, D00.00.38
Autosampler	Agilent	7683B series
Electronic Control Module	APEX Technologies	ProStep 800
GC	Agilent	7890A
Software	Chemstation	G1701EA, REV E 02.00

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Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GC	HP	5890 Series II GC
Software	Chemstation	G1701BA, B01.00
Oven	Yamato	DX 600
MUFFLE FURNACE	THERMO FISHER	664
Oven	VULCAN	A-550
Balance	RADWAG	AS 220/C/2
Autosampler	CETAC	ASX-400
CVAA	CETAC	QuickTrace M-6100
Autosampler	CETAC	ASX-520
ICP	THERMO FISHER	iCAP 6000 Series
Hotblock	Thomas Cain	DEENA
Hotblock	Environmental Express	
Autosampler	Dionex	AS
Column	Dionex	ICS SERIES
IC	Dionex	ICS-2100
Suppressor	Dionex	ICS-3000 DC
IC	Dionex	ICS-3000 SP
pH Meter	Jenco	pH-Vision 6071
Hotplate Stirrer	Environmental Express	
Fridge	Kenmore	960102787
Spectrophotometer	Hach	DR 2800
Hotblock		Smart Block 125
Hood	NuAire	
Hood	LABCONCO	BASIC 47
Freezer	Americana	A23316ABSDRWW
Fridge	Americana	A23316ABSDRWW
IR Gun	Oakton	InfraPro
IR Gun	Oakton	InfraPro
Freezer	Danby	DUFM505WDB00
Cooler	VWR Scientific Products	
COOLER	VWR Scientific Products	GDM-41
Cooler	VWR Scientific Products	
Cooler	HELMER	A
COOLER	REVCO	
Walk-in Cooler	Norlake	
Cooler	KELVINATOR	BT50RG-2
Tumbler	Analytical Testing	42R5BFCI-E3

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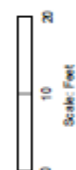
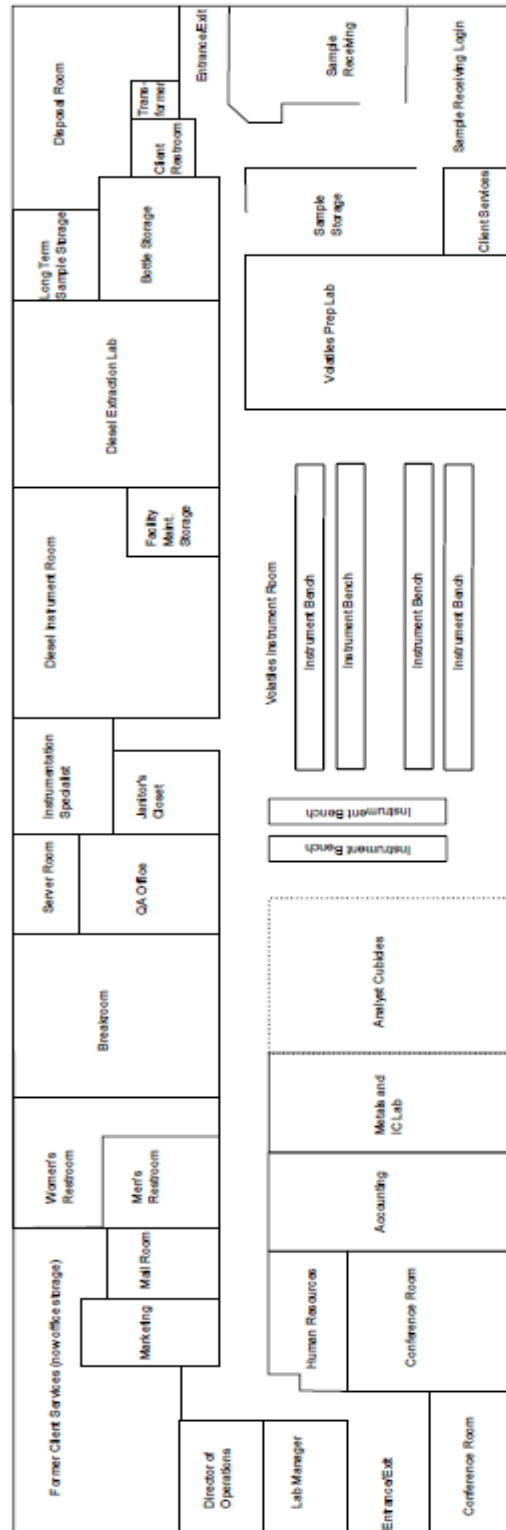
	Corporation	
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701AA, A03.00
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701BA, B01.00
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701BA, B01.00
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701BA, B01.00
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701DA, D00.00.38
Autosampler	ENTECH	7032A-L
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701DA, D00.00.38
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701DA, D00.00.38
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701DA, D00.00.38
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701DA, D00.00.38
Autosampler	Dynatech Archon	Varian
Concentrator	Tekmar	3100 P&T
GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701DA, D00.00.38
Autosampler	ENCON	CENTURIAN
Concentrator	ENCON	ENCON EV

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GCMS	HP	6890 GC/HP5973 MS
Software	Chemstation	G1701DA, D00.00.38
Autosampler	ENCON	CENTURIAN
Concentrator	ENCON	ENCON EV
GCMS	Agilent	7820A GC/ 5977B MS
Software	Chemstation	G1701DA, D00.00.38
Concentrator	OI CORPORATION	4560
Hot plate	VWR Scientific Products	Dylatherm Hot Plate
Hot plate	VWR Scientific Products	Dylatherm Hot Plate
Turbidimeter	Hach	2100N
DI Water System	Advantage	Milli-Q
Tumbler	Analytical Testing Corporation	42R5BFCI-E3
extraction vessel		
Hood	VWR Scientific Products	
Hood	VWR Scientific Products	
Balance	Sartorius	BP410
Balance	Acculabs	Vicon
Balance	Sartorius	CP2202S
Balance	Sartorius	BP410
PID	MiniRAE	MiniRAE 2000
PID	MiniRAE	MiniRAE 2000
Vortexer	VWR Scientific Products	VM-3000
Centrifuge	Damon	HN-SII
Freezer	Cool-Lab	
Cooler	VWR Scientific Products	
Freezer	Lab Line	
Freezer	Kenmore	
pH/conductivity Meter	Hach	HQ440d Multi
Burette	Pyrex	
Hot plate-Stirrer	Corning	PC-351
Stirrer	Cole-Palmer	03402-40

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ATTACHMENT IV- LABORATORY FLOOR PLAN (CURRENT AS OF ISSUE DATE)



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ATTACHMENT V- LABORATORY SOP LIST (CURRENT AS OF ISSUE DATE)

SOP TITLE	SOP NUMBER
DATA ARCHIVING AND RETRIEVAL	S-MN-L-106
REAGENT WATER QUALITY	S-MN-L-110
RECEIPT AND STORAGE OF LABORATORY SUPPLIES	S-MN-L-117
DATA REVIEW PROCESS	S-MN-L-132
SYRINGE TECHNIQUE	S-MN-L-139
PURCHASING LABORATORY SUPPLIES	S-MN-L-145
SAMPLE HOMOGENIZATION AND SUB-SAMPLING	S-MN-L-147
MANUAL INTEGRATION	S-MN-Q-214
CONTROL OF HAZARDOUS ENERGY PROGRAM – LOCKOUT/TAGOUT	S-MN-Q-249
METHOD VALIDATION AND MODIFICATION STUDIES	S-MN-Q-252
ESTIMATION OF MEASUREMENT UNCERTAINTY	S-MN-Q-255
MANAGEMENT OF CHANGE	S-MN-Q-257
PROFICIENCY TESTING PROGRAM	S-MN-Q-258
EVALUATION AND QUALIFICATION OF VENDORS	S-MN-Q-259
CONFLICT OF INTEREST PLAN	S-MN-Q-261
CORRECTIVE AND PREVENTIVE ACTIONS	S-MN-Q-262
MONITORING TEMPERATURE CONTROLLED UNITS	S-MN-Q-263
SUPPORT EQUIPMENT	S-MN-Q-264
DOCUMENT CONTROL AND MANAGEMENT	S-MN-Q-268
DETERMINATION OF LIMIT OF DETECTION AND LIMIT OF QUANTITATION	S-MN-Q-269
REVIEW OF ANALYTICAL REQUESTS	S-MN-Q-270
INTERNAL AND EXTERNAL AUDITS	S-MN-Q-271
MCL VIOLATION REPORTING	S-MN-Q-272
PREPARATION OF STANDARD OPERATING PROCEDURES	S-MN-Q-273
SPREADSHEET VALIDATION	S-MN-Q-274
STANDARD AND REAGENT MANAGEMENT AND TRACEABILITY	S-MN-Q-275
SAFETY MANUAL	CORPORATE REVISION 10.0
DOCUMENT NUMBERING	S-ALL-Q-003
LABORATORY DOCUMENTATION	S-ALL-Q-009
QUALITY SYSTEM	S-ALL-Q-014
REVIEW OF LABORATORY MANAGEMENT SYSTEM	S-ALL-Q-015
TRAINING PROCEDURES	S-ALL-Q-020
DATA RECALL	S-ALL-Q-035
DATA REVIEW PROCESS	S-DAV-Q-001
REGULATED SOIL HANDLING	S-DAV-Q-002
SAMPLE MANAGEMENT	S-DAV-C-001
SUBCONTRACTING SAMPLES	S-DAV-C-002

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BOTTLE PREPARATION	S-DAV-C-003
WASTE HANDLING AND MANAGEMENT	S-DAV-W-001
WASTE MANAGEMENT AND TRAINING REQUIREMENTS	S-DAV-W-002
AIR QUALITY MONITORING AND FUME HOOD MONITORING	S-DAV-W-003
HAZARD ASSESSMENT	S-ALL-S-001
MEASUREMENT OF VOLATILE ORGANIC COMPOUNDS AND GASOLINE BY GC/MS	S-DAV-O-001
VOLATILES WATER SAMPLE COMPOSITING PROCEDURE	S-DAV-O-002
MEASUREMENT OF EXTRACTABLE PETROLEUM PRODUCTS IN SOIL AND WATER BY NWTPH	S-DAV-O-004
MEASUREMENT OF SEMI VOLATILE PETROLEUM HYDROCARBONS IN SOIL BY GC/FID	S-DAV-O-005
MEASUREMENT OF SEMI VOLATILE PETROLEUM HYDROCARBONS IN WATER BY GC/FID	S-DAV-O-006
MEASUREMENT OF MERCURY BY CVAA	S-DAV-M-001
METALS DIGESTION AND ANALYSIS BY ICP-OES	S-DAV-M-002
TCLP AND CA-WET LEACHATE	S-DAV-M-003
FILTRATION OF AQUEOUS SAMPLES FOR DISSOLVED METALS	S-DAV-M-004
HARDNESS	S-DAV-M-005
MEASUREMENT OF PH	S-DAV-I-001
PHOSPHORUS BY SM4500P-E	S-DAV-I-003
MEASUREMENT OF HEXAVALENT CHROMIUM BY IC	S-DAV-I-004
MEASUREMENT OF FERROUS IRON IN AQUEOUS SAMPLES BY SPECTROPHOTOMETER	S-DAV-I-005
ANIONS BY IC	S-DAV-I-006
MEASUREMENT OF SULFIDE IN AQUEOUS SAMPLES BY SPECTROPHOTOMETER	S-DAV-I-007
ALKALINITY	S-DAV-I-008
PERCENT MOISTURE	S-DAV-I-009
CONDUCTIVITY	S-DAV-I-010

SOPS AS NAMED, OR EQUIVALENT REPLACEMENT.

SOPS CURRENTLY UTILIZED IN THE LABORATORY ARE UNDER THE NAME OF THE PREVIOUS OWNERSHIP. THE SOPS WILL BE CONVERTED TO THE PACE SOP NAMES AND FORMAT AS LISTED ABOVE. A CURRENT LISTING OF THE SOPS IS AVAILABLE UPON REQUEST FROM THE QUALITY MANAGER.

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ATTACHMENT VI- LABORATORY CERTIFICATION LIST (CURRENT AS OF ISSUE DATE)
SCOPE AND APPLICATION CERTIFICATES ARE MAINTAINED AND FILED IN THE LOCAL QUALITY
DEPARTMENT

State	Agency	Program	Cert #
California	Dept of Health Services	DW, WW, HW	08263CA
North Dakota	Dept of Health and Consolidated Labs	RCRA	R-214
Oregon	ORELAP	DW, NPW, Solid	CA300002
Washington	Dept of Ecology	NPW, SCM	C926-15a

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**ATTACHMENT VIII- METHOD HOLD TIME, CONTAINER AND PRESERVATION GUIDE
(CURRENT AS OF ISSUE DATE)**

THE HOLDING TIME INDICATED IN THE CHART BELOW IS THE MAXIMUM ALLOWABLE TIME FROM COLLECTION TO EXTRACTION AND/OR ANALYSIS PER THE ANALYTICAL METHOD. FOR METHODS THAT REQUIRE PROCESSING PRIOR TO ANALYSIS, THE HOLDING TIME IS DESIGNATED AS ‘PREPARATION HOLDING TIME/ANALYSIS HOLDING TIME’.

Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Acid Base Accounting	Sobek	Solid	Plastic/Glass	None	N/A
Acidity	SM2310B	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	14 Days
Acid Volatile Sulfide	Draft EPA 1629	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	14 Days
Actinides	HASL-300	Water	Plastic/Glass	$\text{pH} < 2 \text{ HNO}_3$	180 Days
Actinides	HASL-300	Solid	Plastic/Glass	None	180 Days
Alkalinity	SM2320B/310.2	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	14 Days
Alkylated PAHs		Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$; $\text{pH} < 2$ 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved
Alkylated PAHs		Solid	8oz Glass	$\leq 10^{\circ}\text{C}$	1 Year/40 Days
Anions (Br, Cl, F, NO_2 , NO_3 , o-Phos, SO_4 , bromate, chlorite, chlorate)	300.0/300.1/SM411 0B	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$; EDA if bromate or chlorite run	All analytes 28 days except: NO_2 , NO_3 , o-Phos (48 Hours); chlorite (immediately for 300.0; 14 Days for 300.1). NO_2/NO_3 combo 28 days.
Anions (Br, Cl, F, NO_2 , NO_3 , o-Phos, SO_4 , bromate, chlorite, chlorate)	300.0	Solid	Plastic/Glass	$\leq 6^{\circ}\text{C}$	All analytes 28 days except: NO_2 , NO_3 , o-Phos (48 hours); chlorite (immediately). NO_2/NO_3 combo 28 days.

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Anions (Br, Cl, F, NO ₂ , NO ₃ , o-Phos, SO ₄)	9056	Water/ Solid	Plastic/Glass	≤ 6°C	28 days
Aromatic and Halogenated Volatiles (see note 1)	8021	Solid	5035 vial kit	See note 1	14 days
Aromatic and Halogenated Volatiles	602/8021	Water	40mL vials	pH<2 HCl; ≤ 6°C; Na ₂ S ₂ O ₃ if Cl present	14 Days (7 Days for aromatics if unpreserved)
Asbestos	EPA 600/R-93/116	Solid	Plastic/Glass; bulk- 2" square; popcorn ceiling- 2tbsp; soil- 4oz	None (handling must be done in HEPA filtered fume hood; drying may be required)	N/A
Bacteria, Total Plate Count	SM9221D	Water	Plastic/WK	≤ 6°C; Na ₂ S ₂ O ₃	24 Hours
Base/Neutrals and Acids	8270	Solid	8oz Glass	≤ 6°C	14/40 Days
Base/Neutrals and Acids	625/8270	Water	1L Amber Glass	≤ 6°C; Na ₂ S ₂ O ₃ if Cl present	7/40 Days
Base/Neutrals, Acids & Pesticides	525.2	Water	1L Amber Glass	pH<2 HCl; ≤ 6°C; Na sulfite if Cl present	14/30 Days
Biomarkers		Water	≤ 6°C; pH<2 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	≤ 6°C; pH<2 1:1 HCl (optional)
Biomarkers		Solid	≤ 10°C	1 Year/40 Days	≤ 10°C
BOD/cBOD	SM5210B	Water	Plastic/Glass	≤ 6°C	48 hours
Boiling Range Distribution of Petroleum Fractions	ASTM D2887-98	Product	10mL glass vials	≤ 6°C	N/A
BTEX/Total Hydrocarbons	TO-3	Air	Summa Canister	None	14 Days
BTEX/Total Hydrocarbons	TO-3	Air	Tedlar Bag or equivalent	None	48 Hours
Carbamates	531.1	Water	Glass	Na ₂ S ₂ O ₃ , Monochloroacetic acid pH <3; ≤ 6°C	28 Days
Carbamates	8318	Water	Glass	Monochloroacetic acid pH 4-5; ≤ 6°C	7/40 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Carbamates	8318	Solid	Glass	$\leq 6^{\circ}\text{C}$	7/40 Days
Carbon Specific Isotope Analysis (CSIA)	AM24	Water	40mL clear VOA vial with TLS	$\leq 6^{\circ}\text{C}$, trisodium phosphate or HCl	N/A
Cation/Anion Balance	SM1030E	Water	Plastic/Glass	None	None
Cation Exchange	9081	Solid	8oz Glass	None	unknown
Cations (Ferrous Iron, Ferric Iron, Divalent Manganese)	7199 modified	Water	40mL clear VOA vials with mylar septum	$\leq 6^{\circ}\text{C}$; HCl	48 Hours
Chloride	SM4500Cl-C,E	Water	Plastic/Glass	None	28 Days
Chlorinated Hydrocarbons in Vapor	AM4.02	Vapor	20cc vapor vial with flat septum	None	N/A
Chlorine, Residual	SM4500Cl-D,E,G/330.5/Hach 8167	Water	Plastic/Glass	None	15 minutes
Chlorophyll	SM10200H	Water	Opaque bottle or aluminum foil	$\leq 6^{\circ}\text{C}$	48 Hours to filtration
COD	SM5220C, D/410.4/Hach 8000	Water	Plastic/Glass	$\text{pH} < 2 \text{ H}_2\text{SO}_4$; $\leq 6^{\circ}\text{C}$	28 Days
Coliform, Fecal	SM9222D	Water	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	8 Hours
Coliform, Fecal	SM9222D	Solid	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	24 Hours
Coliform, Fecal	SM9221E	Water	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	8 Hours
Coliform, Fecal	SM9221E	Solid	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	24 Hours
Coliform, Total	SM9222B	Water	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	8 Hours
Coliform, Total	SM9221B	Solid	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	8 Hours
Coliform, Total, Fecal and E. coli	Colilert/ Quanti-tray	Water	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	8 Hours
Coliform, Total and E. coli	SM9223B	Drinking Water	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	30 Hours
Color	SM2120B,E	Water	Covered Plastic/Acid Washed Amber Glass	$\leq 6^{\circ}\text{C}$	24 Hours

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Condensable Particulate Emissions	EPA 202	Air	Solutions	None	180 Days
Cyanide, Reactive	SW846 chap.7	Water	Plastic/Glass	None	28 Days
Cyanide, Reactive	SW846 chap.7	Solid	Plastic/Glass	None	28 Days
Cyanide, Total and Amenable	SM4500CN-A,B,C,D,E,G,I,N/9010/ 9012/335.4	Water	Plastic/Glass	pH $\geq$ 12 NaOH; $\leq$ 6°C; ascorbic acid if Cl present	14 Days (24 Hours if sulfide present-applies to SM4500CN only)
Diesel Range Organics- Alaska DRO	AK102	Solid	8oz Glass	$\leq$ 6°C	14/40 Days
Diesel Range Organics- Alaska DRO	AK102	Water	1L Glass	pH<2 HCl; $\leq$ 6°C	14/40 Days
Diesel Range Organics- TPH DRO	8015	Solid	8oz Glass Jar	$\leq$ 6°C	14/40 Days
Diesel Range Organics- TPH DRO	8015	Water	1L Amber Glass	$\leq$ 6°C; Na ₂ S ₂ O ₃ if Cl present	7/40 Days
Diesel Range Organics- TPH DRO	8015	Tissue	1L Amber Glass	$\leq$ - 10°C	1 Year if frozen/40 Days
Diesel Range Organics- TPH DRO	TO-17	Air	Thermal desorption tubes via SKC Pocket Pumps or equivalent	$\leq$ 6°C but above freezing	28 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Solid	8oz Glass Jar	$\leq$ 6°C	14/40 Days
Diesel Range Organics- NwTPH-Dx	Nw-TPH-Dx	Water	1L Amber Glass	pH <2 HCl; $\leq$ 6°C	14/40 Days; 7 Days from collection to extraction if unpreserved
Diesel Range Organics- Wisconsin DRO	WI MOD DRO	Solid	Tared 4oz Glass Jar	$\leq$ 6°C	10/47 Days
Diesel Range Organics- Wisconsin	WI MOD DRO	Water	1L Amber Glass	$\leq$ 6°C; pH <2 HCl	14/40 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
DRO					
Dioxins and Furans	1613B	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	1 year
Dioxins and Furans	1613B	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present	1 year
Dioxins and Furans	1613B	Fish/Tissue	Aluminum foil	$\leq 6^{\circ}\text{C}$	1 year
Dioxins and Furans	8290	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present	30/45 Days
Dioxins and Furans	8290	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	30/45 Days
Dioxins and Furans	8290	Fish/Tissue	Not specified	$< -10^{\circ}\text{C}$	30/45 Days
Dioxins and Furans	TO-9	Air	PUF	None	30/45 Days
Diquat/Paraquat	549.2	Water	Amber Plastic	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	7/21 Days
EDB/DBCP (8011) EDB/DBCP/1,2,3-TCP (504.1)	504.1/8011	Water	40mL vials	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present	14 Days
Endothall	548.1	Water	Amber Glass	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	7/14 Days
Enterococci	EPA 1600	Water	100mL Plastic	$\leq 10^{\circ}\text{C}$	8 Hours
Enterococci	Enterolert	Water	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	8 Hours
Explosives	8330/8332	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$	7/40 Days
Explosives	8330/8332	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	14/40 Days
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Water	1L Amber Glass	$\text{pH} < 2$ HCl; $\leq 6^{\circ}\text{C}$	14/40 Days
Extractable Petroleum Hydrocarbons (aliphatic and aromatic)	MA-EPH	Solid	4oz Glass Jar	$\leq 6^{\circ}\text{C}$	7/40 Days
Fecal Streptococci	SM9230B	Water	100mL Plastic	$\leq 10^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$	8 Hours
Ferrous Iron	SN3500Fe-D; Hach 8146	Water	Glass	None	Immediate
Flashpoint/Ignitability	1010	Liquid	Plastic/Glass	None	28 Days
Florida PRO	FL PRO DEP (11/1/95)	Liquid	Glass, PTFE lined cap	$\leq 6^{\circ}\text{C}$; $\text{pH} < 2$ H_2SO_4 or HCl	7/40 Days
Fluoride	SM4500Fl-C,D	Water	Plastic	None	28 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Gamma Emitting Radionuclides	901.1	Water	Plastic/Glass	pH<2 HNO ₃	180 days
Gasoline Range Organics	8015	Water	40mL vials	pH<2 HCl	14 Days
Gasoline Range Organics	8015	Solid	5035 vial kit	See note 1	14 days
Gasoline Range Organics (C3-C10)	8260B modified	Water	40mL vials	≤ 6°C; HCl	14 Days
Gasoline Range Organics (C3-C10)	8260B modified	Solid	4oz Glass Jar	≤ 6°C	14 Days
Gasoline Range Organics- Alaska GRO	AK101	Solid	5035 vial kit	See 5035 note*	28 Days if GRO only (14 Days with BTEX)
Gasoline Range Organics- Alaska GRO	AK101	Water	40mL vials	pH<2 HCl; ≤ 6°C	14 Days
Gasoline Range Organics- NwTPH-Gx	Nw-TPH-Gx	Water	40mL vials	pH<2 HCl; ≤ 6°C	7 Days unpreserved; 14 Days preserved
Gasoline Range Organics- NwTPH-Gx	Nw-TPH-Gx	Solid	40mL vials	≤ 6°C; packed jars with no headspace	14 Days
Gasoline Range Organics- Wisconsin GRO	WI MOD GRO	Water	40mL vials	pH<2 HCl; ≤ 6°C	14 Days
Gasoline Range Organics- Wisconsin GRO	WI MOD GRO	Solid	40mL MeOH vials	≤ 6°C in MeOH	21 Days
Glyphosate	547	Water	Glass	≤ 6°C; Na ₂ S ₂ O ₃	14 Days (18 Months frozen)
Grain Size	ASTM D422	Solid	Not specified	Ambient	N/A
Gross Alpha (NJ 48Hr Method)	NJAC 7:18-6	Water	Plastic/Glass	pH<2 HNO ₃	48 Hrs
Gross Alpha and Gross Beta	9310/900.0	Water	Plastic/Glass	pH<2 HNO ₃	180 Days
Gross Alpha and Gross Beta	9310	Solid	Glass	None	180 Days
Haloacetic Acids	552.1/552.2	Water	40mL Amber vials	NH ₄ Cl; ≤ 6°C	14/7 Days if extracts stored ≤ 6°C or 14/14 Days if extracts stored at ≤ -10°C

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Hardness, Total (CaCO ₃)	SM2340B,C/130.1	Water	Plastic/Glass	pH<2 HNO ₃	6 Months
Heterotrophic Plate Count (SPC/HPC)	SM9215B	Water	100mL Plastic	≤ 10°C; Na ₂ S ₂ O ₃	8 Hours
Heterotrophic Plate Count (SPC/HPC)	SimPlate	Water	100mL Plastic	≤ 10°C; Na ₂ S ₂ O ₃	8 Hours
Herbicides, Chlorinated	8151	Solid	8oz Glass Jar	≤ 6°C	14/40 Days
Herbicides, Chlorinated	8151	Water	1L Amber Glass	≤ 6°C; Na ₂ S ₂ O ₃ if Cl present	7/40 Days
Herbicides, Chlorinated	515.1/515.3	Water	1L Amber Glass	≤ 6°C; Na ₂ S ₂ O ₃ if Cl present	14/28 Days
Hexavalent Chromium	7196/218.6/SM3500Cr-B, C, D	Water	Plastic/Glass	≤ 6°C	24 Hours (see note 4)
Hexavalent Chromium	218.6/SM3500Cr-B, C, D	Water	Plastic/Glass	<u>Ammonium Buffer pH 9.3-9.7</u>	28 Days (see note 4)
Hexavalent Chromium	218.6/218.7	Drinking Water	Plastic/Glass	<u>Ammonium Buffer pH >8</u>	14 Days (see note 4)
Hexavalent Chromium	7196 (with 3060A)	Solid		≤ 6°C	30 Days from collection to extraction and 7 days from extraction to analysis
Hydrocarbons in Vapor	AM4.02	Vapor	20cc vapor vial with flat septum	None	N/A
Hydrogen by Bubble Strip	SM9/AM20GAx	Water	20cc vapor vial with stopper septum	None	14 Days
Hydrogen Halide and Halogen Emissions	EPA 26	Air	Solutions	None	6 Months
Ignitability of Solids	1030	Non-liquid Waste	Plastic/Glass	None	28 Days
Lead Emissions	EPA 12	Air	Filter/Solutions	None	6 Months
Light Hydrocarbons by Bubble Strip	SM9/AM20GAx	Water	20cc vapor vial with stopper septum	None	14 Days
Light Hydrocarbons in Vapor	AM20GAx	Vapor	20cc vapor vial with flat	None	14 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
			septum		
Lipids	Pace Lipids	Tissue	Plastic/Glass	$\leq -10^{\circ}\text{C}$	1 Year if frozen
Mercury, Low-Level	1631E	Solid	Glass	None	28 Days
Mercury, Low-Level	1631E	Water	Fluoropolym er bottles (Glass if Hg is only analyte being tested)	12N HCl or BrCl	48 Hours for preservation or analysis; 28 Days to preservation if sample oxidized in bottle; 90 Days for analysis if preserved
Mercury, Low-Level	1631E	Tissue	Plastic/Glass	$\leq -10^{\circ}\text{C}$	28 Days if frozen
Mercury	7471	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	28 Days
Mercury	7470/245.1/245.2	Water	Plastic/Glass	pH<2 HNO ₃	28 Days
Mercury	7471/245.6	Tissue	Plastic/Glass	$\leq -10^{\circ}\text{C}$	28 Days if frozen
Metals (GFAA)	7000/200.9	Water	Plastic/Glass	pH<2 HNO ₃	180 Days
Metals (ICP)	NIOSH 7300A/7303	Air	Filters	None	180 Days
Metals (ICP/ICPMS)	6010/6020	Solid	8oz Glass Jar	None	180 Days
Metals (ICP/ICPMS)	6010/6020/200.7/2 00.8	Water	Plastic/Glass	pH<2 HNO ₃	180 Days
Metals (ICP/ICPMS)	6020	Tissue	Plastic/Glass	$\leq -10^{\circ}\text{C}$	180 Days if frozen
Methane, Ethane, Ethene	8015 modified	Water	40mL vials	HCl	14 Days
Methane, Ethane, Ethene	RSK-175; PM01/AM20GAx	Water	40mL vials	HCl; or trisodium phosphate or benzalkonium chloride and $\leq 6^{\circ}\text{C}$	14 Days; 7 Days unpreserved
Methane, Ethane, Ethene	EPA 3C	Air	Summa Canister	None	14 Days
Methane, Ethane, Ethene	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
Methanol, Ethanol	8015 modified	Water	40mL vials	$\leq 6^{\circ}\text{C}$	14 Days
Methanol, Ethanol	8015 modified	Solid	2oz Glass	$\leq 6^{\circ}\text{C}$	14 Days
Methyl Mercury	1630	Water	Teflon/ fluoropolymer	Fresh water- 4mL/L HCl; Saline water-	6 months

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
				2mL/L H ₂ SO ₄ (must be preserved within 48 hours of collection)	
Methyl Mercury	1630	Tissue	2-4oz glass jar	≤ 0°C	28 Days; ethylated distillate 48 hours
Nitrogen, Ammonia	SM4500NH ₃ /350.1	Water	Plastic/Glass	pH<2 H ₂ SO ₄ ; ≤ 6°C	28 Days
Nitrogen, Kjeldahl (TKN)	351.2	Solid	Plastic/Glass	≤ 6°C	28 Days
Nitrogen, Kjeldahl (TKN)	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H ₂ SO ₄ ; ≤ 6°C	28 Days
Nitrogen, Nitrate	SM4500-NO ₃ /352.1	Water	Plastic/Glass	≤ 6°C	24 Hours preferred
Nitrogen, Nitrate & Nitrite combination	353.2	Solid	Plastic/Glass	≤ 6°C	28 Days
Nitrogen, Nitrate & Nitrite combination	SM4500-NO ₃ /353.2	Water	Plastic/Glass	pH<2 H ₂ SO ₄ ; ≤ 6°C	28 Days
Nitrogen, Nitrite or Nitrate separately	SM4500-NO ₂ /353.2	Water	Plastic/Glass	≤ 6°C	48 Hours
Nitrogen, Organic	SM4500-Norg/351.2	Water	Plastic/Glass	pH<2 H ₂ SO ₄ ; ≤ 6°C	28 Days
Non-Methane Organics	EPA 25C	Air	Summa Canister	None	14 Days
Non-Methane Organics	EPA 25C	Air	Tedlar Bag or equivalent	None	48 Hours
Odor	SM2150B	Water	Glass	≤ 6°C	24 Hours
Oil and Grease/HEM	1664A/SM5520B/9070	Water	Glass	pH<2 H ₂ SO ₄ or HCl; ≤ 6°C	28 Days
Oil and Grease/HEM	9071	Solid	Glass	≤ 6°C	28 Days
Oil Range Organics	8015	Solid	Glass	≤ 6°C	14/40 Days
Oil Range Organics	8015	Water	Glass	≤ 6°C	7/40 Days
Organic Matter	ASA 29-3.5.2	Solid	Plastic/Glass	None; samples air-dried and processed prior to analysis	N/A
Oxygen, Dissolved (Probe)	SM4500-O	Water	Glass	None	15 minutes
Oxygenates on Product (GCMS SIM)	1625 modified	Product	10mL glass vial	≤ 6°C	14 Days (7 Days from extraction)

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
PBDEs	1614	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$	1 Year/1 Year
PBDEs	1614	Solid	Wide Mouth Jar	$\leq 6^{\circ}\text{C}$	1 Year/1 Year
PBDEs	1614	Tissue	Aluminum Foil	$\leq -10^{\circ}\text{C}$	1 Year/1 Year
PCBs and Pesticides, Organochlorine (OC)	TO-4/TO-10	Air	PUF	None	7/40 Days
PCBs and Pesticides, Organochlorine (OC)	608	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present	Pest: 7/40 Days; PCB: 1 Year/1 Year
PCBs, Pesticides (OC), Herbicides	508.1	Water	Glass	Na_2SO_3 ; $\text{pH} < 2$ <u>HCl</u> ; $\leq 6^{\circ}\text{C}$	14/30 Days
Perchlorate	331	Water	Plastic/Glass	$\geq 0-6^{\circ}\text{C}$, field filtered with headspace	28 Days
Permanent Gases (O_2 , N_2 , CO_2)	RSK-175; PM01/AM20GAx	Water	40mL vials	benzalkonium chloride and $\leq 6^{\circ}\text{C}$	14 Days
Permanent Gases by Bubble Strip	SM9/AM20GAx	Water	20cc vapor vial with stopper septum	None	14 Days
Permanent Gases in Vapor	AM20GAx	Vapor	20cc vapor vial with flat septum	None	14 Days
Pesticides, Organochlorine (OC)	8081	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present	7/40 Days
Pesticides, Organochlorine (OC)	8081	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	14/40 Days
Pesticides, Organochlorine (OC)	8081	Tissue	8oz Glass Jar	$\leq -10^{\circ}\text{C}$	1 Year if frozen/40 Days
Pesticides, Organophosphorous (OP)	8141	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	14/40 Days
Pesticides, Organophosphorous (OP)	8141	Water	1L Amber Glass	$\text{pH } 5-8$ with NaOH or H_2SO_4 ; $\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present	7/40 Days
PCBs (Aroclors)	8082	Water	1L Amber	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if	1 Year/1 Year

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
			Glass	Cl present	
PCBs (Aroclors)	8082	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	1 Year/1 Year
PCBs (Aroclors)	8082	Tissue	Plastic/Glass	$\leq -10^{\circ}\text{C}$	1 Year if frozen/1 Year
PCB Congeners	1668A	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$ but above freezing	1 Year/1 Year
PCB Congeners	1668A	Solid	4-8oz Glass Jar	$\leq 6^{\circ}\text{C}$ but above freezing	1 Year/1 Year
PCB Congeners	1668A	Tissue	4-8oz Glass Jar	$\leq -10^{\circ}\text{C}$	1 Year/1 Year
Paint Filter Liquid Test	9095	Water	Plastic/Glass	None	N/A
			Plastic/Glass (100g sample)		
Particle Size	ASA 15-5 modified	Solid		None	N/A
Particulates	PM-10	Air	Filters	None	180 Days
Permanent Gases	EPA 3C	Air	Summa Canister	None	14 Days
Permanent Gases	EPA 3C	Air	Tedlar Bag or equivalent	None	48 Hours
pH	SM4500H+B/9040	Water	Plastic/Glass	None	15 minutes
pH	9045	Solid	Plastic/Glass	None	7 Days
Phenol, Total	420.1/420.4/9065/9066	Water	Glass	$\text{pH} < 2 \text{ H}_2\text{SO}_4; \leq 6^{\circ}\text{C}$	28 Days
Phosphorus, Orthophosphate	SM4500P/365.1/365.3	Water	Plastic	Filter; $\leq 6^{\circ}\text{C}$	Filter within 15 minutes, Analyze within 48 Hours
Phosphorus, Total	SM4500P/365.1/365.3/365.4	Water	Plastic/Glass	$\text{pH} < 2 \text{ H}_2\text{SO}_4; \leq 6^{\circ}\text{C}$	28 Days
Phosphorus, Total	365.4	Solid	Plastic/Glass	$\leq 6^{\circ}\text{C}$	28 Days
Polynuclear Aromatic Hydrocarbons (PAH)	TO-13	Air	PUF	None	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	TO-17	Air	Thermal desorption tubes via SKC Pocket Pumps or equivalent	$\leq 6^{\circ}\text{C}$ but above freezing	28 Days
Polynuclear Aromatic Hydrocarbons	8270 SIM	Solid	8oz Glass Jar	$\leq 6^{\circ}\text{C}$	14/40 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
(PAH)					
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Water	1L Amber Glass	$\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present	7/40 Days
Polynuclear Aromatic Hydrocarbons (PAH)	8270 SIM	Tissue	Plastic/Glass	$\leq -10^{\circ}\text{C}$	1 Year if frozen/40 Days
Purgeable Organic Halides (POX)	9021	Water	Glass; no headspace	$\leq 6^{\circ}\text{C}$	14 Days
Radioactive Strontium	905.0	Water	Plastic/Glass	$\text{pH} < 2 \text{ HNO}_3$	180 days
Radium-226	903.0/903.1	Water	Plastic/Glass	$\text{pH} < 2 \text{ HNO}_3$	180 days
Radium-228 (see note 3)	9320/904.0	Water	Plastic/Glass	$\text{pH} < 2 \text{ HNO}_3$	180 days
Radium-228 (see note 3)	9320	Solid	Plastic/Glass		
Residual Range Organics- Alaska RRO	AK103	Solid	8oz Glass	$\leq 6^{\circ}\text{C}$	14/40 Days
Saturated Hydrocarbons		Water	$\leq 6^{\circ}\text{C}$; $\text{pH} < 2$ 1:1 HCl (optional)	14/40 Days preserved; 7/40 Days unpreserved	$\leq 6^{\circ}\text{C}$; $\text{pH} < 2$ 1:1 HCl (optional)
Saturated Hydrocarbons		Solid	$\leq 10^{\circ}\text{C}$	1 Year/40 Days	$\leq 10^{\circ}\text{C}$
Silica, Dissolved	SM4500Si-D	Water	Plastic	$\leq 6^{\circ}\text{C}$	28 Days
Solids, Settleable	SM2540F	Water	Glass	$\leq 6^{\circ}\text{C}$	48 Hours
Solids, Total	SM2540B	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	7 Days
Solids, Total	SM2540G	Solid	Plastic/Glass	$\leq 6^{\circ}\text{C}$	7 Days
Solids, Total (FOC, OM, Ash)	ASTM D2974	Solid	Plastic/Glass	$\leq 6^{\circ}\text{C}$	7 Days
Solids, Total Dissolved	SM2540C	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	7 Days
Solids, Total Suspended	SM2540D/USGS I-3765-85	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	7 Days
Solids, Total Volatile	160.4/SM2540E	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	7 Days
Solids, Total Volatile	160.4	Solid	Plastic/Glass	$\leq 6^{\circ}\text{C}$	7 Days
Specific Conductance	SM2510B/9050/12 0.1	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	28 Days
Stationary Source Dioxins and Furans	EPA 23	Air	XAD Trap	None	30/45 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
Stationary Source Mercury	EPA 101	Air	Filters	None	180 Days, 28 Days for Hg
Stationary Source Metals	EPA 29	Air	Filters	None	180 Days, 28 Days for Hg
Stationary Source PM10	EPA 201A	Air	Filters	None	180 Days
Stationary Source Particulates	EPA 5	Air	Filter/Solutions	None	180 Days
Sulfate	SM4500SO4/9036/9038/375.2/ASTM D516	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	28 Days
Sulfide, Reactive	SW-846 Chap.7	Water	Plastic/Glass	None	28 Days
Sulfide, Reactive	SW-846 Chap.7	Solid	Plastic/Glass	None	28 Days
Sulfide, Total	SM4500S/9030	Water	Plastic/Glass	pH>9 NaOH; ZnOAc; $\leq 6^{\circ}\text{C}$	7 Days
Sulfite	SM4500SO3	Water	Plastic/Glass	None	15 minutes
Surfactants (MBAS)	SM5540C	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	48 Hours
Total Alpha Radium (see note 3)	9315/903.0	Water	Plastic/Glass	pH<2 HNO ₃	180 days
Total Alpha Radium (see note 3)	9315	Solid	Plastic/Glass	None	180 days
Total Inorganic Carbon (TIC)	PM01/AM20GAx	Water	40mL VOA vial with mylar septum	$\leq 6^{\circ}\text{C}$	14 Days
Total Organic Carbon (TOC)	SM5310B,C,D/9060	Water	Glass	pH<2 H ₂ SO ₄ or HCl; $\leq 6^{\circ}\text{C}$	28 Days
Total Organic Carbon (TOC)	9060/Walkley Black/Lloyd Kahn	Solid	Glass	$\leq 6^{\circ}\text{C}$	14 Days
Total Organic Halogen (TOX)	SM5320/9020	Water	Glass; no headspace	$\leq 6^{\circ}\text{C}$	14 Days
Total Petroleum Hydrocarbons (aliphatic and aromatic)	TPHCWG	Water	40mL vials	pH<2 HCl, no headspace, $\leq 6^{\circ}\text{C}$	7 Days
Total Petroleum Hydrocarbons (aliphatic and aromatic)	TPHCWG	Solid	Glass	$\leq 6^{\circ}\text{C}$	14 days
Tritium	906.0	Water	Glass	None	180 days
Turbidity	SM2130B/180.1	Water	Plastic/Glass	$\leq 6^{\circ}\text{C}$	48 Hours
Total Uranium	908.0/ASTM D5174-97	Water	Plastic/Glass	pH<2 HNO ₃	180 days
UCMR3 Metals	200.8	Water	Plastic or glass	pH<2 HNO ₃	28 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
UCMR3 Hexavalent Chromium	218.7	Water	HDPE or propylene	Na ₂ CO ₃ /NaHCO ₃ / (NH ₄) ₂ SO ₄ ; pH>8	14 Days
UCMR3 Chlorate	300.1	Water	Plastic or glass	EDA	28 Days
UCMR3 Hormones	539	Water	Amber glass	Na ₂ S ₂ O ₃ , 2-mercaptopyridine-1-oxide, sodium salt	28 Days
UCMR3 Perfluorinated Compounds	537	Water	Polypropylene	Trizma	14 Days
UCMR3 Volatiles	524.3	Water	40 mL amber glass vials	Ascorbic acid. Maleic acid pH~2	14 Days
UCMR3 1, 4 Dioxane	522	Water	Glass	Na ₂ SO ₃ , NaHSO ₄ ; pH<4	28 Days
UV254	SM5910B	Water	Glass	≤ 6°C	48 Hours
Vermiculite	EPA 600/R-93/116	Solid	Plastic/Glass	None (handling must be done in HEPA filtered fume hood; drying may be required)	N/A
Volatile Fatty Acids	AM21G	Water	40mL clear VOA vials	≤ 6°C	21 Days
Volatile Fatty Acids (low level)	AM23G	Water	40mL clear VOA vials	≤ 6°C with benzalkonium chloride	14 Days
Volatile Petroleum Hydrocarbons (aliphatic and aromatic)	MA-VPH	Water	40mL vials	pH<2 HCl; ≤ 6°C	14 Days preserved
Volatile Petroleum Hydrocarbons (aliphatic and aromatic)	MA-VPH	Solid	4-8oz Glass Jar	≤ 6°C; packed jars with no headspace	7/28 Days
Volatiles	TO-14	Air	Summa Canister	None	30 Days
Volatiles	TO-14	Air	Tedlar Bag or equivalent	None	48 Hours
Volatiles	TO-15	Air	Summa Canister	None	30 Days
Volatiles	TO-17	Air	Thermal desorption tubes via SKC Pocket	≤ 6°C but above freezing	28 Days

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Parameter	Method	Matrix	Container	Preservative	Max Hold Time
			Pumps or equivalent		
Volatiles	TO-18/8260	Air	Tedlar Bag or equivalent	None	72 Hours
Volatiles	8260	Solid	5035 vial kit	See note 1 (analyze for acrolein and acrylonitrile per local requirements)	14 days
Volatiles	8260	Water	40mL vials	pH<2 HCl; $\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present (preserve and analyze for acrolein and acrylonitrile per local requirements)	14 Days
Volatiles	8260	Conc. Waste	5035 vial kit or 40mL vials	$\leq 6^{\circ}\text{C}$	14 Days
Volatiles	624	Water	40mL vials	pH<2 HCl; $\leq 6^{\circ}\text{C}$; $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present (or unpreserved if run within 7 days of collection) (preserve and analyze for acrolein and acrylonitrile per local requirements)	14 Days (7 Days for aromatics if unpreserved)
Volatiles (see note 2)	524.2	Water	40mL vials (in duplicate)	pH<2 HCl; $\leq 6^{\circ}\text{C}$; Ascorbic acid or $\text{Na}_2\text{S}_2\text{O}_3$ if Cl present ²	14 Days
Whole Oil	ASTM D3328 (prep); ASTM D5739	Product	10mL glass vials	$\leq 6^{\circ}\text{C}$	N/A

¹ **5035/5035A Note:** 5035 vial kit typically contains 2 vials water, preserved by freezing **or**, 2 vials aqueous sodium bisulfate preserved at 4°C , **and** one vial methanol preserved at $\leq 6^{\circ}\text{C}$ **and** one container of unpreserved sample stored at $\leq 6^{\circ}\text{C}$.

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² Method 524.2 lists ascorbic acid as the preservative when residual chlorine is suspected, unless gases or Table 7 compounds are NOT compounds of interest and then sodium thiosulfate is the preservative recommended.

³ Methods 9315 and 9320 both state that if samples are unpreserved, the samples should be brought to the lab within 5 days of collection, preserved in the lab, and then allowed to sit for a minimum of 16 hours before sample preparation/analysis.

⁴ The holding time for hexavalent chromium may be extended by the addition of the ammonium buffer listed in EPA 218.6 per the 2012 EPA Method Update Rule. Although Method 218.6 stipulates a different pH range (9.0 to 9.5) for buffering, this method requirement was modified in the Method Update Rule to a pH range of 9.3 to 9.7. For non-potable waters, adjust the pH of the sample to 9.3 to 9.7 during collection with the method required ammonium sulfate buffer to extend the holding time to 28 days. For potable waters, addition of the buffer during collection will extend the holding time for 14 days per EPA 218.7 and the EPA UCMR3 program.

TEG NORTHERN CALIFORNIA, Inc.
STANDARD OPERATING PROCEDURES (SOP)
QUALITY ASSURANCE PLAN (QAP)

GC/MS
EPA Method 8260B

Revision 11

January 2012

1.0 Scope and Applications

This SOP has been prepared for TEG Laboratories to help insure consistent analytical protocol and applies to the performance of the EPA Method 8260B. The scope of topics discussed in this SOP include the following:

- * Method Summary
- * Instrumentation and Equipment
- * Detection Limits
- * Precision, Bias and Working range
- * Sample Collection, Preservation and Holding Times
- * Reagents and Standards
- * Procedure (Sample Preparation, Instrument Operation, Calibration and Analysis)
- * QA/QC Requirements
- * Run Logs
- * Reporting
- * Safety Precautions

2.0 Summary of Method

TEG Laboratories uses EPA Method 8260B to identify and quantify volatile organic compounds. Samples are introduced into the chromatograph by Purge and Trap by EPA Method 5030, and EPA Method 5035 either as a direct purge of soil or water or as an extraction followed by purge and trap of an aliquot of the extract. Soil vapor samples are treated in a similar manner to that of water samples with the exception that the internal standards and surrogates are in the water added to the purge apparatus subsequent to the introduction of the vapor sample. The analysis is performed on a gas chromatograph (GC) with a quadrupole mass spectrometer (MS).

3.0 Instrumentation and Equipment

TEG utilizes Agilent Technologies 6850 GCs with 5973N and 5975 Mass Spectrometer (MSD) systems for performing EPA Method 8260B. The purge and traps include Tekmar Dohrman 3000 and 3100 with Archon and Tekmar 2016 autosamplers with sixteen to fifty-one sample capacity. The column is a J&W-DB624. The carrier gas is ultra high purity (UHP) Helium.

Soil samples are weighed on precision, top loading digital balances. Water samples are transferred by the Archon sampler to the purge and trap or measured in syringes from 5mL down to 10 uL. Purge and Trap grade methanol is used as the solvent for soil extractions. 10 uL and 25 uL syringes are used during dilution preparations. Sample preparation is performed with ventilation directed to the outside of the lab. Soil vapor samples are taken in 5, 20, 50, or 100 mL syringes and immediately transferred to the autosampler sparge tube.

Agilent Technologies Chemstation software with Enviroquant software running on Windows XP personal computers are used for data acquisition and instrument control. Chromatograms are printed out on HP Laserjet printers.

The above-mentioned equipment requires 110 VAC as a power source to operate.

Sources of further information can be found in the Agilent Technologies GC, MS and Tekmar Purge and Trap hardware and software manuals, which are kept with each instrument. Each instrument also comes with Agilent Technologies maintenance information on CD, which can be viewed on the computer.

4.0 Reporting Limits

The normal reporting limits (RL) are nominally 5-10 ng of compound on column. This typically corresponds to 5-10 ug/kg for a one-gram soil sample, 1 ug/L for a 5 ml water sample, or 0.1 ug/L of vapor for a 50 cc vapor sample. These limits should be compared annually to the MDL's to make certain that they are appropriate. Depending upon client data quality objectives (DQO's) TEG may report lower than these values. Ideally, the reporting limits should be no lower than twice the MDL, and never less than the MDL, calculated at initial instrument checkout and updated yearly or at major instrument overhaul. Results reported that are between the RL and the MDL can be flagged with the "J" flag as a quantitative estimate at the clients request. Reporting limits may be raised to accomplish specific data quality objectives as clients or regulatory agencies dictate with no effect on the data or flags required.

5.0 Working Range

The applicable working range of the analyses for the EPA Method 8260B is dependent upon the concentrations of the calibration standards used while developing the calibration curve for the instrument. This calibration curve is discussed in Section 7.0, Calibration. Generally, the working range of the instrument is between the detection limit for the analyte and the concentration of the high standard used for system calibration (normally 500 ng). In the event that the analytical results are greater than the highest standard value, the sample should be diluted and reanalyzed or labeled with an "E" flag (estimated value). In the case of the DTSC-LARWQCB protocol for soil vapor samples, the "E" flag will be used if the sample is greater than 150% of the high standard.

6.0 Sample Collection, Preservation and Holding Times

It is the responsibility of the field scientist (geologist, consultant, etc.), to collect all soil, water, and soil vapor samples in manners which are consistent with protocol as set forth by federal, state and local regulatory agencies. The lab operator should assist in any manner possible but the ultimate responsible lies with the sampler to assure that samples are taken in proper containers with preservatives, if required. Care should be taken by the lab operator to insure that samples are not inadvertently contaminated in the lab.

6.1 Soil Samples

All soil samples should be collected in clean brass or stainless steel sample tubes (usually during drilling) or clean, laboratory approved, glass sample jars with Teflon liners. When sample tubes are used, the tube ends should be sealed with an impermeable material such as aluminum foil or Teflon tape. Next, the sample tubes should be capped with plastic caps. Care should be taken to insure that the sample tubes are full and no headspace is present.

When using glass sample jars, they too must be completely filled to alleviate headspace. After filling, the jars should be securely capped with screw-on caps.

Once soil samples have been obtained, they should be placed in an ice chest or appropriate cooler by TEG. Care must be taken to insure the soil samples are kept at, or below, 4 degrees C +/- 2 degrees. The holding time for soil samples should not exceed 14 days from the time of collection.

6.2 Water Samples

As is the case with soil samples, it is the responsibility of the field scientist to insure that all water samples are collected in accordance with regulatory protocol. Water samples should be collected in glass vials designed to prevent the loss of volatile compounds. The vials should be completely filled, then securely capped with

screw-on caps. No headspace should be present within the vials. To check for headspace, invert the capped vial and look for air bubbles.

Once water samples have been collected, they should immediately be placed in an ice chest or other appropriate cooler and maintained at a temperature of 4 degrees C +/- 2 degrees. Care must be taken to insure that the samples do not freeze, thus bursting the sample container. The holding time for water samples should not exceed 14 days from the time of collection, if preserved with HCl.

6.3 Soil Vapor Samples

As is the case with soil and water samples, it is the responsibility of the field scientist to insure that all vapor samples are collected in accordance with regulatory protocol. Samples should be collected in syringes, Tedlar bags, or other vessels designed to prevent the loss of volatile compounds. Holding times for the various sample vessels should be observed. For example, TEG will observe maximum holding times of 30 minutes for syringe samples, and 6 hours for Tedlar bag samples.

6.4 Chains-of-Custody

The laboratory operator or sample custodian accepts samples from the field. Soil and water samples should be delivered with the appropriate chain-of custody (COC) form. The lab operator or sample custodian should immediately open the cooler and inspect the contents of the cooler. The contents are removed and inspected against the COC. The custodian should note that the following are in place. The COC must contain:

- Unique sample identifier for all samples
- Date and time of sampling
- Source of sample including name, location and sample type
- Designation of MS/MSD
- Preservatives used
- Analyses required
- Name of collector
- Pertinent field data
- Serial numbers of custody seals and transport cases (if used)
- Custody transfer signatures and dates and times of sample transfer from the field to transporter and the lab
- Bill of lading or transporter tracking numbers (if applicable)

The sample custodian will check the COC for the above criteria in reference to the applicable methods. If any discrepancies are found, the custodian should document those on the COC or in the daily analysis logs. The custodian should also immediately inform the field personnel of the problem. No samples whose name or other information is in question should be analyzed. Once sampling personnel have solved the problem analysis can begin. Samples awaiting analysis are stored in refrigerators or freezers separate from those containing analytical standards.

6.5 Sample Storage

Samples for VOCs are stored in the lab refrigerator at 4 degrees +/- 2 degrees. The refrigerators are monitored for temperature 7 days per week and records maintained in the excursion log.

6.6 Sample Handling

6.6.1 High Level Samples

For the purposes of this SOP, high level samples will be defined as those samples exhibiting a noticeable odor, are wet with nonaqueous material or those which have been prescreened by another technique and shown to be high level or those designated by the field as high level.

The following precautions may be taken by the lab operator in order to protect their health and safety. Because all lab operators have been OSHA 40 hour trained, and are considered personnel of supervisory level, it will be left to the lab operator to determine the level of precaution required on an individual and project basis. The following protections are available to the operator.

- a) Preparation using eye protection and gloves
- b) Use of the well ventilated preparation room with doors open
- c) Use of the laboratory fume hood
- d) Store sample until more protection can be arranged.

If at any time the lab operator feels ill, especially after handling samples which may be high level, the operator should inform supervisory and/or medical personnel at the site and discontinue sample contact.

7.0 Calibration

7.1 Reagents and Standards

Purge and Trap grade methanol is used for all extractions and dilutions of standards. Stock standards for analytes, surrogates and internal standards are normally purchased and are diluted for use. All purchased and prepared solutions are recorded in Laboratory Standards notebooks. Each mobile lab and the fixed based lab have notebooks to log standards.

In addition to the stock standards, medium and/or low secondary standards are also necessary for GC/MS calibration. Normally a solution is diluted to a convenient volume such as 10 to 1. To prepare a medium dilution from a standard, measure 1 ml from the stock (high) standard with a 2500 ul syringe and transfer it to a 10-ml volumetric flask. Add methanol to the flask until a volume of 10 ml has been achieved. Calculate the concentration of the medium standard by dividing the concentration of the high standard by 10.

To prepare the low secondary standard, transfer 100 ul of the high standard to a 10-ml volumetric flask and add methanol until 10 ml has been achieved. Calculate the concentration of the low standard by dividing the concentration of the high standard by 100.

All standards should be transferred to glass vials, securely capped and labeled. The standards should then be refrigerated to 4 degrees c. All standards should be logged into the standards logs located within the labs or in the lab master standards log. All standards should be stored in the standards refrigerators located within the labs and stored separately from samples.

7.2 Standard Expiration

Standards for VOC analysis will be prepared and given expiration dates. Typical expiration dates are shown below. Care must be taken that these dates do not exceed the manufacturer's date of expiration.

Internal Standards and surrogates	- 6 months
VOCs	- 6 months
Gaseous VOCs	- 6 months

The lab operator should monitor response factors to determine whether standards are degrading. In general, response factors will vary with tuning characteristics. However, comparison to response factors from fresh standard is suggested.

8.0 Procedures

8.1 System Start-Up

The mass spectrometer is maintained heated and under vacuum through the use of generators, or shore power. Helium is always supplied to the gas chromatograph but is automatically shut off when the GC is off through the electronic pressure control.

Upon arriving on site:

- 1) Connect to shore power (if available) and wait for the delay period to ensure that the system is running on AC shore power. Fill out excursion log.
- 2) If not already running, start air conditioners, if needed.
- 3) Supply power to the GC, purge and trap and autosamplers. Make sure computer and printer also have power. Load method 8260 on the GC and make sure system is "ready".
- 4) Start computer. Go to windows and load "ENV TOP", Purge and Trap will beep to indicate power had failed. Follow directions to click OK.
- 5) Select "MS Tuning", Diagnostics, Vacuum Status to view vacuum status. diff. pump should be hot, MS should be around 145-165 degrees, 150 degrees for the analyzer and foreline pressure around 35-45 mm.

8.1.1 Initial System Calibration

Prior to performing analyses, the GC-MS must be tuned and calibrated to insure system precision and accurate results.

Tuning of the GC-MS is accomplished using the Agilent Target Tune function in the BFB tune mode. The instrument automatically performs the tuning in an attempt to adjust parameters such that the spectrum of the compound 1,4-Bromofluorobenzene will meet the following specifications:

- Mass 50 15 percent to 40 percent of mass 95
- Mass 75 30 percent to 60 percent of mass 95
- Mass 95 base peak, 100 percent relative abundance
- Mass 96 5 percent to 9 percent of mass 95
- Mass 173 less than 2 percent of mass 174
- Mass 174 greater than 50 percent of mass 95
- Mass 175 5 percent to 9 percent of mass 174
- Mass 176 greater than 95 percent, but less than 101 percent of mass 174
- Mass 177 5 percent to 9 percent of mass 176

Following tuning, BFB must immediately be evaluated in the next blank or standard to determine the validity of the tune. Once the tune has passed, samples can be analyzed for a 12 hour period. After 12 hours the calibration midpoint and BFB must be re-evaluated before analyzing additional samples. If the above criteria are not met, the instrument must be retuned or the problem found prior to proceeding.

Prior to performing analyses, the GC-MS must be calibrated to insure system precision and accurate results. To calibrate the GC-MS, standards of the analytes, along with internal standards and surrogates are injected into reagent water, and measured by the method. (For convenience in standard preparation four standards are used, internal standards, surrogate standards, the 8260B compounds and the 8260B permanent gases. A minimum of five concentration levels should be used during calibration for EPA Method 8260B. Each standard solution is analyzed under the identical parameters as samples will be analyzed. The end result is a calibration curve for each analyte. (Note: Certain regulatory protocols i.e. LARWQCB and specific client Data Quality Objectives (DQOs) may require fewer than five initial calibration standards)

To prepare a calibration curve:

- 1) Turn on the system. Refer to Section 7.1.
- 2) Load a Method (e.g.M18260.mth) into the software. Schedule the autosampler for the correct sample que.
- 3) Inject 20ng of the 8260B compounds, 20ng of the 8260B gases, 20 ng of the surrogates and 50ng of the internal standards into 5 mL of reagent water in a five-mL syringe. Connect the syringe to the purge apparatus and load the purge tube with the standard/water mix. Initiate the run by clicking start in the P&T windows.
- 4) Repeat for 50ng, 100ng, 150ng, and 200ng of target and surrogate keeping the internal standards constant at 50 ng. Other levels may be used to extend the calibration curve to higher concentrations.
- 5) After completing the analyses, quantitate and load the five standards as the initial calibration. Evaluate the initial curve for linearity and response factors per the current version of EPA Method 8260B (or project specific DQO's).
 - a) The SPCC compounds must have RF's greater than:

Chloromethane	0.1
1,1-Dichloroethane	0.1
Bromoform	0.1
Chlorobenzene	0.3
1,1,2,2-Tetrachloroethane	0.3
 - b) The CCC compounds must have %RSD less than 30%.
The CCC's are vinyl chloride, 1,1-Dichloroethene, chloroform, 1,2-Dichloropropane, toluene, ethylbenzene.
 - c) Target compounds that have a %RSD less than 15% are considered to be linear within the calibration curve. For these compounds the average response factor is chosen as the calibration curve type.
 - d) Targets with %RSD greater than 15% may be treated in one of the following manners:
 1. The analyst may run an additional calibration point and drop either the high or low point of the curve thus achieving an abbreviated or narrower linear range for the curve. In this instance, this compound will have a lower high point for the curve. If the low point is dropped, the reporting limit must be raised proportionately.
 2. The mean of the RSD values for all analytes in the calibration is less than or equal to 15%
 - 3 A linear regression of the instrument response versus the concentration of the standards may be calculated.
 - 4 A minimum of a six-point curve may be prepared and a quadratic fit of the points used for calibration.

The calibration curve is checked for validity using a calibration standard from a second source. The second source is introduced into the system in the same manner as the curve. In order for validity to be achieved the second source must pass the requirements of a daily calibration i.e., SPCC's and CCC's must pass per method

The calibration curve must be verified each working day by injecting standards. SPCCs must have RF's at least equal to the levels specified above. CCC compounds must be less than 20% for the system to be considered still within calibration.

If all the above CCC compounds do not meet the 20% criteria several options are available.

- a. The analyst may reanalyze the calibration standard, reprepare the calibration standard and reanalyze and/or perform instrument troubleshooting and reanalyze.
- b. The average of the %drifts for all calibrated target compounds may be calculated. If this is less than 20% the system may be assumed to be calibrated. However, calibration data should accompany the report so that the user may know which compounds did not meet the criteria. In this case, however, no compound may have a %RSD greater than 40%.
- c. Target compounds may be individually screened to see if they meet the 20% criteria. If the target analytes meet the 20% criteria, analysis may continue.
- d. Data from those compounds which do not pass the 20% criteria may be flagged as estimated.

8.2 Laboratory Blank Preparation

Add 5 ml blank water (nitrogen purged bottled drinking water, e.g. Alhambra, Arrowhead) to a 5 mL syringe. Using a 5 or 10 ul syringe add 50ng internal standard (I.S.) and 50ng of surrogate solution. The I.S. and Surrogate solutions may be combined for daily calibration, sample and blank analysis although they must be separate for initial calibration.

8.3 Low Level Soil Sample Preparation/analysis

Soil samples should be prepared using the following steps:

- 1) Check the analytical balance with calibration weights. Record the weight and expected weight on the daily extraction log. The balance should be checked daily when samples are extracted or when the balance is moved.
- 2) Tare (zero) the balance with a clean VOA vial, containing a stir bar, on the balance tray. Add 5.0 grams of soil to a VOA vial with a clean scoop or 5.0 gram subcore as outlined in EPA method 5035. Add 5.0 ml of reagent grade water. Place the VOA vial on the autosampler.
- 3) The autosampler adds an additional 5 ml of reagent water and 50 ng of I.S./surrogate to the sample vial. The sample is purged through the sealed VOA vial.
- 4) The sample is analyzed on the GC/MS.

8.4 Medium/High Level Soil Sample Preparation/Analysis

Soil samples should be prepared using the following steps:

- 1) Check the analytical balance with calibration weights. Record the weight and expected weight on the daily extraction log. The balance should be checked daily when samples are extracted or when the balance is moved.
- 2) Tare (zero) the balance with a 40-mL VOA bottle on the balance tray. Add 5.0 grams of soil to the tube with a clean object such as a scoop. Add 5.0 mL of Purge and Trap grade Methanol to the VOA. Shake.
- 3) Add 5.0 ml reagent water to the 5.0 ml syringe and add 50 ng I.S./surrogate solution. Then add an aliquot of the MeOH extract to the syringe and add to the purge tube on the autosampler. Depending upon the expected concentration of analytes in the sample aliquots of 25ul, 10ul, 2ul may be chosen. The respective dilution factors associate with these are 40, 100 and 500 respectively.
- 4) The sample is analyzed on the GC/MS.

8.5 Water Sample Preparation

Preparing water samples using the Archon autosampler:

- 1) Insert VOA vial containing the water sample into the autosampler.
- 2) The autosampler transfers a 5.0 ml aliquot of sample to the purge & trap unit as 50 ng of I.S./surrogate is added to the sample.
- 3) The sample is purged in the purge & trap unit.
- 4) The sample is analyzed on the GC/MS.

8.5.1 Soil Vapor Sample Preparation

Prepare soil vapor samples using the following steps:

- 1) Inject the soil vapor into the purge and trap purge tube.
- 2) Transfer 5 ml of reagent water to a syringe.
- 3) Add the required amount of internal standard and surrogates (2.5ul)
- 4) Inject the water into the purge tube.

8.6 Analysis

Once the system has been turned on, the daily calibration checked and a blank analyzed, samples may be analyzed. After preparing the sample extractions as directed above, the procedures outlined below should be followed for sample analysis.

8.6.1 Start-up Procedure for Analysis

8.6.1.1 Turn on GC-MS, Purge and Trap (P&T), Autosampler, and computer. Load method files on P&T and GC-MS. Use sequencing for multiple GC-MS analyses. Use scheduling to run multiple P&T samples.

8.6.1.2 Analysis of blank water

- a. Add 5 mL blank water to syringe.
- b. Add 50 ng each of surrogates and internal standards solutions to water
- c. Introduce into purge tube. Start run.

8.6.1.3 Standard Analysis

- a. Add 50 ng targets and 50ng surrogates and 50 ng internal standards to 5 mL reagent in the syringe.
- b. Introduce into purge tube and analyze.

8.6.1.4. Remove and clean purge vessel.

8.6.2 Data Analysis

8.6.2.1. Blank must have all targets < R.L.

8.6.2.2 Daily Calibration standard must have all SPCC and CCC compounds within method specifications otherwise corrective must be taken.

All SPCCs must be within specifications of the method. A second calibration can be analyzed. If all SPCC compounds do not meet criteria instrument troubleshooting should be performed.

If all CCC compounds are within 20% drift then all analytes are assumed to be within calibration. If any one CCC compound has a response factor that differs from its average by more than 20%, then each compound must be examined to determine whether it fits the 20% drift criteria. (Exception: If vinyl chloride is the only CCC out of calibration all compounds except the gases may be assumed to be calibrated.) Otherwise compound "hits" out of calibration must be flagged as estimated. Data quality objectives may be revised on a project by project basis to relax this requirement.

8.7 Detection Limits/ Reporting Limits - Dilutions

When samples are diluted for 8260B, the R.L.s are raised proportionately. All multipliers must also be applied to the R.L.s as well. Dilutions are recorded on the daily extraction/run logs and are entered into the Agilent chemstation software for the particular analysis.

8.8 Data Processing

8.8.1 Peak Integration

The GC/MS data system will perform peak integration of the target ion chromatograms. If parameters for thresholding and peak width are correctly set (see Agilent manuals), the algorithm used by the Agilent instruments should correctly integrate 90% or greater of the ion chromatograms correctly. It is recommended that the operator allow this to occur and to simply view or monitor the result.

Sometimes manual integration is necessary. The following are some common examples in Method 8260 where manual integration may be necessary.

- 1) Gaseous VOCs at low levels:
Owing to noise at the top of the peak the program may only choose one half of the peak to integrate.
- 2) Peak tailing:
Excessive peak tailing can add significant area to a peak. The peak should be cut off such that the peak is as symmetrical as possible.
- 3) Unresolved peaks:
The program may pick the wrong peak to quantitate. eg. the internal standard chlorobenzene-d5 is not always completely resolved from chlorobenzene and the latter is chosen. This may be manually integrated using a drop to baseline method.
- 4) Interference:
Interference with the target ion may require manual integration. eg. the surrogate 1,4 bromofluorobenzene is often interfered by fuel hydrocarbons.
- 5) Noise in the baseline:
Noise in the baseline may add area to compounds which may incorrectly increase the amount detected. This is more often a problem at the lower levels. A noisy baseline can be witnessed by several small "bumps" in the ion chromatogram preceding or following the peak of interest. If noise is evident it shall be acceptable to manually integrate from the top of the noise line instead of the "zero" baseline level.

When manual integration is necessary, it must be documented. The operator should follow the following guidelines.

- a. Check to see how the particular compound integration is performed on the standards (ICAL, CCAL). Is it baseline, valley to valley, etc?
- b. Manually integrate the compound in the new data file in a manner as consistent with (a) as possible.

8.8.2 Reporting and Review

8.8.2.1 The Data Package

The analyst will prepare a data package for Reporting and Review. For EPA Method 8260B the package will be produced on a daily basis corresponding to the 12-hour window of operations. The typical package will consist of the following:

The Original COCs for the samples analyzed during that day

The daily run logs

The BFB tuning report

Edited Quantitation reports from the daily initial Calibration (ICAL) or the passing Continuing Calibration Verification (CCV)

The Response factor summary (if ICAL) or the Evaluation of CCV (if daily CCV)

Edited quantitation report from a blank analysis

Edited quantitation reports for all analyses.

Edited quantitation for MS/MSD if applicable.

MS/MSD summary with control limits.

In addition to the above daily package, other data pertinent to the project should be supplied to the data entry person(s) and the reviewer. Such project specific information as out of control events and associated recommendations for qualifier flags, corrective actions, MDL studies should be added to the above package if required by project DQOs.

The analyst will assure that the data is in the proper format above before passing it on for data entry or review.

8.8.2.2 Report Review

Data Review will consist of a second party review of the data generated during this project. The data reviewer will check:

- 1) Folder
 - a. Project Number
 - b. Project Name (site)
 - c. Project date
- 2) Accounting Information
 - Lab confirmation form
 - a. Report to information
 - b. Billing to information
- 3) Print report on plain paper
- 4) From Chain of Custody Record confirm:
 - a. Project information (client, project No. etc.)
 - b. Correct dates
 - c. Special instructions or out of control items
 - d. Does the COC sample names match the report.
 - e. Check the COC for the following items:

Unique sample identifier for all samples:

 - a. Date and time of sampling
 - b. Source of sample including name, location and sample type
 - c. Designation of MS/MSD
 - d. Preservatives used
 - e. Analyses required
 - f. Name of collector
 - g. Pertinent field data
 - h. Serial numbers of custody seals and transport cases (if used)
 - i. Custody transfer signatures and dates and times of sample transfer from the field to transporter and the lab
 - j. Bill of lading or transporter tracking number (if applicable)

- 5) From Raw Data:
Organize raw data in order of date.

Go through the raw data:

- a. Date - is the correct date analyzed listed
 - b. BFB tuning – does it pass?
 - c. Blank - is it clean
 - d. ICAL – does it meet project QC requirements (if applicable)
 - e. ICV - does it meet project QC requirements?
 - f. CCAL - is it acceptable under project QC
 - g. LCS – within specifications
 - h. Sample - identify each individual set of data
- 6) Using the final report forms, check that the raw data from above is correctly entered in the proper places on the forms. Apply data qualifier flags to the data as necessary according to project requirements.
- 7) Edits
- a. In spreadsheet, with edited copy of rough draft
 - b. Page by page make all changed marked in red
 - c. Print out on letterhead
 - d. Compare final to rough draft
- 8) Mail
- a. Prepare the report; spreadsheet pages, and COC.
 - b. Make a complete copy for our file

9.0 Quality Assurance and Quality Control

Quality Assurance (QA) and Quality Control (QC) are a set of procedures and conditions designed to maximize the precision and accuracy of the analytical process. QA/QC is a continuous process requiring verification by inspection and, if necessary, appropriate corrective action. Listed below are key items used to insure proper QA/QC. A brief description of each term is included, along with TEG and regulatory requirements.

Initial Calibration
Continuing Calibration
Chain-of-custody
Detection Limit
Minimum detection limit (MDL)
Reporting Limit
Matrix Spiking
Blanks
Percent Recovery Calculation
Relative Percent Difference (RPD)
Laboratory control Limits
Sample Run Logs

9.1 Initial Calibration (ICAL)

Prior to performing sample analysis, the GC must be initially calibrated. Following a clean blank analysis, a minimum of five levels of target compounds along with surrogates and internal standards are introduced into the GC/MS system and the total area under each peak determined. These values are entered into the software. The computer will construct the calibration curve according to one of several methods. Among these are (a) average response factors, (b) straight line through origin, (c) straight line using origin, (d) quadratic. Hardcopy output of the five chromatograms should be saved and kept with the instrument throughout the lifetime of the ICAL. The hardcopy output should list the method used to generate the ICAL curve. The ICAL is considered valid until the continuing calibration fails or a major change in the instrument operating condition occurs.

9.2 Continuing Calibration (CCAL)

The calibration of the instrument is checked prior to running samples. The continuing calibration (CCAL) or continuing calibration verification (CCV) normally uses a standard corresponding to the midpoint of the calibration curve to check the validity of the ICAL. Response of the compounds of interest must be within that specified by the method for the continuing calibration check compounds (CCCs) for the curve to be valid. If not all compounds are of interest only those being analyzed need to be checked.

9.3 Chain of Custody Record

A Chain of Custody Record serves to note the disposition of the soil and water samples, from the time of collection to laboratory receipt. This form should be filled out at the time of collection and signed by all persons collecting, relinquishing and receiving samples. All soil and water samples must be documented on an appropriate Chain of Custody form.

9.4 Detection Limits

9.4.1 Minimum Detection Limit (MDL)

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory shall establish MDLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory shall revalidate these MDLs at least once per twelve-month period. The laboratory shall maintain proof of the MDL demonstrations (i.e., before project samples are analyzed) and upon request in the format specified in Section 8. Results less than or equal to the MDL shall be reported as the MDL value and flagged with a "U" (see Section 8).

Laboratories participating in this work effort shall demonstrate the MDLs for each instrument, including confirmatory columns, method of analysis, analyte, and matrix (i.e., water and soil) using the following instructions:

- (1) Estimate the MDL using one of the following:
 - a) The concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5, or
 - b) The concentration equivalent of 3.143 times the standard deviation of replicate measurement of the analyte in reagent water, or
 - c) The region of the standard curve where there is a significant change in sensitivity (i.e., a break in the slope of the standard curve).
- (2) Prepare (i.e., extract, digest, etc.) and analyze seven samples of a matrix spike (ASTM Type II water for aqueous methods, Ottawa sand for soil methods, glass beads of 1 mm diameter or smaller for metals) containing the analyte of interest at a concentration three to five times the estimated MDL.

(3) Determine the variance (S^2) for each analyte as follows:

$$S^2 = \frac{1}{n-1} \left[\sum_{i=1}^n (x_i - \bar{x})^2 \right]$$

where x_i = the i th measurement of the variable x and $\bar{x}$ = the average value of x

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n x_i$$

(4) Determine the standard deviation (s) for each analyte as follows:

$$s = (S^2)^{1/2}$$

(5) Determine the MDL for each analyte as follows:

$$\text{MDL} = 3.14(s)$$

(note: 3.143 is the one-sided t-statistic at the 99 percent confidence level appropriate for determining the MDL using 7 samples)

Where multiple instruments are used, the MDL used for reporting purposes shall represent the least sensitive instrument.

9.4.2 Reporting Limit

The Reporting Limit (RL), also referred to as the Practical Quantitation Limit (PQL), is equal to the lowest level of the calibration curve which should be 2 to 5 times greater than the MDL. Results between the MDL and the RL may be reported only as estimated.

9.5 Matrix Spike and Matrix Spike Duplicate

The Matrix Spike (MS) and Matrix Spike Duplicate (MSD) are two aliquots of the same sample, which have been spiked with a known concentration of a target analyte. Together, the results of these two sample spikes are used to indicate method precision and accuracy, and to characterize the effects, if any, of matrix interference. TEG uses a minimum of 5 percent of all samples for these spikes.

9.6 Blanks

A Method Blank is an analyte free matrix sample, run through the sample preparation and analysis procedures of those used for samples. These blanks check the levels of contamination for the method.

9.7 Percent Recovery Calculation

The values for the MS and MSD are used to calculate the Percent Recovery (PR), an estimate of the accuracy of the analytical process. The Average PR can be calculated using the following general equation:

$$\text{Average PR} = \frac{(\text{MS} + \text{MSD})/2}{\text{SA}} \times 100$$

where: PR = Percent Recovery

MS = Matrix Spike Result

MSD= Matrix Duplicate Spike Result

SA = Spiked amount

TEG calculates the PR for each set of spikes (MS and MSD) and the resultant value is included in the QA/QC section of the report.

9.8 Relative Percent Difference

The Relative Percent Difference (RPD) is calculated from MS and MSD data and is used to estimate overall method precision. The RPD can be calculated using the following general equation:

$$\text{RPD} = \frac{\text{MS} - \text{MSD}}{(\text{MS} + \text{MSD})/2} \times 100$$

This RPD data is calculated for each set of spikes (MS and MSD) and is included in the QA/QC section of the report.

9.9 Laboratory Control Limits

Each certified laboratory establishes their own set of Laboratory Control Limits (LCL's). These limits include criteria such as recovery ranges and maximum allowable RPD's. TEG has established the following preliminary list of control limits for EPA Method 8260B from the method:

	Average percent recovery	RPD
MS/MSD or LCS/LCSD:		
1,1-Dichloroethene	60-130	<30
Trichloroethene	60-130	<30
Chlorobenzene	60-130	<30
Benzene	60-130	<30
Toluene	60-130	<30

Surrogate recovery:

4-Bromofluorobenzene	60-140
dibromofluoromethane	60-140
toluene -d8	60-140

Spiked matrix/duplicate pairs which exceed this limit are either reanalyzed or a matrix blank is spiked (Lab Control Spike) to check method performance.

Samples whose surrogate exceeds the limits are reanalyzed one time.

9.10 Sample Run Logs

TEG maintains a Sample Run Log for all samples analyzed. A new log is prepared for each work day. The following information is included on the run logs:

- Date of operation
- TEG job number
- Operator name
- Instrument No.
- Analysis type
- Solvent type
- Extraction method
- Matrix Spike, Matrix Spike Duplicate information
- Sample extraction data (sample amount, solvent amount, dilution factor, etc.)
- Calibration Standard identification
- Sample Analysis data

Also located in each lab are instrument and excursion logs. The instrument log is used to document maintenance, problems and subsequent corrective action for the instrumentation (excessive column bleed, baseline irregularities, interference, etc.). The excursion log documents where and when the particular job takes place, the type of analysis, and operating conditions (weather, temperature, etc.). The excursion log should be filled out for each new job.

10.0 Reporting

The following information should be included in each TEG report:

- Client
- Client job number
- Site location
- Dates samples received
- Dates samples analyzed
- Analyst
- Sample results in table form
- Sample number
- Amount found and units
- Detection limit for each sample
- QA/QC report for each method used
- Chain of custody
- Cover letter
 - A brief description of the method
- Narrative
 - A description of any unusual or notable events or conclusions

10.1 Data Retention

TEG maintains hardcopy and electronic data for a period not less than three years.

11.0 Preventive Maintenance

Preventive Maintenance (PM) is that set of procedures taken in an effort to assure that sample throughput is continued and that data quality is not degraded by system malfunctions. Although failure to perform preventive maintenance does not of itself produce poor quality data, the lack of such procedures may lead to earlier degradation of data and slower processing of samples.

This section treats PM in two sections: preparation and instrument PM.

11.1 Preparation PM

The primary area where preventable errors can enter throughout the preparation steps is the introduction of contamination. Preventive maintenance in the preparation steps primarily consists of thorough washing of glassware and other apparatus.

11.1.1 Purge tubes are cleaned by washing with tap water, rinsing with reagent water and baked prior to reuse. The GC oven is used to bake the purge tubes before reuse.

Purge tubes which had high level samples in them should receive a methanol rinses prior to aqueous washing.

At washing inspect the purge tubes for cracking at the top of the tube.

11.2 Instrument PM

There are five pieces of instrumentation involved in the analysis of volatile organics by GC/MS. These are:

- (1) Mass Spectrometer
- (2) Gas Chromatograph
- (3) Purge and Trap concentrator
- (4) Purge and Trap Autosampler
- (5) computer system

1) TEG Labs follows the manufacturer's recommendations on mass spectrometer PM. Monitoring and changing rough and diffusion pump oil, cleaning of source are performed at regular intervals. A full stock of parts are kept in the lab including but not limited to source filaments and cleaning apparatus.

2) Gas Chromatograph PM consists primarily of maintaining a full stock of consumable parts. Swagelok nuts, ferrules, septa, extra columns etc. allow the operator to repair, change worn parts quickly and to continue operation without loss of time. Tubing should be periodically inspected for cracks and possible leaks. Monitoring of the gas levels and rate of pressure loss may help discover problems.

3) The purge and trap concentrator can be monitored for leaks by observing the pressure of purging. In general the purge operates at a purge pressure of 4-5 psi. A pressure less than this may indicate a leak in the purge vessel.

4) Autosampler(AS) PM is mainly concerned with cleanliness of the purging system and the checking of leaks. Following high level samples and standards it is desirable to run blank water and purge gas through the AS.

5) The Computer system PM consists of keeping dust and dirt out of the components and backing up the data and methods as often as possible.

12.0 Safety

TEG employs conservative safety practices at all times. Eye protection is to be worn by all laboratory operators while sample preparation; extraction and analysis are taking place. The laboratory operator is not to enter the exclusion zone (nor any other areas designated as exclusive by the field safety officer) at any time. Sample handling will be carried out beneath the "hood" when possible. Smoking is not permitted in the lab. Fire extinguishers, first aid kits and Material Safety Data Sheets are located in each lab.

Soil Vapor Standard Operating Procedures
TEG-Northern California, Inc.

Fulfilling CA-EPA (DTSC), LA-RWQCB, and SF-RWQCB
Advisory – Active Soil Gas Investigations (April 2012)

Revision 5
January 2013

Soil Gas Sampling Procedures

Probe Construction and Insertion

TEG's hydraulically or manually driven soil vapor probes are constructed of either 1.0, 1.25, or 1.5 inch outside diameter steel probe rods and equipped with a hardened drop-off steel tip. The probes are nominally 4 feet long and threaded together to reach multiple depths. The probe rod is driven into the subsurface with TEG's *Strataprobe*™ direct-push system, or by an electric rotary hammer. Once inserted to the desired depth, an inert 1/8 inch nylaflow tube is threaded down the center of the probe rod and connected to a sampling port just above the drop-off tip. Teflon tubing can also be used if needed. This internal, disposable sample tubing design eliminates any contact between the probe rod and the soil vapor sample. The probe is retracted slightly to expose the vapor sampling port. The probe rod is sealed at the surface with granular and hydrated bentonite and allowed to equilibrate for a minimum of 2 hours before sampling. After a sample is obtained the tubing is removed and the probe rod advanced to the next sampling depth or removed. This design prevents clogging of the sampling port and cross-contamination from soils during insertion.

Alternately, a temporary vapor implant can be installed in an open hole created by a direct push probe rod as above, or in some cases by hand augering. For same day sampling, an inert, plastic sparge implant tip is typically installed in the middle of a one foot sand pack with 1/8 or 1/4 inch diameter nylaflow tubing running from the tip to the surface. Teflon tubing can also be used if needed. Dry bentonite is placed in the hole above the sand pack, followed by hydrated bentonite to the surface, to complete the vapor point installation and seal the sand pack zone from other zones and ambient air. If the implants are to be installed for a longer period of time for later sampling or to allow for resampling, a stainless steel sparge implant tip is recommended instead of plastic. The vapor implant is allowed to equilibrate, before sampling, for a minimum of 2 hours for sampling points installed by direct push, or 48 hours for points installed by hand augering.

Soil Gas Sampling

A syringe is used to place a vacuum on the sample train to test the integrity of all the connections from the surface to the sampling tip. Soil vapor is withdrawn from the end of the inert nylaflow tubing sample train that runs from the sampling tip to the surface using a 20 to 100 cubic centimeter (cc) syringe or gas tight canister (Summa) connected via an on-off valve. The probe tip and sampling tubing is nominally purged of three internal dead volumes, or based upon a pre-determined purge volume as established by a purge volume test as described below. A sample of in-situ soil vapor is then withdrawn and immediately transferred to the mobile lab for analysis within minutes of collection. The use of small calibrated syringes allows for careful monitoring of purge and sample volumes. This procedure ensures adequate sample flow is obtained without excessive pumping of air or introduction of surface air into the sample.

For off-site analysis, samples are collected in stainless steel canisters, or in tedlar bags when allowed. Samples collected in tedlar bags for VOC analysis are either analyzed within six hours or transferred to a canister.

Purge Volume Test

If required, a site specific purge volume test is conducted at the beginning of the soil gas survey to purge ambient air from the sampling system. Three different volumes are sampled (nominally 1, 3, 10 purge volumes) and analyzed immediately to determine the volume amount with the highest concentration. This optimum purge volume, based on the purge volume test, is achieved and used during the entire site investigation.

Use of Tracer Compound to Ensure Probe Seal Integrity

A tracer compound, typically 1,1 difluoroethane (1,1 DFA), iso-propanol (IPA), or hexane is used to test for leaks around the probe rod at the ground surface and in the sampling system. The tracer is placed around the base of the probe rod and at the top of the probe rod during sample collection. If the tracer is detected per CA-EPA (DTSC), LA-RWQCB, and SF-RWQCB *Advisory – Active Soil Gas Investigations* (April 2012) specifications, the sampling train is inspected for vacuum integrity, and if necessary the sample point is reinstalled, and another sample is collected.

Sample Flow Rate

Sample collection is timed so that the flow rate does not exceed 200 milliliters per minute. This is accomplished by withdrawing the plunger on the syringe at a constant rate of 3 milliliters per second. The collector notes the collection time, and also records any resistance to sample flow that is felt on the syringe during collection.

Summa Canister

Summa canisters are connected to the end of the nylaflow tubing to the same three way valve used with the syringe. A choke is placed on the canister to ensure that the flow rate is no more than 200 milliliters per minute into the summa canister.

Field Records

The field technician maintains a logsheet summarizing:

- Sample identification
- Probe location
- Date and time of sample collection
- Sampling depth
- Identity of samplers
- Sampling methods and devices
- Soil gas purge volumes
- Volume of soil gas extracted
- Observation of soil or subsurface characteristics (any condition that affects sample integrity)
- Chain of custody protocols, if needed, and records used to track samples from sampling point to analysis.

Analytical Methodology

The following typical analytical protocols fulfill the specific EPA analytical methods and the most recent CA-EPA (DTSC), LA-RWQCB, and SF-RWQCB *Advisory – Active Soil Gas Investigations* (April 2012) (the advisory documents).

Operating Conditions and Instrumentation

Volatile Organic Compounds (VOCs) by EPA 8260

Instrument: Agilent 6850/5973N or 6850/5975N GCMS
Column: 20 meter DB-624, 0.18mm x 1.0u. capillary.
Carrier flow: Helium at 1.0 ml/min.
Detectors: Quadrupole MS, full scan mode or SIM
Concentrator: Tekmar 3000/Archon or Tekmar 3100/Archon

Fixed and Biogenic Gases (O₂, CO₂, & Methane)

Instrument: SRI 8610 or Carle AGC 311 Gas Chromatograph
Column: 6 foot CTR
Carrier flow: Helium at 15 ml/min.
Detectors: Thermoconductivity (TCD) for O₂ & CO₂.
Detectors: Flame ionization detector (FID) or TCD for methane.

Hydrogen Sulfide

Instrument: Jerome 631x
Detectors: Gold-film

Standard Preparation

Primary (stock) standards: Made from certified neat components or from traceable standards purchased from certified suppliers.

Secondary (working) Standards: Made by diluting primary standard. Typical concentrations are 1ug/ml, 10 ug/ml, and 50 ug/ml.

Laboratory Check Samples are prepared at the midpoint concentration from a standard purchased from a source different than the primary standards.

Lot numbers and preparations of all standards are recorded on a log sheet and kept in the mobile laboratory.

Initial Multi-Point Calibration Curve

An initial calibration curve of multiple points as per the individual method requirements, is performed either:

- At the start of the project.
- When the GC column or operating conditions have changed.
- When the daily mid-point calibration check cannot meet the requirements as specified below.

Calibration curves for each target component are prepared by analyzing low, mid, and high calibration standards covering the expected concentration range. A linearity check of the calibration curve for each compound is performed by computing a correlation coefficient or an average response factor (RF). If a correlation coefficient (r) of 0.99, or a percent relative standard deviation (%RSD) of +/- 30% of the RF, is obtained, an average response factor is used over the entire calibration range. If the linearity criteria are not obtained, the mean of the RSD values can be calculated, or quantitation for that analyte is performed using a calibration curve as per the method (e.g. EPA 8260B). Details of various calibration procedure details are outlined in the method.

After each initial multi-point calibration, the validity of the curve is further verified with a laboratory control standard (LCS) typically prepared at the mid-point of the calibration range. The LCS includes target compounds, and the response factor (RF) should fall within +/- 20% of the RF from the initial calibration curve as per the advisory documents, adjusted to the published accuracy of the LCS standard.

Continuing Calibration (Daily Mid-point Calibration Check)

Calibration Check Compounds (CCCs) are prepared from a traceable source and analyzed at the beginning of each day. Acceptable CCC agreement is set at +/- 20% to the average response factor from the calibration curve. When calibration checks fall outside this acceptable range for analytes detected on the site, corrective action, consisting of verification of the standard and/or a new calibration curve for the analytes out of specifications is performed by the on-site chemist.

The continuing calibration includes all compounds expected or detected at the site in addition to any specific compounds designated in the project workplan.

Reporting Limits

Typical reporting limits are outlined below:

Compound	Detector	Report Limit
VOCs by 8260B	Mass Spec	1.0 to 0.01 ug/l-vapor
Methane	FID	1000 ppmv
Fixed Gases	TCD	1% by vol
H2S	Gold Film	0.10 ppmv

Injection of Soil Gas Samples

Vapor samples from the probe sampling syringe are injected with surrogates into a purge & trap instrument for VOC analysis. Separate aliquots are directly injected into gas chromatographs for fixed gases and methane analysis

Laboratory Data Logs

The field chemist maintains injection and sample analysis records including date and time of analysis, sampler's name, chemist's name, sample ID number, concentrations of compounds detected, calibration data, and any unusual conditions.

Quality Control Procedures

Compliance With Standards

Sampling and analytical procedures complied with the CA-EPA (DTSC), LA-RWQCB, and SF-RWQCB *Advisory – Active Soil Gas Investigations* (April 2012).

Sampling Quality Control

Method Blanks

Prior to sampling each day, all components of the sampling system are checked for contamination by drawing ambient air from above ground through the sampling equipment, and injecting a sample into a gas chromatograph. The analysis results are recorded in the data tables as blanks.

Sample Quality Control

Each sample is given a unique identification number specifying location and depth. Purge and sample volumes are monitored closely using small calibrated syringes to assure a proper flow of soil gas. This ensures a representative sample is obtained from the sample zone without excessive pumping, which could result in sampling of surface air.

Decontamination Procedures

To minimize the potential for cross-contamination between sites, all external soil vapor probe parts are wiped or washed cleaned of excess dirt and moisture with solvents or potable water as appropriate. The probe's internal nylaflow tubing is purged with clean air between sampling locations or replaced as necessary. Sampling syringes are flushed with clean air after each use, baked in an oven, or replaced.

Corrective Action

Corrective action is taken when unexpected contaminant levels are detected. First duplicate samples are taken to verify the initial detection of contamination. If contamination is suspected, then the sample probes are disassembled, wiped cleaned of excess dirt and moisture, rinsed with potable water, washed with Alconox and water, and rinsed again with potable water. The sample tubing in the probe is replaced. Contaminated sampling syringes are baked in an oven or discarded.

Analytical Quality Control

Method Blanks

Method blanks are performed at the start of each day by drawing clean air through the sampling equipment and analyzing. These blanks verify all components of the sampling and analytical system are free of contamination. Additional blanks are performed more often as appropriate depending upon the measured concentrations, generally at a minimum 1 every 20 samples. Blank analyses are typically recorded in the data tables. If a blank shows a measurable amount of any target compound, the on-site chemist will investigate and determine the source, and resolve the contamination problem prior to analyzing any samples.

Duplicate Samples

Duplicate (repetitive) analysis of a sample is performed when inconsistent data are observed, but typically at least one every 20 samples. Because soil vapor duplicates can vary widely, nominal relative percent difference (RPD) acceptance criteria is $\pm$ a factor of 2.

Continuing Calibration (Daily Mid-point Calibration Check)

As described earlier, continuing calibration standards prepared from a traceable source are analyzed at the beginning of each day.

Laboratory Check Standard

Laboratory check standards, prepared at the RL concentration, are analyzed at the end of each day if all samples are below detection. Acceptance criteria is a minimum recovery of 50% from the true value. If the laboratory check standards fall outside this acceptance range for analytes analyzed on site, corrective action, consisting of verification of the standard and/or a new calibration curve for the analytes out of specifications, is performed.

APPENDIX C

SOPS FOR FIELD EQUIPMENT DECONTAMINATION, SOIL
VAPOR, SOIL, AND GROUNDWATER SAMPLE COLLECTION,
SAMPLE HANDLING, AND DOCUMENTATION

DECON SOP

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1.0 OBJECTIVES

The primary objective of this standard operating procedure (SOP) is to establish uniform methods to reduce or eliminate:

- Contamination and cross-contamination of environmental samples by sample equipment, other samples, or personnel
- Health and environmental risk caused by the spread of contaminants.

2.0 APPLICABILITY

Decontamination should occur any time a sampling tool or instrument used in field investigations may contact sampled media, or personnel using the equipment. This procedure will be used in conjunction with use of reusable equipment during field activities associated with handling, sampling or measuring environmental media such as soil, groundwater, soil gas, or air. These procedures are to be implemented primarily on-site such as at the point of use or at a designated equipment decontamination station at the project site. Equipment decontamination should be completed before each use and prior to transporting off-site.

Examples of soil and groundwater sample collection equipment usually requiring decontamination includes pumps, bailers, oil/water interface tapes, tubing, hand augers, split spoon samplers, and other related equipment used for the collection of samples or the measurement of field parameters.

These procedures are general minimum standards. They may be modified or supplemented for a specific project by site-specific workplans or health and safety plans.

3.0 RESPONSIBILITY

The Project Manager, or designee, will have the responsibility to oversee and ensure that equipment decontamination procedures are implemented in accordance this SOP and any other project specific plans. The field personnel will be responsible for the understanding and implementation of this SOP during all field activities, as well as, obtaining the appropriate field logbooks, forms and records necessary to complete the field activities.

4.0 REQUIRED MATERIALS

The equipment and supplies required for this SOP can include the following:

- Clean buckets or tubs to hold wash and rinse solutions of a size appropriate to the equipment to be decontaminated
- Tap water
- Deionized or distilled water (grade determined by project requirements. Many

projects require “organic free” or ASTM Type II water)

- Long-handled brushes for scrubbing. Flat-bladed scrapers, garden type spray bottles (no oil lubricated parts)
- Non-phosphate detergent such as Alconox or Liqui-Nox
- Plastic sheeting for the decontamination area
- Department of Transportation certified drums to hold waste decontamination solutions and expendable supplies
- Drum labels to properly identify the contents of the drum (more information about drum labels is included in the SOP for Investigation Derived Waste Handling Procedures)
- Plastic bags and/or aluminum foil to keep decontaminated equipment clean until the next use
- Gloves, aprons, safety glasses, and any other PPE required in the SSHP
- Towels and wipes
- Dispensing bottles
- Methanol (if required by the project work plan or quality assurance plan)
- Hexane (if required by the project work plan or quality assurance plan)
- Hot water high-pressure sprayer
- Sump and collection system for waste derived liquids.

Additional equipment rinses based on the contaminants being investigated may be required. Examples of this are 0.1N nitric acid when cross- contamination from metals is a concern, and solvents such as methanol, isopropanol, or hexane, when cross-contamination from organics is a concern. If these are required, labeled inert dispensing bottles and MSDS for these rinses will be necessary. Labels should be well marked. MSDS’ should be filed on site and hazard communication needs to occur.

5.0 METHODS

Decontamination consists of physically removing contaminants from personnel or equipment. To prevent the transfer of harmful materials, procedures have been developed and are implemented before anyone enters a site and continue throughout site operations.

A decontamination plan should be based on the worst-case scenario (if information about the site is limited). The plan can be modified, if justified, by supplemental information. Initially, the decontamination plan assumes all protective clothing and equipment which leave the

exclusion zone are contaminated. Based on this assumption, a system is established to wash and rinse all non-disposable equipment.

The decontamination area should be located, if possible, where decontamination fluids and soil wastes can be easily discarded or discharged after receipt of analytical results which determine if discharge parameters have been met. Decontamination wastewater should be managed in accordance with the Investigation Derived Waste Plan or as directed in the work plan or quality assurance plan. Wastewater will be collected and stored onsite until it can be properly disposed.

6.0 DECONTAMINATION STATION SET-UP

A decontamination pad should be established for cleaning of heavy equipment or large sampling tools. This pad can be a prefabricated area that already exists on site for washing large equipment, or can be constructed. If a prefabricated area exists, it needs have characteristics that allow for collecting fluids and solids that will fall off the large equipment. Decontamination pads can be constructed in a variety of ways, but things to consider during construction are the following:

- The pad will need to be constructed so it provides complete secondary containment. Hence all sides will require berms to prevent off pad migration of fluids. The berms need to be constructed by considering the balance between sump pump removal rates and the amount of fluid that will be generated.
- Fluids from decontamination processes cannot escape and be directly discharged vertically into the ground; hence if plastic sheeting is used it should be minimally double layered and thick (greater than 8 mil).
- The pad will have to drain in one general direction where a sump pump can collect fluids.
- The pad will need to be located near power and water, if possible. However, a generator can supply power and water can be trucked in.

For small equipment decontamination and PPE decontamination a smaller station is established, usually in the contaminant reduction zone, between the exclusion zone and buffer zone. For this station, clean buckets or tubs (5 gallon buckets are most common) should be used. There should be enough room within this area for storing used and unused drums. Buckets should be placed on plastic sheeting to prevent spillage to the ground, and to help keep the decontamination area and equipment as clean as possible. The buckets should be filled half to three-quarters full as follows:

Bucket 1	Tap water with non-phosphate detergent such as Liqui-Nox made up as directed by the manufacturer
Bucket 2	Tap water or deionized water for rinsing
Bucket 3	Deionized or distilled water for the second rinsing

If additional rinses using wash or dispensing bottles are called for in the project- specific documents, an additional bucket to catch the discharge from the final rinse will be necessary.

A clean area, generally covered with plastic sheeting or large clean plastic bags, is also needed to set down decontaminated equipment prior to reuse or air drying and packaging for later use.

After the decontamination area is set up, equipment decontamination is comprised of four general steps:

1. Removal of gross (visible) contamination
2. Removal of residual contamination
3. Prevention of recontamination, and
4. Disposal of wastes associated with the decontamination

Remove Gross Contamination

Gross contamination generally applies to soil sampling equipment, which may have significant residue clinging to the piece of equipment. This can be removed by dry brushing or scraping or by a high-pressure steam or water rinse often, in areas not grossly contaminated, steam washes may be all that is applied to larger equipment, such as drill casings. If utilizing high-pressure steam or water, the rinse water should be containerized as investigation derived waste. Since a significant amount of wastes may be generated, this operation is often best conducted on a decon pad, which has been designed as a secondary containment area to collect wastes.

Remove Residual Contamination

All sampling equipment used at the site must be cleaned prior to any sampling effort, after each sample is collected, and after the sampling effort is accomplished.

Removal of residual contamination consists of the following steps:

1. Place the item in the first bucket (detergent wash) and scrub the entire surface area of each piece of equipment to be decontaminated. Utilize scrub brushes to remove all visible contamination. Change the water periodically to minimize the amount of residue carried over into the second rinse.
2. Place the item in the second bucket (clear water rinse – tap or deionized water) and rinse. Change the water periodically to minimize the amount of residue carried over into the third rinse.
3. Place the item in the third bucket (deionized or distilled water) and repeat the rinsing procedure. Change water as necessary.
4. Unless additional rinses may be required, place the item on a clean surface such as plastic sheeting to await reuse or packaging for storage (e.g., wrapping foil).

Additional rinses for field sampling equipment are sometimes called. These include a 0.1 N nitric acid rinse when cross contamination from metals is a concern, and a pesticide-grade solvent (e.g., methanol, isopropanol, or hexane) when organic contamination may be present. These rinses are applied with a wash bottle so that the stream of liquid has completely covered the area of surface of the equipment that may come in contact with the sample. The rinse should be conducted over a container to catch the runoff from the equipment. The nitric acid rinses, if required, should also be followed by a distilled water rinse, also applied with a wash bottle. Solvent rinses should be conducted from more polar (i.e., methanol) to less polar (i.e. hexane or methylene chloride), and allowed to air dry if at all possible. Application of the methanol and hexane rinses requires liberal amounts of hexane to remove the methanol. Under some circumstances (e.g., poor weather), complete air drying of equipment is impractical. In such a case, allowing the equipment to dry as long as practical followed by an organic free water rinse can be used. In some projects (few), equipment may need to be baked to complete the decontamination process. Typical items baked are stainless steel air sampling fittings, where typical decontamination practices are not sufficient to remove potential contamination. Other items that may be baked are soil sleeves. Items are baked at 160 degrees Celsius for a minimum of 8 hours. The requirement to bake items is a project specific requirement and should be specifically discussed in project specific planning documents.

Prevent Recontamination After Decontamination

After the decontamination process, equipment should be stored to preserve its clean state to the extent practical. The method will vary by the nature of the equipment. Protection measures include covering or wrapping in plastic or sealable plastic bags, or wrapping with oil-free aluminum foil.

Disposal of Contaminants and Spent Rinse Fluids

All washing and rinsing solutions are considered investigation derived waste and should be containerized. After use, gloves and other disposable PPE should also be containerized and handled as investigation derived waste.

Record Keeping

The decontamination method should be documented within the field documentation designated for the project. Entries documenting the procedure used, fluids used, lot numbers for fluids, and any changes and approval for changes should be entered into a bound field notebook or on project-specific forms. Upon completion of the field activity, it is the responsibility of the field personnel to ensure the project/task manager receives copies of all of the field documentation.

7.0 REFERENCES

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FIELD DOCUMENTATION SOP

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1.0 OBJECTIVES

The objective of this standard operating procedure (SOP) is to establish a consistent method and format for the use and control of documentation generated during daily field activities. Field notes and records are intended to provide sufficient information that can be used to recreate the field activities, as well as, the collection of environmental data. Information placed in these documents and/or records shall be factual, detailed and objective.

2.0 SCOPE AND APPLICABILITY

This procedure will be used during all field activities, regardless of the purpose by all project team personnel and subcontractors who conduct field investigations. These activities may include, but are not limited to, all types of media sampling (soil vapor, soil, groundwater, wastewater, etc), utility clearance, well installation, sample point locating and surveys, site reconnaissance, free product removal, remediation, and waste handling.

3.0 RESPONSIBILITY

The Project Manager (PM), or designee, will have the responsibility to oversee and ensure that field documentation is collected in accordance with this SOP and any site-specific or project specific planning documents. The field sampling personnel will be responsible for the understanding and implementation of this SOP during all field activities, as well as, obtaining the appropriate field logbooks, forms and records necessary to complete the field activities. Field personnel shall ensure all field activities are documented completely at the end of each field day. Field personnel are responsible for tracking the location of all field documentation, including field logbooks. Field personnel are responsible for assuring that the original documentation (or copies of the field log book, if needed for another project at the same site), are filed at the end of the field project or during a long project (greater than month) every couple of weeks.

4.0 REQUIRED MATERIALS

The materials required for this SOP include the following:

- Bound field logbooks, and
- Black waterproof and/or indelible ink pens
- Field Forms

5.0 METHODS

This SOP primarily includes the documentation procedures for the field logbooks. However, procedures discussed in this SOP are applicable to all other types of field documentation collected, and should be universal in application. Details of other field records and forms (e.g.

boring logs, sample labels, chain of custody records, and waste containment labels are discussed in the specific SOP associated with that particular field activity (e.g. borehole drilling, sample handling, investigative derived waste), and not covered in detail in this SOP.

Field Logbooks

Field personnel will keep accurate written records of their daily activities in a bound logbook that will be sufficient to recreate the project field activities without reliance on memory. This information will be recorded in chronological order. All entries will be legible, written in black waterproof or indelible ink, and contain accurate and inclusive documentation of field activities, including field data observations, deviations from project plans, problems encountered, and actions taken to solve the problem. Each page of the field logbook will be consecutively numbered, signed and dated by the field author(s). Pages should not be removed for any reason.

There should be no blank lines on a page. A single blank line or a partial blank line (such as at the end of a paragraph) should be lined to the end of the page. If only part of a page is used, the remainder of the page should have an "X" drawn across it.

In addition to documenting field activities, field logbooks will include, but are not limited to, the following:

- Date and time of activities
- Site location
- Purpose of site visit
- Site and weather conditions
- Personnel present, including sampling crew, facility/site personnel and representatives (including site arrival and departure times)
- Subcontractors present
- Regulatory agencies and their representatives (including phone numbers, site arrival and departure times)
- Level of health and safety protection
- Sampling methodology and information
- Sample Locations (sketches are very helpful)
- Source of sample(s), sample identifications, sample container types and preservatives used, and lot numbers for bottles and preservatives (if applicable and if not recorded on other forms or in a sample control logbook)
- A chronological description of the field observations and events
- Specific considerations associated with sample acquisition (e.g., field parameter

measurements, field screening data, HASP monitoring data, etc.) (if not recorded on another form)

- Wastes generated, containment units (including volumes, matrix, etc), and storage location (if not recorded on another form)
- Field quality assurance/quality control samples collection, preparation, and origin (if not recorded on other forms or in a sample control logbook)
- The manufacturer, model and serial number of field instruments (e.g., OVM, water quality, etc.) shall be recorded, if not using a calibration form. Also, source lot # and expiration date of standard shall be recorded if calibrated in the field
- Well construction materials, water source(s), and other materials used on-site (if not recorded on another form)
- Sample conditions that could potentially affect the sample results
- If deviating from plan, clearly state the reason(s) for deviation
- Persons contacted and topics discussed
- Documentation of exclusion zone set-up and location
- Documentation of decontamination procedures, and
- Daily Summary.

Field situations vary widely. No general rules can specify the extent of information that must be entered in a logbook. However, records should contain sufficient information so that someone can reconstruct the field activity without relying on the collector's memory. Language used shall be objective, factual, and free of personal opinions. Hypothesis for observed phenomena may be recorded, however, they must be clearly indicated as such and only relate to the subject observation.

Logbooks will be assigned to a specific sampling team. If it is necessary to transfer the log book to alternative team member during the course of field work, the person relinquishing the log book will sign and date the log book at the time of transfer.

Field logbooks should consist of a bound book, in which the insertion or removal of pages will be visibly noticeable after the logbook has been assembled. Logbooks can be prepared by gluing or laminating pages together either at the left side or top of the page. If inclement weather is expected, logbooks may have plastic laminated front and back covers to protect the interior pages, and should not be broken apart for coping. Loose-leaf binding, such as comb binding is not considered hard binding. To maintain the integrity of the logbook, pages should be consecutively numbered prior to use. Logbook pages can be of any format, and may include blank pages for recording or field forms that are used for specific tasks. As an alternative, commercially bound and consecutive page numbered field logbooks may also be used.

Photographs

Photographs provide the most accurate demonstration of the field worker's observations. They can be significant to the field team during future inspections, informal meetings, and hearings. Photographs should be taken with a camera-lens system having a perspective similar to that afforded by the naked eye. Telephoto or wide-angle shots cannot be used in enforcement proceedings. Some industrial clients do not permit photographs on their sites. In industrial settings, confirm with the project manager that photographs are allowed.

A photograph must be documented if it is to be a valid representation of an existing situation. Therefore, for each photograph taken, several items shall be recorded in the field logbooks:

- Date and time photograph taken;
- Name of photographer
- Site name, location, and field task
- Brief description of the subject and the direction taken; and
- Sequential number of the photograph and the roll number.

Additional Field Forms/Records

Additional field records may be required for each specific field event. The use of these records and examples are described in other SOPs specific for the activity (e.g. Borehole Logging SOP, Groundwater Sampling and Purging SOP, etc.). These other records may include:

- Borehole Logs during drilling
- Well Construction and Development records (groundwater, soil vapor, extraction, etc.),
- Groundwater Purge and Sample Collection Records,
- Soil Vapor Purge and Sample Collection Records,
- Water Level Monitoring and Product Removal Records,
- NAPL Removal Records,
- Investigation Derived Waste (IDW) Tracking Records,
- Instrument Calibration Records, and
- Health and Safety Monitoring Records and sign-off sheets.

Prior to field activities, the field sampling personnel will coordinate with the Project Manager, or designee, to determine which additional records will be required for the specific field task. These additional records will be maintained in a field file or a three-ring notebook throughout

the duration of the field activities, or included in a specially prepared site-specific notebook. If the field notebook is being created, the forms may be part of the laminated book.

6.0 CORRECTIONS

If an error is made in the field, logbook corrections will be made by drawing a single line through the error, entering the correct information, and initialing and dating the change. Materials that obliterate the original information, such as correction fluids and/or mark-out tapes, are prohibited. All corrections will be initialed and dated. Some projects require that a brief reason for the change must also be added where the correction was made. Ask the Project Manager, if this requirement is necessary.

7.0 DOCUMENTATION REVIEWS

Periodically, the Project Manager, or designee, will review the field logbooks pertaining to the activities under their supervision. The elements of this review will include technical content, consistency, and compliance with the project plans and SOPs. Discrepancies and errors identified during the review should be resolved between reviewer and author of the field documentation. Corrections and/or additions of information shall be initialed and dated by the field author or reviewer.

8.0 FIELD RECORD BACKUP

Periodically, the Project Manager, or designee, will determine if and when field logbooks and records need to be photocopied. Photocopies will be maintained in the project files, and can be used as backup in the event that the original field logbook or records are lost or damaged.

9.0 DOCUMENTATION ARCHIVE

At the completion of the project, all original field logbooks and records will be store in the project files in accordance with Brown and Caldwell procedures. Typically project files lifetimes are controlled and spelled out in contractual agreements with clients. Typically, project files are archived after project finalization and kept indefinitely in archive.

GROUNDWATER SAMPLING SOP

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1.0 OBJECTIVES

The primary objective of this standard operating procedure (SOP) is to establish a uniform method for environmental and groundwater sample collection to reduce the potential variability associated with such activities.

2.0 SCOPE AND APPLICABILITY

This SOP will be used to support groundwater monitoring programs and conducting the field groundwater sampling activities. Groundwater sampling involves two primary operations, purging stagnant water from a well followed by the collection of a sample from the same well. Groundwater sampling variables can be significantly controlled through the appropriate selection and use of purging and sampling equipment, and through the use of procedures that are described in this SOP.

3.0 REQUIRED MATERIALS

Materials required for conducting groundwater sampling are variable depending upon the method chosen to conduct the sampling. Therefore the listing of materials will be separated into two parts in this SOP. This section will present materials that are general in applicability – things that should be included regardless of purge or sampling method. In Section 5, where specific methods and approaches are discussed, additional materials will be listed. General materials that should be considered regardless of method are as follows:

- Health and safety records
- Personal protection equipment (as required by the Site Safety Plan)
- Health and safety monitoring equipment (e.g., PID)
- Well Completion Forms and Data from previous sampling efforts (if available)
- Water level indicator
- Decontamination supplies (5 gallon buckets, decontamination fluids, squirt bottles)
- Water quality monitoring equipment
- Purge pumps and control boxes
- Generator
- Twine
- Permanent marking pens
- Notebook

- Calculator
- Measuring tape
- IDW containers and labels
- Garbage bags
- Drinking water
- Phone, Camera
- Shipping labels and Chain of Custody records
- Coolers
- Ice
- Filters (0.45 μ m), if appropriate
- Tubing

4.0 RESPONSIBILITIES

The Project Manager, or designee, will have the responsibility to oversee and ensure that groundwater purging and sampling procedures are implemented in accordance this SOP and any project- or site-specific planning documents.

The field personnel will be responsible for the understanding and implementation of this SOP during groundwater sampling activities, as well as, obtaining the appropriate field logbooks, forms and records necessary to complete the field activities.

5.0 METHODS

General Considerations

Groundwater sampling involves two primary operations. These include the purging of stagnant water from the well followed by the collection of a sample. Groundwater sampling variables can be significantly controlled through the appropriate selection and use of purging and sampling equipment, and through the use of procedures that are described below.

Good communication is essential to the ultimate success of a groundwater sampling project. This includes communication within the project team, as well as communication with the client and analytical laboratory, when establishing project objectives.

Good communication with the project team, laboratory, client, and, if appropriate, regulatory agencies, includes complete project specific planning documents such as field sampling plans, quality assurance plans, and scope of work documents for subcontracted laboratories. Plans should include detailed information with respect to site-specific requirements, with reference to

SOPs wherever possible, and risk criteria that will be used to assess the data. A quality assurance plan and laboratory scope of work (of which the quality assurance plan can be part) should contain detailed information regarding what is expected from the laboratory regarding the methods to be used, quality assurance measures and calibrating corrective measures, and deliverables (especially electronic deliverable formats). A detailed quality assurance plan is even more important in light of EPA's Performances Based Measurement Standard (PBMS) initiative.

In addition to good communication, the project plans should consider equipment decontamination, sampling equipment, sampling sequence, and field quality assurance/quality control (QA/QC) samples. These are described in the following sections.

Equipment Decontamination

Equipment that will be in contact with the sample must be decontaminated prior to each use. This is necessary to minimize inadvertent contamination of the sample. Specific methods for equipment cleaning are dependent upon a number of factors including the sample media, analytical parameters, the purpose of the investigation, the equipment to be cleaned, and the specific regulatory guidelines that may apply.

Equipment decontamination procedures are described in the Equipment Decontamination SOP. Any site specific decontamination procedures can be specified in the field sampling plan for each project.

Dedicated and Disposable Equipment

Use of dedicated and new, disposable purging and sampling equipment are preferable to decontamination of reusable sampling equipment. Dedicated equipment, and use of new, disposable equipment, can virtually eliminate cross- contamination between samples caused by incomplete decontamination. Dedicated equipment can also increase sampling efficiency through the elimination of the need to decontaminate equipment for successive sampling. Furthermore, dedicated equipment can also help to reduce the physical handling of the equipment that can cause sample contamination through contact with potentially contaminated surfaces. New, disposable equipment may need to be decontaminated before use. Review project-specific planning documents regarding decontamination of disposable equipment.

Sequence of Sampling

The groundwater sampling operation should always be conducted in a sequence that proceeds from wells containing the lowest concentrations to wells containing the highest concentrations. Sampling in this order will further minimize the likelihood of sample cross-contamination that can be caused through improper handling or equipment cleaning. This type of sampling sequence should be used even for programs in which equipment is dedicated to minimize the cross-contamination that could result from exposure to contaminated garments or other equipment. If water quality is not known, the wells upgradient of a suspected source area should be sampled first, followed by the wells furthest away and cross-gradient or downgradient.

Sampling sequence also applies to the order that different analytes are collected. Typically these analytes that are volatile are collected first, followed by those that are sensitive to oxidation.

Field QA/QC Samples

Additional samples should be collected for the specific purpose of documenting the Quality Assurance/Quality Control (QA/QC) of the field sampling procedures. Field QA/QC samples provide technically and legally defensible data regarding the reproducibility and overall quality of the groundwater sample. Descriptions of the type and frequency of QA/QC sampling should be specified in the project-specific planning documents. Field QA/QC samples can include field blanks, equipment blanks, trip blanks, and blind duplicates. These samples are collected in addition to the laboratory QA/QC samples which may include method blanks, matrix spikes and matrix spike duplicate samples.

Purging and Sampling Procedures

This section provides a description of the procedures to be used for groundwater sampling. These procedures include planning, preparatory office activities, preparatory field activities, well purging, well sampling, and post sampling activities.

Planning

The planning phase should include the selection of specific field methods, including the well purging strategy and planning for the proper disposal of the purge water. The sampling program should be discussed in project-specific planning documents.

Good communication with the analytical laboratory is essential to the success of a groundwater sampling project. The analytical requirements must be well defined and clearly communicated, prior to conducting the field work. Written communication is encouraged, in particular to document requirements for specific analytical methods, low detection limits, and other special needs. Written communication should include a detailed scope of work that includes the quality assurance plan for the project. These plans should specifically identify detection limits, with particular emphasis placed on how these limits relate to regulatory criteria or risk based criteria that have been developed for the project.

Purging and Sampling Equipment Selection

Some of the factors that should be considered in the selection of purging and sampling devices include:

- Well yield
- Depth to water
- Well diameter and depth
- Required material of construction
- Analytical parameters

- Regulatory requirements
- Cost

Purging Strategies

The strategy that will be employed for well purging should be determined prior to sampling and presented in project-specific planning documents. Several different strategies are commonly used in order to assess the completeness of well purging. The most common purging strategies are listed below.

- Purging is continued until stabilization of certain indicator parameters is observed in successive measurements over a specified time or volume. The most commonly used indicator parameters include pH, specific conductivity, turbidity, temperature, oxidation/reduction potential (ORP), and dissolved oxygen (DO)
- Purging 3 to 5 well volumes of water from the well
- Purging low yield wells until the water level reaches the top of the well screen, and then allowing the well to partially recover. After partial recovery, the well is re-purged to the top of the well screen and allowing the well to partially recover a second time. It is recognized, however, that it may not be possible to avoid dewatering the well screen in many shallow wells
- Very low yield wells are purged until dryness and allowing the well to partially recover (often 12 to 24 hours)
- Low or no-flow purging strategies. Generally, well is pumped at rates (<0.5 gallons per minute) that do not induce drawdown and ostensibly mirror flow rates in the aquifer. These are gaining acceptance in many areas because such techniques reduce generated wastes. Often regulatory agencies will require a comparison study before acceptance but these can be valuable when long term monitoring programs will be implemented.

Purge Water Disposal

The methods and responsibility for collection, containerization, treatment and disposal of purge water should be determined prior to initiation of any sampling project.

Collection and contamination is often accomplished through use of 55 gallon drums, mobile storage tanks, or through use of vacuum trucks which can directly transport off site to a treatment facility or to larger storage tanks on site. If specifically allowed by the responsible agency, purge water may be reapplied to the ground surface. Treatment of purge water may be accomplished on site at facilities that have wastewater treatment plants, or by using a mobile treatment unit. Responsibility for off-site disposal of containerized purge water must be determined prior to conducting the work.

Preparatory Office Activities

Equipment and containers should be organized in the office prior to embarking on a field sampling project to the extent practicable. The time spent in the field should be spent on sample collection, making field measurements and recording data.

Prepare Sampling and Purging Equipment

The purging and sample collection equipment and all required hardware should be obtained, organized and decontaminated prior to the initiation of the field sampling program. To accommodate waste generated during decontamination, these activities may be completed at the site prior to sampling.

Sample Containers and Preservatives

The appropriate sample containers and associated preservatives must be obtained. The containers and preservatives are normally, but not always, supplied by the laboratory that will be responsible for the analyses. Sample containers should be organized and inventoried several days prior to initiation of the sampling program in order to provide sufficient time to rectify any problems, should they occur. Whenever possible, pre-printed sample labels should be created prior to mobilization, if possible.

Initiation of Field Data Records

Field data sheets should be initiated prior to the start of sampling. Examples of initial data to be recorded include site and sampling location identification, well depth and construction, and purging and sampling collection methods.

Preparatory Field Activities

The following procedures should be conducted in the field prior to well purging and sampling.

Well Maintenance Check

A well maintenance check should be performed that includes a visual inspection of the condition of the protective casing and surface seal. In addition, the well should be inspected for other signs of damage or unauthorized entry. Any problems should be documented.

It is recommended that the bottom of the well not be sounded each time the well is sampled. Routine sounding of the well can increase the risk of inadvertent well contamination because it is difficult to adequately decontaminate the tapes used for this purpose. Well depths obtained from well completion records are generally adequate for the purpose of the determination of well volume. Generally, the only reason to sound well depth is if a need to verify the depth arises, or if you suspect that sediment/soil has collected in the bottom of the well.

Preparation of Well Area

A suitable work area should be established around the perimeter of the well. Sampling equipment should be placed on a clean surface such that it will not become inadvertently contaminated. This work area can be prepared by placing new polyethylene (PE) sheeting on the ground around the well, taking care not to step on it. Alternatives also include the placement of a clean PE-lined trash can, a clean PE or aluminum covered table, or similar, adjacent to the well. Remember – a clean work area leaves a much more favorable impression than a dirty work area.

Water Level Measurements

The depth to water should be measured prior to initiation of all purging and sampling activities.

Non-Aqueous Phase Liquid (NAPL) Determination

If their presence is suspected, each well should be evaluated for the presence of light or dense non-aqueous phase liquids (LNAPLs or DNAPLs) prior to well purging.

Calculation of Well Purge Volume

The volume of water standing in the well should be calculated through the application of the depth to water data, the known well depth, and the well diameter using the constants presented below. Well depth information obtained from the well completion records are generally sufficiently precise for the purpose of well volume calculations that would be used for subsequent purging determinations.

The following conversions allow quick calculation of well casing volumes:

<u>Well Casing Diameter</u> <u>(inches)</u>	<u>Gallons per foot of water</u>
1.0	0.041
2.0	0.163
3.0	0.367
4.0	0.653
6.0	1.469

Alternatively, the well casing volume may be calculated using the formula $V = CF \cdot d^2 h$, where

V = volume of water (gallons) d =
diameter of well (inches)

h = height of water column (feet)

CF = conversion factor (0.0408) that includes conversion of cubic feet to gallons,
inches to feet, and diameter to radius.

In some states the volume of the entire well (not just the well casing, but entire borehole) is required when determining well volume. Check local state requirements to determine which method of well volume calculation applies to your site. This volume can be calculated in a manner similar to above with the following formula:

$$V = 0.0408 d^2 h + 0.0408 (D^2 - d^2) h \square$$

where

V = volume of water in well (gallons) D =

diameter of borehole (inches)

d = diameter of well casing (inches) h =

height of water column (feet)

$\square$ = porosity of sand pack (often approximated at 0.30)

Which of the above methods should be used should be discussed or defined in the project-specific planning documents.

Well Purging

Monitoring wells must be purged prior to the collection of aqueous phase samples. The placement of a device (in most cases a pump) that will be used for well purging is critical in order to ensure a complete exchange of the entire water column. The intake of a device used for purging should be placed as high in the water column as is possible under pumping conditions. Optimum placement is to have the pump at the top of the water column. This is done so that purging will draw water from the formation into the screened area of the well, and up through the casing, so that the entire static water column can be removed.

If the monitoring well is a slow recharging well, then the pump should be placed near the surface and slowly lowered at a rate similar to groundwater withdrawal. As an alternative approach the pump could be set at no more than three to five feet below the water surface. If the recovery rate of the well is faster than the pump rate and no observable drawdown occurs, the pump can be raised until the intake is within one foot of the top of the water column for the duration of purging. If the pump rate exceeds the well recovery rate, the pump will have to be lowered as needed based upon the amount of drawdown.

Upon completion of purging, the device should continue to be operated as it is slowly withdrawn from the well to purge any water that remains above the pump intake. One should be very careful not to keep the pump on too long after removal, because a pump can easily burn up without groundwater to cool it. It is recommended that pumps be fitted with backflow prevention valves so that purged water in the discharge tubing does not flow back into the well. Under no circumstances should the pump intake simply be placed at the bottom of the well without first making an effort to evaluate the pumping characteristics of the particular well.

Standard Purging Approach

Initially, groundwater withdrawal should occur no more than three to five feet below the water surface. If the recovery rate of the well is faster than the pump rate and no observable drawdown occurs, the pump should be raised until the intake is within one foot of the top of the water column for the duration of purging. If the pump rate exceeds the well recovery rate, the pump will have to be lowered as needed based upon the amount of drawdown.

An adequate purge is normally achieved when three to five times the volume of standing water in the well has been removed. After three well volumes have been removed, if the chemical parameters have not stabilized according to the criteria given below, additional well volumes may be removed. If the parameters have not stabilized within five volumes, it is at the discretion of the project manager whether or not to collect a sample or to continue purging.

Considering groundwater chemistry, an adequate purge is achieved when the pH, specific conductance, and temperature of the groundwater have stabilized and the turbidity has either stabilized or is below 10 Nephelometric Turbidity Units (NTUs). In very silty formations, the turbidity stabilization criteria given above may be impossible to reach and should be disregarded. Other parameters such as salinity, dissolved oxygen, and oxidation reduction potential also may be important criteria for stabilization, especially under low flow purging. Stabilization occurs when parameter measurements are within 10 percent between two readings spaced approximately one well volume apart, or under low flow purging, between two readings determined in project planning documents. A water meter quality fitted with flow through cell, which allows continuous monitoring of the above parameters is recommended for these measurements.

Attempts should be made to avoid purging wells to dryness, as previously described. However, even with slow purge rates, a well may be purged dry. In those cases, this constitutes an adequate purge and the well can be sampled when recovery is sufficient (enough volume to fill the sample containers). Recovery criteria are often cited as 80 percent of the original well column height.

Low Stress or Low Flow Groundwater Purging

Sometimes it is desirable to collect representative samples while exerting minimum stress on the water-bearing formation. Typically this is accomplished by limiting the flow rate during purging to the range of 100 to 500 ml/min (0.025 to 0.13 gallons/min). For this procedure, the goal is to induce a steady flow rate while minimizing the drawdown.

It is important to insert the sampling equipment carefully, so as to prevent the re-suspension of silt and clay particles in the well. In order to minimize turbidity, it is preferable to use dedicated equipment, or to allow sufficient time after the installation of non-dedicated equipment to allow soil particles to re-settle before purging and sampling. Sufficient time for settling should be verified by turbidity measurements.

Initially, the purge flow rate should start at approximately 200 ml/min (0.053 gallons/min), and water level should be frequently monitored. Flow rate should be adjusted so that drawdown

will not exceed 0.3 ft, or approximately 2 percent of the saturated thickness of low permeability formations, whichever is greater.

Indicator parameters which should be monitored for low stress groundwater purging include turbidity, specific conductance, temperature, pH, ORP, and DO. In-line analyzers and continuous readout displays are recommended, so that the sample is not exposed to air prior to measurement. The well is considered stabilized when three consecutive readings vary no more than 10% or are below 10 NTUs for turbidity, 3% for specific conductance, 0.3 SU for pH, 10 mV for ORP, and 10% for DO. Measurement of the indicator parameters should continue every three to five minutes until these measurements indicate stability in water quality. If these parameters have not stabilized after about an hour, the well should be purged until a minimum of three well volumes have been removed.

Groundwater Sampling

It is important that wells be sampled as soon as possible after purging. If adequate volume is available, the well should be sampled immediately as long as the well has recovered to 80 percent of the original water column height. If not, sampling should occur as soon as the well has recovered sufficiently to provide adequate volume.

Standard Sampling Approach

As with purging equipment, there are a number of considerations in the selection of sample collection equipment. Furthermore, it is common to use a different device for sample collection than for purging. An example would be to purge with the use of submersible pump and to collect the sample with the use of a disposable bailer.

Low Flow Groundwater Sampling

Sometimes it is desirable to collect representative samples while exerting minimum stress on the water-bearing formation. Typically this is accomplished by limiting the flow rate during sampling to the range of 100 to 250 ml/min (0.025 to 0.065 gallons/min). Sampling flow rate should not exceed the purge flow rate for which water quality indicator parameters stabilized. Sampling equipment must be the same equipment that was used for purging, and should not be moved between purging and sampling activities.

Equipment Instructions

This section provides specific instructions for the installation and use of various devices for both well purging and groundwater sample collection, and includes the following equipment:

- Bailer
- Bladder pump
- Small diameter (2-inch) electric submersible pump
- Large diameter (4-inch) electric submersible pump

- Compressed gas-driven piston pump
- Gasoline powered centrifugal pump
- Peristaltic suction pump
- Inertial lift pump.

It is recognized that a combination of the procedures may be employed. An example would be the use of a small diameter electric submersible pump for purging and a bailer for sample collection. The specific methods to be used for purging and sampling a well should be outlined in the project-specific planning documents.

Bailer

A bailer is one of the simplest groundwater sampling devices. The same bailer can be used for both purging and sample collection. Bailers consist of a rigid tube equipped with a bottom and/or top check valve that is lowered into the well on a flexible cord.

Required Equipment:

- Bailer of appropriate size and material
- New bailer cord of appropriate material
- New disposable gloves of appropriate material
- Clean trash can and supply of trash can liners, or new plastic sheeting
- Five gallon pail, graduated in minimum one gallon increments
- Bottom emptying device (optional)
- Water quality monitoring equipment.

Purging Instructions:

- Determine the volume of water to be purged, as described previously
- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves. Decontaminate equipment as outlined in decontamination SOP
- Attach a cord to the bailer
- Lower the bailer into the well until it is completely submerged. The bailer should be

lowered slowly so that it does not cause a splash that could aerate the water column

- Pull the bailer out of the well while placing the cord on the PE sheet or in a PE-lined bucket. An alternate method is to wind the bailer cord between the hands. Care should be taken to prevent the bailer or the cord from contacting any surface other than the interior of the well or the plastic liner
- Empty the bailer into the pail
- Repeat the operation until the necessary volume of water has been purged from the well
- monitor indicator parameters as discussed previously.

Sampling Instructions:

- Prepare the well area and lower the bailer into the well following the method described previously for purging
- Allow the bailer to fill slowly and then gently retrieve the bailer from the well while avoiding contact with the sides of the well. Care should be taken to prevent the bailer or the line from contacting any surface other than the interior of the well or the PE sheet or PE-lined bucket
- Fill the sample containers slowly. The use of a bottom emptying device is preferred in that sample aeration and sample volume loss are minimized
- Bottles should be filled in order of sensitivity to volatilization and oxidation as previously discussed. Care should be taken to ensure that no head space remains in the volatile organic vials. Certain other parameters may also require minimizing headspace (e.g., reduced or ferrous iron)
- Filtered samples can be obtained by filling a non-preserved sample receptacle, and then transferring the liquid through an in-line filter (typically a 0.45 μ m disposable filter) into a preserved sample receptacle using a peristaltic pump. Other gravity feed filters also are available.

Bladder Pump

A bladder pump is one of the easiest devices to operate for the purpose of purging and sample collection. The bladder pump is often dedicated to the well and can be used in conjunction with an inflatable packer in order to minimize the purge volume necessary to accomplish effective purging.

Required Equipment:

- Bladder pump

- Tubing of appropriate type and length
- Bladder pump controller
- Compressed air source
- New disposable gloves of appropriate material
- New plastic sheeting
- Five gallon pail, graduated in minimum one gallon increments
- Water quality monitoring equipment (preferably a flow through cell)

Installation Instructions (initial installation or non-dedicated use):

- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves
- Assemble the pump and tubing and lower into the well being careful not to contact any surface other than the interior of the well or the plastic sheeting
- Decontaminate equipment and pump (if not dedicated)
- Install the air inlet and water discharge fittings on top of the well (for a dedicated installation).

Purging Instructions:

- Refuel the gasoline-powered compressor, if used, at a location that is remote from the well, being very careful not to spill any fuel on equipment or clothing that will be used at the well site
- Place the gasoline-powered compressor as far from the well as possible in a down-wind direction to eliminate potential exhaust impact to sampling
- Connect the compressed air source and pump controller to the pump as per manufacturer's instructions
- Don a new pair of gloves after handling the gasoline-powered compressor.
- Determine the volume of water to be purged, as described previously
- Start the pump by opening the regulator on the controller, which allows compressed air to flow into the system
- The controller should be adjusted to maximize the flow rate while minimizing the rapid "jolting" of the tubing as water is drawn into pump
- Direct the pump discharge to the five gallon pail and determine the pumping rate

- Continue pumping until the necessary volume of water has been purged from the well
- Monitor indicator parameters as discussed previously.

Sampling Instructions:

- Allow the well to recharge after completion of purging, if necessary
- Resume pumping after adjusting the regulator to the minimum pressure that will still allow water to be pumped to the surface
- Collect the samples by pumping directly into each of the required containers
- Bottles should be filled in order of sensitivity to volatilization and oxidation as discussed in Section 5.1.3 or as outlined in project-specific planning documents. Care should be taken to ensure that no head space remains in the volatile organic vials. Certain other parameters may also require minimizing headspace (e.g., reduced or ferrous iron)
- Filtered samples can easily be obtained by installing an in-line, 0.45 μ m disposable cartridge filter directly onto the pump discharge.

Small Diameter (2") Electric Submersible Pump

A small-diameter electric submersible pump (Grundfos Redi-Flo2 or equivalent) can be operated with a wide variety of pumping rates such that it is very versatile for both well purging and sample collection. This type of pump can be used in either a dedicated or non-dedicated mode. Collecting groundwater samples from these pumps is only appropriate if approved project-specific planning documents specifically include this technique for collecting samples.

Required Equipment:

- Small diameter electric submersible pump
- Pump shroud (when used in a six-inch or larger well to minimize turbulence, to keep motor cool)
- Teflon[®] jacketed power cable on a plastic reel
- Tubing of appropriate type and length
- Check valve (optional)
- Electric pump controller with appropriate power plug
- 230 volt, single phase, electric power source, >10 amps

- Tool kit including basic tools, tubing cutters, extra tubing connector bracket, electrical connectors, wire ties, etc.
- Ground fault interrupter (GFI)
- New disposable gloves of appropriate material
- New PE sheeting
- Five gallon pail, graduated in minimum one gallon increments
- Water quality monitoring equipment (preferably a flow through cell).

Installation Instructions:

- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves
- Assemble the pump, tubing, optional check valve, and electric power cables.
- Decontaminate equipment and pump (if not dedicated)
- Prime pump with deionized water by inverting the pump and removing fill cap
- Lower pump slowly into the well, being careful not to contact any surface other than the interior of the well or the plastic sheeting. When lowering the pump be particularly sensitive to areas that suggest drag or problems in the well where the pump could get stuck. If a problem exists do not continue, but discuss ways to investigate with PM or senior technical personnel
- Place the pump intake as discussed in Section 5.4.2. Monitor the pump discharge and well hydraulics as discussed previously.

Purging Instructions:

- Refuel the electric generator at a location that is remote from the well, being very careful not to spill any fuel on equipment or clothing that will be used at the well site
- Place the gasoline-powered compressor as far from the well as possible in a down-wind direction to eliminate potential exhaust impact to sampling
- Don a new pair of gloves after handling the generator
- Connect electric power, GFI, and pump controller to the pump
- Determine the volume of water to be purged, as described previously
- Start the pump

- Direct the pump discharge to the five gallon pail and determine the pumping rate.
- Continue pumping until the necessary volume of water has been purged from the well
- If the pump intake has been placed deeply down into the water column for some reason, slowly withdraw the pump upward through the water column while it is still running to purge all water standing above the pump unless the pump will be used for sample collection
- Shut off the pump rapidly whenever the pump stops pumping water
- Monitor indicator parameters as discussed previously.

Sampling Instructions:

- Allow the well to recharge after completion of purging, if necessary
- Resume pumping and adjust the pumping rate to the slowest possible rate
- Collect the samples by pumping directly into each of the required containers
- Bottles should be filled in order of sensitivity to volatilization and oxidation as discussed in Section 5.1.3 or as outlined in project-specific planning documents. Care should be taken to ensure that no head space remains in the volatile organic vials. Certain other parameters may also require minimizing headspace (e.g., reduced or ferrous iron)
- Filtered samples can easily be obtained by installing an in-line, 0.45 μ m disposable cartridge filter directly onto the pump discharge.

Large Diameter (4") Electric Submersible Pump

A large-diameter electric submersible pump is most frequently used for purging large-diameter wells that cannot be efficiently purged using other methods. Large-diameter pumps can also be used for sample collection for parameters that are not particularly pH or pressure sensitive. This type of pump is usually not dedicated. Collecting groundwater samples from these pumps is only appropriate if approved project-specific planning documents specifically include this technique for collecting samples.

Required Equipment:

- Large-diameter, stainless steel electric submersible pump
- [Optional] Check valve, install internally within the pump or externally between the pump and the tubing
- Electric power cable on a plastic reel (Teflon[®] jacketed cable is preferred)

- Stainless steel or polypropylene support line
- 1/2" to 1" PE Tubing of appropriate length
- Flow control valve
- 120 or 240 volt electric power source (as appropriate)
- Ground fault interrupter (GFI)
- Tool kit including assorted basic tools, tubing cutters, wire cutters, hose clamps, waterproof connectors, wire ties, hose fittings, assorted pipe nipples and adapters, etc.
- New disposable gloves of appropriate material
- New plastic sheeting
- Five gallon pail, graduated in minimum one gallon increments or flow meter
- Bleeder tee (if the submersible pump is used for sample collection). This consists of a tee with a large diameter, valved pump discharge port and a Water quality monitoring equipment
- small diameter, valved port equipped with a sample weephole
- Water quality monitoring equipment (preferably a flow through cell).

Installation Instructions:

- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves.
- Decontaminate equipment and pump (if not dedicated) as outlined in decontamination SOP.
- Assemble the pump, tubing, flow control valve, electric power cables and support line and lower into well being careful not to contact any surface other than the interior of the well or the PE sheeting.
- The tubing, electrical power cable and support line should be fastened together at 15 to 20 foot intervals with the use of nylon wire ties (not with electrical tape) taking care to leave adequate slack in the electric power cable.
- The use of a check valve is recommended to prevent rapid backflow of water from the tubing after the pump is shut off. It is recognized, however, that the use of a check valve makes it more difficult to pull the pump from the well due to the added weight of the water in the tubing and can increase the chance of "sand locking" occurring in the pump.

- Lower pump slowly into the well, being careful not to contact any surface other than the interior of the well or the plastic sheeting. When lowering the pump be particularly sensitive to areas that suggest drag or problems in the well where the pump could get stuck. If a problem exists do not continue, but discuss ways to investigate with PM or senior technical personnel.
- Place the pump intake appropriately. Monitor the pump discharge and well hydraulics as discussed previously.

Purging Instructions:

- Refuel the electric generator at a location that is remote from the well, being very careful not to spill any fuel on equipment or clothing that will be used at the well site
- Place the gasoline-powered compressor as far from the well as possible in a down-wind direction to eliminate potential exhaust impact to sampling
- Don a new pair of gloves after handling the generator
- Connect electric power and GFI to the pump
- Determine the volume of water to be purged, as described previously
- Start the pump
- Determine the pumping rate either by directing the pump discharge to the five gallon pail or with the use of a flow meter
- Adjust pumping rate to match the yield of the well
- Continue pumping until the necessary volume of water has been purged from the well
- If the pump intake has been placed deeply down into the water column for some reason, slowly withdraw the pump upward through the water column while it is still running to purge all water standing above the pump
- Shut off the pump immediately whenever the pump stops pumping water
- Dispose of the tubing and support line after use
- Monitor indicator parameters as discussed previously.

Sampling Instructions:

- Allow the well to recharge after completion of purging, if necessary.
- Resume pumping and adjust the bleeder tee valves so that a slow, steady, non-aerated flow emanates from the bleeder tee weephole (approximately 100 ml/min).
- Collect the samples directly from the weephole into each of the required

containers.

- Bottles should be filled in order of sensitivity to volatilization and oxidation as previously discussed
- Filtered samples can easily be obtained by installing an in-line, 0.45 μ m disposable cartridge filter directly onto the pump discharge.

Compressed Gas-Driven Piston Pump

A compressed gas-driven piston pump can be used for purging and sample collection in two-inch diameter wells at great depths. This type of pump is not typically dedicated. Collecting groundwater samples from these pumps is only appropriate if approved project-specific planning documents specifically include this technique for collecting samples

Required Equipment:

- Small diameter air driven pump
- Tubing of appropriate type and length
- Pump controller
- Compressed air source
- New disposable gloves of appropriate material
- New plastic sheeting
- Five gallon pail, graduated in minimum one gallon increments
- Water quality monitoring equipment (preferably a flow through cell).

Installation Instructions:

- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves
- Decontaminate equipment and pump (if not dedicated) as outlined in decontamination SOP
- Assemble the pump and tubing and lower into the well, being careful not to contact any surface other than the interior of the well or the plastic sheeting
- Lower pump slowly into the well, being careful not to contact any surface other than the interior of the well or the plastic sheeting. When lowering the pump be particularly sensitive to areas that suggest drag or problems in the well where the

pump could get stuck. If a problem exists do not continue, but discuss ways to investigate with PM or senior technical personnel. Place the pump intake appropriately

- Monitor the pump discharge and well hydraulics as discussed previously.

Purging Instructions:

- Connect the air source and pump controller to the pump
- Determine the volume of water to be purged, as described above
- Start the pump
- Direct the pump discharge to the five gallon pail and determine the pumping rate
- Continue pumping until the necessary volume of water has been purged from the well.
- If the pump intake has been placed deeply down into the water column for some reason, slowly withdraw the pump upward through the water column while it is still running to purge all water standing above the pump
- Shut off the pump immediately whenever pump stops pumping water
- Monitor indicator parameters as discussed previously.

Sampling Instructions:

- Allow the well to recharge after completion of purging, if necessary
- Resume pumping and adjust to a slow pumping rate (approximately 100 ml/min)
- Collect the samples by pumping directly into each of the required containers
- Bottles should be filled in order of sensitivity to volatilization and oxidation as discussed above
- Filtered samples can easily be obtained by installing an in-line, 0.45 μ m disposable cartridge filter directly onto the pump discharge.

Gasoline Powered Centrifugal Suction Pump

A two-cycle gasoline-engine-powered centrifugal pump provides an effective way to rapidly purge any well in which the depth to the pumped water level is less than about 20 to 25 feet. This type of pump is normally used with dedicated tubing. Groundwater sampling cannot be conducted using these pumps.

Required Equipment:

- Two-cycle gasoline-engine-powered centrifugal pump
- 1/2" to 3/4" PE tubing of appropriate length
- Flow control valve
- Check (foot) valve
- Supply of distilled or deionized water
- New disposable gloves of appropriate material
- New PE sheeting
- Five gallon pail, graduated in minimum one gallon increments
- Water quality monitoring equipment.

Installation Instructions:

- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves
- Decontaminate equipment such as hose (if not dedicated) as outlined in decontamination SOP
- A check valve should be installed on the bottom of the tubing in order to prevent backflow of water into the well from the tubing and the pump after the pump is shut off. The check valve will also aid in priming the pump
- Lower the tubing into well, being careful not to contact any surface other than the interior of the well or the PE sheeting. The outside of the tubing should be decontaminated following instructions in the Decontamination SOP
- Place the intake of the tubing as high in the well as is possible but deep enough that it will not break suction.

Purging Instructions:

- Refuel the pump at a location that is remote from the well, being very careful not to spill any fuel on equipment or clothing that will be used at the well site. Pay strict attention to the required fuel mixture (gasoline/oil) that is specified by the pump manufacturer
- Place the gasoline-powered compressor as far from the well as possible in a down-wind direction to eliminate potential exhaust impact to sampling

- Connect the tubing to the pump
- Don a new pair of gloves after handling the pump
- Determine the volume of water to be purged, as described previously
- Prime the pump using either distilled, deionized, or potable water. Use potable water only if the source has been tested analytically and found to be clear of the constituents of interest. Alternately, a pump equipped with a check valve on the tubing can be primed by working the tubing in an up and down motion, as with the inertial lift pump. This second approach should only be used if no other alternative is available for priming the pump
- Start the pump
- Direct the pump discharge to the five gallon pail and determine the pumping rate
- Adjust the pumping rate to match the yield of the well
- Continue pumping until the necessary volume of water has been purged from the well
- If the pump intake tubing has been placed deeply down into the water column for some reason, slowly withdraw the tubing upward through the water column while it is still running to purge all water standing above the bottom intake
- Dispose of the tubing after use, unless it is dedicated
- Monitor indicator parameters as discussed previously.

Sampling Instructions:

- A centrifugal pump is not suitable and may not be used for sample collection.

Peristaltic Suction Pump

A peristaltic pump can be used to purge shallow, small diameter wells at a low to modest rate. The lift capacity is very limited with these pumps and often exceeded at groundwater depths of greater than 30 feet (depending upon pump size). This type of pump is normally used with dedicated tubing. Peristaltic pumps can also be used for sample collection for parameters that are not pH or pressure sensitive. Collecting groundwater samples from these pumps is only appropriate if approved project-specific planning documents specifically include this technique for collecting samples.

Required Equipment:

- Peristaltic pump, electric powered 12 VDC
- 12 VDC power source, such as a sealed motorcycle battery or connection to vehicle battery
- 1/4" to 1/2" PE, PP, or Teflon® tubing of appropriate length
- 5/8" OD, 3/8" ID medical grade silicone tubing Do not attempt to use Tygon® tubing.
- New disposable gloves of appropriate material
- New PE sheeting
- Five gallon pail, graduated in maximum one gallon increments
- Water quality monitoring equipment (preferably a flow through cell).

Installation Instructions:

- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves
- Replace the silicone tubing in the pump head if the pump will be used for sample collection
- Lower the tubing into the well, being careful not to contact any surface other than the interior of the well or the plastic sheeting
- Place the intake of the tubing as high in the well as possible but deep enough that it will not break suction.

Purging Instructions:

- Connect the tubing to the pump
- Determine the volume of water to be purged, as described above
- Start the pump.
- Direct the pump discharge to the five gallon pail and determine the pumping rate
- Continue pumping until the necessary volume of water has been purged from the well
- If the pump intake tubing has been placed deeply down into the water column for some reason, slowly withdraw the tubing upward through the water column while it is still running to purge all water standing above the bottom intake

- Dispose of the tubing after use
- Monitor indicator parameters as discussed previously.

Sampling Instructions:

- Allow the well to recharge after completion of purging, if necessary
- Resume pumping and adjust to a slow pumping rate, (approximately 100 ml/min) if the pump is equipped with a speed control
- Collect the samples by pumping directly into each of the required containers
- Bottles should be filled in order of sensitivity to volatilization and oxidation as discussed above
- Filtered samples can easily be obtained by installing an in-line, 0.45 μ m disposable cartridge filter directly onto the pump discharge.

Inertial Lift Pump

An inertial lift pump is a very simple device that can be used to purge and sample wells of almost any diameter to a depth of approximately 100 feet. This type of pump is normally dedicated to the well. Collecting groundwater samples from these pumps is only appropriate if approved project-specific planning documents specifically include this technique for collecting samples.

Required Equipment:

- 1/2" OD HDPE pump tubing
- Check valve
- Electric motor driven lift arm [OPTIONAL]
- Electric power source [OPTIONAL]
- New disposable gloves of appropriate material
- New plastic sheeting
- Five gallon pail, graduated in minimum one gallon increments
- Water quality monitoring equipment (preferably a flow through cell).

Installation Instructions:

- Place new polyethylene (PE) sheet on suitable surface adjacent to well, taking care not to step on the PE sheet
- Don a new pair of gloves

- Decontaminate equipment and pump (if not dedicated)
- Install self-threading valve on the bottom of the tubing
- Lower pump slowly into the well, being careful not to contact any surface other than the interior of the well or the plastic sheeting. When lowering the pump be particularly sensitive to areas that suggest drag or problems in the well where the pump could get stuck. If a problem exists do not continue, but discuss ways to investigate with PM or senior technical personnel
- Place the tubing intake as high in the well as is possible but deep enough that it will not break suction. The tubing intake can be placed deeper in the well if the inertial lift pump will also be used for sample collection.

Purging Instructions:

- Refuel the electric generator, if used, at a location that is remote from the well, being very careful not to spill any fuel on equipment or clothing that will be used at the well site
- Place the generator as far from the well as possible in a down-wind direction
- Don a new pair of gloves after handling the generator
- Connect the tubing to the pump arm, if used
- Determine the volume of water to be purged, as described above
- Start pumping by working the pump tubing in an up and down motion
- Direct the pump discharge to the five gallon pail and determine the pumping rate
- Continue pumping until the necessary volume of water has been purged from the well
- If the pump intake tubing has been placed deeply down into the water column for some reason, slowly withdraw the tubing upward through the water column while it is still running to purge all water standing above the bottom intake. This should be accomplished by reconnecting the pump arm at progressively lower points on the tubing and allowing the pump to operate for short periods of time. This step is not required if the inertial lift pump will be used for sample collection
- Dispose of the tubing after use, unless it is left in the well
- Monitor indicator parameters as discussed previously.

Sampling Instructions:

- Allow the well to recharge after completion of purging, if necessary
- Resume pumping at a slow rate either by decreasing the speed of the lift arm unit or by operating the tubing manually

- Collect the samples by pumping directly into each of the required containers
- Bottles should be filled in order of sensitivity to volatilization and oxidation as discussed above
- Filtered samples can easily be obtained by installing an in-line, 0.45 μ m disposable cartridge filter directly onto the pump discharge.

Field Measurements

The final determination of pH, specific conductance, and temperature should be made immediately upon collection of the samples. It is preferred that these parameters be measured continuously using a water quality meter coupled with a "flow through" cell. Alternately, these measurements would be made in an aliquot contained in a disposable plastic cup.

Field Records

Accurate field records must be maintained to document groundwater sampling activities. These records include technical field data, sample identification labels, and chain-of-custody information for each sample. These records are described in detail in the following sections.

Specifically for groundwater sampling, the field sampling records should include, at a minimum, the following information:

- Sampling location
- Date and time
- Condition of the well
- Static water level (depth to water)
- Depth to the bottom of the well
- Calculated well volume
- Purging method
- Actual purged volume
- Sample collection method
- Sample description
- Field meter calibration data
- Water quality measurements
- General comments.

All data entries should be made using black indelible ink and should be written legibly. Entry errors should be crossed out with a single line, dated, and initialed by the person making the correction.

Sample Shipment

Shipment of samples to an analytical laboratory is usually required upon completion of sample collection. Proper packaging is necessary in order to protect the sample containers, to maintain the samples at or below a temperature of 4°C, and to comply with all applicable transportation regulations.

Special Regulatory Requirements

A number of states and USEPA regions have specific groundwater sampling requirements that must be followed. These requirements must be determined in advance, and should be incorporated in to the project specific planning documents.

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ATTACHMENTS

Attachment A - Groundwater Sampling Checklist

Attachment B – Example Groundwater Sampling Field Data Sheet

Attachment A. Groundwater Sampling Checklist

Planning

- ☐ Select well purging method Determine well purging strategy
- ☐ ☐ Purging until of indicator parameters stabilize ($\pm 10\%$).
- ☐ ☐ Purge predetermined number of well volumes (usually 3 to 5). Low yield wells purged until dryness.
- ☐ ☐ Others
- ☐ Determine containerization and disposal method for purge water Select well sampling method
- ☐ Determine groundwater sampling sequence

Preparatory Office Activities

- ☐ Obtain and decontaminate appropriate purging and sample collection equipment. Obtain appropriate sample containers and
- ☐ preservatives from laboratory.
- ☐ Inventory sample containers and preservatives. Pre-label sample containers.
- ☐ Initiate field data record for each well.
- ☐ Communicate sampling schedule with analytical laboratory and site contact or other parties, as required.

Preparatory Field Activities Perform well maintenance check. Prepare

- ☐ Perform well maintenance check. Prepare clean work area.
- ☐ Determine the depth to groundwater (± 0.02 ft). Calculate the water volume standing in the well
- ☐ ($\pm 2\%$).
- ☐

Well Purging

- ☐ Place purging device at proper depth to ensure complete purging of well (if device is not also used for sample collection).
- ☐ Purge well, following previously selected strategy.
- ☐ Handle and dispose of purge water using previously determined method.

Well Sampling

- ☐ Collect groundwater sample.
- ☐ Fill containers and made field determinations in order of decreasing sensitivity to volatilization and/or pH change.
- ☐ Fill all other sample containers. Record all technical data.
- ☐ Maintain chain of custody records.
- ☐ Pack and ship samples to prevent breakage, to maintain sample temperature of 4°C and to comply with Dang
- ☐ purging tubing
 - Inexpensive rate
 - Relatively simple

GROUNDWATER PURGE AND SAMPLING FIELD DATA SHEET EXAMPLE

1. PROJECT INFORMATION				WELL ID: _____	
Project Number: _____		Task Number: _____		Date: _____	
		Time: _____		Client: _____	
Personnel: _____ Project _____					

2. WELL DATA	
Casing Diameter: _____ inches	Type of Casing: _____
Screen Diameter: _____ inches (d)	Type of Screen: _____ Screen Length : _____
Total Depth of Well from TOC: _____ feet	
Depth to Static Water from TOC: _____ feet	
Depth to Product from TOC: _____ feet	
Length of Water Column (h): _____ feet Calculated Casing Volume: _____ gal (3 to 5 times one well volume)	
Purge Volume _____	

3. PURGEDATA		Equipment Model(s)
Purge Method: _____		
Materials: Pump/Bailer	1. _____	
Materials: Rope/Tubing	2. _____	

Time	Water Removed	pH	Temp (Units)	SpeCond. (Units)	Ech (Units)	DO (Units)	Turbidit y (NTU)	Other:	Comments

4. SAMPLING DATA	Analyses Requested:
Method(s): _____	
Materials: _____	
Pump/Bailer _____	

5. COMMENTS	

STANDARD OPERATING PROCEDURES

PRE-DEMOLITION BUILDING INSPECTION

OBJECTIVES

The primary objective of this standard operating procedure (SOP) is to establish a uniform method for conducting a pre-demolition building inspection to reduce the potential variability associated with performing such activities.

SCOPE AND APPLICABILITY

This SOP will be used to support inspection activities associated with planning for the demolition of a building.

REQUIRED MATERIALS

Materials required for conducting a pre-demolition inspection may include:

- Personal protection equipment (as required by the Site Health and Safety Plan)
- Permanent marking pens
- Field logbook
- Documents detailing Site history
- Camera
- Scraping tool
- Equipment to access building areas if appropriate (e.g. roof)
- Site plan if available.

RESPONSIBILITIES

The *Project Manager*, or designee, will have the responsibility to oversee and ensure that pre-demolition building inspection procedures are implemented in accordance this SOP and other relevant project- or Site-specific planning documents.

Field personnel will be responsible for understanding and implementation of this SOP during building inspection activities as well as obtaining the appropriate field logbooks, forms, and records necessary to complete the field activities.

METHODS

Review of Historic Files

Prior to visiting the Site, available records should be reviewed and may include:

- Date building was constructed
- Dates when building was renovated and copies of applicable documents (e.g. inspection records, abatement records, building material disposal records, etc.)
- Details regarding building use
- Subsurface utility information
- HVAC information
- Other pertinent information.

After review of available building information is complete the building inspection can be performed.

The pre-building demolition inspection should include:

- Visual inspection and photo documentation of all building components to determine the potential presence of asbestos and lead-based paint
- Visual inspection and photo documentation of all features of potential contamination
- Visual inspection and photo documentation of all general site features
- Estimation of square footage of building and break down by building components for disposal planning purposes
- Sampling of building components could be performed at this time as long as personnel is trained and qualified to collect and document such samples, sample collection media is present, sampling can be performed safely, and building components will not be damaged if pre-approval for creating such damage has not been given.

Following the inspection, a completion report is to be prepared documenting the results of the inspection through text, photos, site maps and analytical data if present, and recommendations for further investigation as appropriate.

Further investigation could include any of the following:

- Building materials/components sampling to determine potential presence of asbestos and/or lead based or lead containing paint, or other contaminant
- Concrete core or chip sampling where potential impacts are identified
- Wipe sampling
- Subsurface sampling.

STANDARD OPERATING PROCEDURES

SAMPLE HANDLING

OBJECTIVES

The primary objective of this standard operating procedure (SOP) is to establish a uniform method for handling environmental samples.

SCOPE AND APPLICABILITY

This procedure will be used during the collection of all types of environmental media that include, but are not limited to, groundwater, surface water and soil. Handling of air samples is not addressed in the current version of this procedure.

REQUIRED MATERIALS

Materials required for conducting a pre-demolition inspection may include:

- Bound field log books
- Black or blue waterproof and/or indelible ink pens
- Field forms
- Chain of Custody forms
- Sample Labels.

RESPONSIBILITIES

The *Project Manager*, or designee, will have the responsibility to oversee and ensure that sample handling procedures are implemented in accordance this SOP and other relevant project- or Site-specific planning documents.

Field personnel will be responsible for understanding and implementation of this SOP during all sample handling activities.

METHODS

The following method outlines general considerations for sample handling in the field and maintaining sample custody after collection.

Environmental samples are collected in the field in order to evaluate whether conditions in soil gas, soil, surface water, or groundwater are significant. These samples therefore, should be handled with the utmost care to maintain integrity so that analytical data represents as closely as possible, field conditions. In addition, sample chain of custody is extremely important for establishing that sample integrity was maintained between field crew and laboratory.

Details regarding collection of samples are provided in other SOPs.

General considerations for handling during sampling are:

- Always wear proper PPE when handling samples
- Sample receptacles or containers should be wrapped in a way that is protective of both surrounding containers and the container the sample is in.
- Always check and document procedures well in field logbooks or sampling forms. There is never “too much information”.
- Field forms should be pre-filled or partially filled out whenever possible to reduce information that has to be processed in the field.

Samples must be stabilized for transport from the field to the laboratory through the use of the proper sample containers and preservation techniques. This is due to the potential changes in chemical quality that may occur after samples are collected.

Great care must be exercised in the sampling and handling of volatile compounds (e.g. VOCs or volatile gases) in order to minimize the introduction of sampling bias. This bias is caused largely through the loss of volatile constituents. Special handling procedures are described in respective sampling SOPs for the handling of aqueous and non-aqueous samples that should be followed in order to minimize the loss of volatile constituents.

Non-aqueous samples for VOC analysis should be placed in the appropriate container as quickly as possible following their collection. Consideration should be given to trimming soil samples that have been in contact with the air and the sampling device in order to minimize the loss of VOCs and inadvertent sample contamination, respectively. Some agencies require the use of USEPA Method 5035 (or similar) that utilizes containerization in a special sampler (EnCoreor equivalent), or field methanol preservation using specially prepared containers. Lastly, the sample containers should be processed and cooled immediately after filling as further described in the soil and groundwater sampling SOPs.

Glass bottles should be provided extra care to avoid breakage. Bubble wrap bags should be used whenever possible and are mandatory if samples are to travel by non-laboratory supplied courier. Extra bottles may also be collected to provide extra sample in case of breakage.

Sample Labels

Sample labels are required on all sample containers for the primary purpose of sample identification. Specific field data need not be recorded on the labels. The sample labels should contain the following information:

- Sample or location identification number (i.e., well number, boring number/depth, or arbitrary sample number)
- Analysis to be performed (if appropriate)
- Preservative
- Project name and number
- Date and time of sample collection
- Details of samplers (initials, etc.)

It is recommended that the sample label be preprinted in the office on adhesive labels prior to initiation of the sampling program. Tape should NOT be used to cover any label or seal the ends of soil sleeves. Recent studies indicate that most commercially available tapes contain VOCs and that there is the potential for contamination from the tapes. Labels should also be fixed to sample containers themselves and not container lids or caps.

Chain-of-Custody

The goal of implementing chain-of-custody procedures is to ensure that the sample is traceable from the time that it is collected until it, or its derived data, are used. Samples would be considered to be "in custody" under the following conditions:

- It is in personal possession
- It is in personal view after being in personal possession
- It was in personal possession when it was properly secured
- It is in a designated secure area.

Chain-of-Custody Forms

A chain-of-custody form may be initiated at the time that the sample containers are filled or, at a minimum, when the sample containers leave the site at which they are prepared, usually that of the analytical laboratory supplying the containers. Additionally, chain-of-custody forms may be specially prepared with some initial information for the project and specific analytical methods listed prior to field work to decrease the amount of information that has to be recorded in the field. However, in this event, actual sample collection information should be recorded only in the field after the sample has been collected.

It is important that the field personnel completely fill out the applicable sections of the form. Chain of custody forms should be numerically sequenced with a number clearly indicated on the form. The chain-of-custody forms should be placed in shipping containers, protected from moisture using plastic bags (e.g., Ziploc®), and should accompany the containers during shipment to the laboratory. Chain-of-custody forms included in any shipping container should only reflect those samples that are in that container. The field personnel collecting the samples will be responsible for the custody of the samples until transport to the laboratory. Sample transfer requires the individuals relinquishing and receiving the samples to sign, date and note the time of transfer on the chain-of-custody forms. The chain-of-custody is considered to be complete after it has been received and signed in by the analytical laboratory. A copy of the chain-of-custody record should be maintained by the field personnel along with the other field records.

Common carriers (i.e., Federal Express) are not expected to sign the chain-of-custody form. However, the bill of lading or airbill becomes part of the chain-of-custody record in the event that a common carrier is used to transport the samples. Airbill or bill of lading numbers should be recorded on the chain-of-custody forms.

Chain-of-Custody Seals

Custody seals shall be affixed to the outside of each shipping container or cooler. One seal is required and should be placed at a point along the front of the cooler at the point where the lid meets the body of the cooler. The seal does not necessarily need to be custody tape, but any type of tape that can be used that cannot be easily removed without showing signs of damage. The custody seals or tape shall include the date and initials of the packager.

Chain-of-custody seals or evidence tape may be used, but are not required, on the sample containers in order to demonstrate that the sample containers have not been opened or otherwise tampered with. Chain-of-custody seals or evidence tape, if used, should be affixed to each sample container as soon after sample collection as is possible.

Sample Shipment

Shipment of samples to an analytical laboratory is usually required upon completion of sample collection. Proper packaging is necessary in order to protect the sample containers, to maintain the samples at a temperature of 6°C or less, and to comply with all applicable transportation regulations.

In general, samples are shipped using packaging that is supplied by the analytical laboratory. The packaging normally includes a shippable insulated box such as an ice cooler and contains protective internal packaging materials such as foam sleeves or bubble wrap. Some laboratories use proprietary sample packaging with integral internal packaging. In either case, provisions need to be made for maintaining the temperature of the samples either with the use of ice packs or ice. Care should be taken to ensure that the sample bottles are adequately protected from breakage during shipments. Samples should be secured tightly with bubble wrap or other suitable packing media and covered with plastic bags. Double bagged ice should be added to the shipping container only after the samples have been secured with packing media. Ice should never be used to provide separation between sample bottles. Once packed, the cooler should be secured shut by wrapping fiber reinforced (strapping) tape completely around the cooler.

Custody seals shall be placed on the outside of the cooler, and clear tape should be wrapped around the cooler to cover each seal without obliterating signatures or other significant data. The shipping label shall be secured to the outside of the shipping container and, if it is attached to the top of a cooler by adhesive, clear tape shall be used to secure it to the packaging. A valid return address must appear on the shipping label in the event the shipper is unable to deliver to the designated address.

Samples will be delivered to the analytical laboratory so that there is sufficient time for analysis of the constituent with the shortest holding time. Samples preserved at 6°C using ice packs or ice shall be shipped via overnight delivery. If samples are sent on Friday, Saturday delivery will be requested and arrangements must be made with the laboratory to receive the shipment. Chemically preserved samples may be delivered to the laboratory using ground transportation.

Regulations must be observed regarding the shipment of Dangerous Goods. Sample containers and certain field equipment may be defined as Dangerous Goods such that special requirements must be followed for their shipment. Air shipment of Dangerous Goods is regulated by the International Air Transport Association (IATA) as described in "Dangerous Goods Regulations". Shipment by ground is regulated by the U.S. Department of Transportation (DOT). Furthermore, individual shippers (e.g., Federal Express) may have additional requirements for Dangerous Goods shipment. The shipment of Dangerous Goods must be consistent with the instruction and authorization of the analytical laboratory shipping and receiving coordinator and the Health and Safety director.

Environmental samples, including groundwater samples, are currently exempt from Hazardous Goods regulations. 40 CFR 261.40(d) states, "A sample of solid waste or a sample of water, soil, or air which is collected for the sole purpose of testing to determine its characteristics or composition is not subject to this Part or Parts 262 through 267 or Part 124 of this chapter or to the notification requirements of Section 3010 of RCRA." Therefore, no special regulations are required to be followed for the shipment of environmental samples from the field. However, sample containers should be properly packed such that inadvertent spillage does not occur during shipment (e.g., any discharge spouts should be taped closed). Samples of NAPL do not fall under this exemption.

Specific regulations do exist, however, for the shipment of many reagents that are commonly used as preservatives and decontamination agents. Consequently, the shipment to the field site of "empty" sample containers containing small quantities of preservatives must be conducted in accordance with the regulations. The most significant limitations for the shipment of preservatives (IATA, 1992) involve those for nitric acid in which only small quantities (<0.5L) of low concentration (<20%) nitric acid can be shipped in any given shipment.

QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance for sample handling centers upon following procedures outlined above and double checks as samples are collected. Checks should be performed either by 1) the field personnel, or, preferably, 2) by a project chemist or other personnel that constantly check field chain of custody forms versus laboratory receipt acknowledgment forms, discuss condition of samples as received by laboratory personnel, and communicate constantly with the laboratory project manager to prevent quality assurance issues from starting or becoming significant problems should they occur.

SOIL SAMPLING SOP

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OBJECTIVES

The primary objective of this standard operating procedure (SOP) is to establish a uniform method for environmental soil sample collection to reduce the potential variability associated with such activities.

SCOPE AND APPLICABILITY

This procedure specifies the methods to be followed by the field personnel for the collection of surface and subsurface soil samples. The collection techniques and equipment selected are dependent on the nature of subsurface soil conditions (i.e., degree of consolidation and moisture content), depth of the desired sample, type of sample required, type of soil being sampled, and analytical and/or geotechnical laboratory testing methods that will be requested for the sample.

Soil samples are used to determine the physical, hydrogeologic, and chemical properties of site soil. Analytical data aid in the characterization of the site, identification of hazardous substance source areas, and determination of the nature and extent of contamination. Typically a project Work Plan will be prepared that details sample locations, numbers, analytical methods, and specific field techniques that may be required. Different SOPs will be referenced in the Work Plan to provide detailed descriptions of how each procedure will be conducted. The project Work Plan may or may not include a field sampling plan (FSP) and Quality Assurance Project Plan (QAPP) based on client requirements. Proper sampling techniques, proper selection of sampling equipment, and proper decontamination procedures as outlined in the project Work Plan eliminates cross-contamination and introduction of contaminants from external sources.

Detailed records will be maintained during sampling activities, particularly with respect to location, depth, color, odor, lithology, hydrogeologic characteristics, and readings derived from field monitoring equipment. These records will be prepared following the Brown and Caldwell SOP for Field Documentation. All soils are classified in the field by a geologist, hydrogeologist, or soil scientist using the Unified Soil Classification System (USCS), and as described in SOP 3.0 Field

Classification and Description of Soils. Color of the samples is determined in the field using a Munsell Color Chart.

RESPONSIBILITIES

The Project Manager develops or directs the preparation of a Work Plan, which describes the sampling procedures to be used and ensures that the procedures achieve the objectives of the investigation.

The Field Supervisor ensures that soil samples are collected according to procedures outlined in the project Work Plan or provides rational and justifiable decisions in circumstances where deviations from the project Work plan are necessary due to field conditions or unforeseen

problems. The field supervisor also ensures that samples are handled, labeled, and shipped according to procedures outlined in the project Work Plan.

Field personnel are responsible for implementing this SOP as stated, and following the Work Plan requirements for sampling, QA/QC sample collection and frequency, and following other Brown and Caldwell SOPs for field sample shipment and handling.

DEFINITIONS

Surface soil is generally considered to be the top 6 inches of a soil horizon profile (i.e., soil from 0-to-6-inches below ground surface [bgs]). Depending on the program or project, however, soil to 2 feet bgs may be considered surface soil. For the purposes of this procedure, surface soil represents the soil occurring from 0- to- 6- inches bgs.

Subsurface soil represents the soil occurring between surface soil and bedrock.

Composite soil samples are combinations of aliquots collected at various sample locations, or at various depths at a single location. Analysis of composite samples yields a value representing an average over the various sampled sites or depths from which individual samples were collected.

Discrete soil samples are discrete aliquots from distinct sampling intervals, of a specific size, that are representative of one specific sample location at a specific point in time.

Continuous samplers are devices that allow a soil specimen to enter a split barrel during drilling. Both plastic and steel liners can be used inside the sample tube to retain the sample. In some formations, the soil sample may be considered “undisturbed.”

Split-barrel samplers collect samples by driving a 1.5-inch nominal inner diameter (typical), split barrel into a soil formation with a 140-pound hammer dropped 30 inches. For environmental applications, 2-, 2.5- and 3-inch inner diameter split barrels are not uncommon. If a standard 1.5-inch split barrel is used, the number of blows to drive the last 1 foot of the sample are referred to as the standard penetration resistance or N-value. See ASTM D-1586 for the specification for this type of sampler. Another type of split barrel sampler is the core barrel. A core barrel is longer and usually wider in diameter than the typical split barrel samplers and used on hollow stem auger drill rigs. Core barrels are usually 5 feet long and approximately 4-inch outside diameter, which sit into the leading auger and collect soil while drilling. Core barrels are typically unlined.

Ring-lined samplers are split barrels lined with removable rings. The rings are thin-walled and arranged in 1-, 2- or 6-inch increments to section the recovered soil sample. This device is used to collect soil samples for environmental applications and to collect relatively undisturbed soils in stiff and hard cohesive soils where it is not possible to push a sampler. See ASTM D3550 for the specification for this type of additional sampler.

Thin-walled tubes are used to recover relatively undisturbed soil samples by pressing the tubes into soil either hydraulically, or with a Denison or Pitcher sampler.

REQUIRED MATERIALS

Equipment used during manual collection of surface or subsurface soil samples may include a wide variety of tools depending upon the type of sampling and methods being used. This equipment can include, but is not limited to the following:

- Hand lens
- Stainless steel spoons/trowels and stainless steel hand augers
- Stainless steel split-spoon, split-barrel or continuous sampler
- Brass or stainless steel sampling sleeves, if applicable
- Encore™ Sampler T-bar and samplers (5 gram or 25 gram size), if applicable
- Field Balance accurate to 0.01 gram and VOA vials, and preservatives for field preservation of VOC vials under EPA 5035, if applicable
- Stainless steel bowls and pans, if applicable
- Silicon Tape, strapping tape, duct tape
- Field notebook or logbook
- Ball point pen
- Paper towels or Kimwipes
- Aluminum foil
- Teflon sheets
- Appropriate decontamination equipment
- Appropriate health and safety equipment
- Appropriate sample containers and labels, sample coolers and ice
- Chain of Custody forms
- Munsell soil color charts and grain size charts

PROCEDURE

This section identifies important preparations that should be made before initiating a soil sampling event and describes the steps that should be followed during soil sample collection at environmental sites.

Surface soil samples are defined in this procedure as samples collected from 0 to 6 inches below ground surface (bgs) or the first 2 inches of soil below a surficial layer of vegetation. These samples can be obtained easily using manual methods (i.e., a spade, trowel and scoop, or hand-auger). Surface soil samples can also be obtained with the assistance of a drilling rig equipped with a split-barrel sampler. The split-barrel sampler may be either unlined or lined with brass or stainless steel thin-wall sleeves.

Subsurface soil samples to be collected from depths greater than 6 inches bgs can be obtained manually using a hand-auger, a drilling rig, or excavating device (e.g., backhoe). A split-barrel sampler can be employed to depths in excess of 100 feet bgs with the assistance of a drilling rig. An excavating device can provide bulk soil samples from the ground surface to the limits of the excavator (typically 15 to 25 feet bgs). For bulk soil sampling at greater depths in unsaturated soils, a bucket auger rig may be used.

Composite soil samples are combinations of aliquots collected at various sample locations, or at various depths at a single location. Analysis of composite samples yields a value representing an average over the various sampled sites or depths from which individual samples were collected. Composite soil sampling is typically used in sampling soil for the characterization of investigation derived waste for disposal purposes, or in characterization of large surface areas when determined appropriate and in conformance with project requirements.

Preparation for Soil Sample Collection

Preparation for the field collection of surface and subsurface soil samples shall commence with an assessment of ground surface conditions (e.g., undeveloped, vegetated or not vegetated, paved or unpaved, type and thickness of any pavement present) and subsurface conditions (e.g., soil types present, degree of consolidation, moisture content, depth of groundwater, chemicals of potential concern). Information available to assess these conditions may include regional soil survey reports by the USDA Natural Resources Conservation Service and/or borehole or test-pit/trench logs maintained during previous geological, geotechnical, or environmental investigations and historical resources.

If a point designated for soil sample collection is overlain by abundant vegetation, it may be necessary to clear the area before sampling to provide access. If the sampling point is overlaid with concrete pavement, it may be necessary to arrange for a cement cutter/corer to remove the paving material prior to sampling (cement cutting services are available through construction support or drilling subcontractors).

Prior to field collection of soil samples, the Project Manager (PM), Task Manager (as appropriate), and field personnel shall also perform the following tasks.

- Conduct a general site reconnaissance in accordance with the site-specific safety and health plan
- Mark or identify all sampling locations using stakes, markers, or flags. If required, a proposed sampling location may be adjusted based on access, property boundaries, surface obstructions, and subsurface utilities
- Determine the extent of the monitoring and sampling effort, analytical methods to be requested for each sample, sample container types required, sampling methods to be used, and specific equipment and supplies necessary to conduct the monitoring and sampling
- Prepare all field forms as appropriate (field logbooks, pre-prepared Chain of Custody records and labels, etc.)
- Determine required monitoring equipment and personal protective equipment (PPE) required for the health and safety of personnel

- Obtain the necessary sampling and monitoring equipment and ensure it is in working order and has been calibrated.
- Prepare field sampling schedules, provide these schedules to the client (if required), subcontractors, and regulatory agencies (if required), and
- coordinate field sampling activities with their designated representatives
- Perform an underground utility clearance of all staked sampling locations prior to excavating or drilling
- Obtain any permits as appropriate based on local regulatory requirements.

Manual Soil Sample Collection

The following sections describe the specific steps that the environmental engineer/geologist shall follow when collecting surface and subsurface soil samples.

Collection of Surface Soil Samples

Tools such as spades, shovels, trowels, scoops, or spoons can be used to collect most surface soil samples, however, the sampler should be certain the sampling tools are not made out of a material that may effect the sample results (e.g., galvanized metal should not be used to collect metals samples and plastic should not be used to collect semivolatile organic samples).

For densely packed soils, and to collect discrete surface soil samples, it may be necessary to use a hand auger or a drilling or direct push rig. Also, if relatively undisturbed samples are required, a flat, pointed, mason trowel can be used to cut a block sample of the desired soil. The procedure is as follows:

1. Prior to beginning sampling, don clean disposable powder free nitrile or latex surgical gloves to prevent cross-contamination and to provide personal protection. New gloves should be donned for sample collection at each new location or whenever gloves are torn or otherwise compromised
2. Carefully remove the top layer of vegetation, soil or debris to the desired sample depth with a decontaminated spade, shovel, or equivalent
3. Using a decontaminated, stainless steel scoop, plastic spoon, trowel, or clean glass laboratory supplied jar if soils are loose, remove and discard a thin layer of soil from the area that came in contact with the spade. Also discard any pebbles, roots and other large objects that may be present in the sample material
4. If a composite sample is required, place the sample into a stainless steel or other appropriate container and mix thoroughly to obtain a homogenous sample representative of the entire depth interval sampled. However, volatile organic compound (VOC) samples are the exception; samples being analyzed for VOCs must be taken from discrete locations prior to mixing. This practice is necessary to prevent loss of volatile constituents and to preserve, to the extent practicable, the

physical integrity of the volatile fraction. The process of homogenization is described below. After homogenization, place the sample into an appropriate container, as specified in the project Work Plan, and secure the cap tightly

5. If the sample is to be analyzed for VOCs, transfer a portion of the sample directly (i.e., without homogenization) into the appropriate sample container with a stainless steel spoon, plastic spoon, or equivalent, and secure the container cap tightly. The sample container should be sealed with Teflon sheeting and capped with rubber caps in order to prevent VOCs from escaping. Alternatively, sampling using EPA Method 5035 may be used
 - Place a sample from each sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate sample container(s) and secure the cap tightly
 - Homogenization of the sample for remaining parameters may be necessary to create a representative sample volume if sample heterogeneity is not being evaluated. Moisture content, sediments, and waste materials may inhibit the ability to achieve complete mixing prior to filling sample containers. Therefore, when homogenization is requested, it is extremely important that soil samples be mixed as thoroughly as possible to ensure that the sample is as representative as possible of the sample location. When homogenization is requested, the following procedure should be followed
 - The soil is extruded from the sampling apparatus (i.e., drive sampler) or collected by a stainless steel trowel and emptied into the decontaminated stainless steel tray or bowl. Homogenization should be accomplished by then mixing with a decontaminated stainless steel or Teflon® instrument or by hand using new gloves as described above
 - The method of choice for mixing is referred to as quartering and can be performed in a bowl or tray of an appropriate material (material depends on the parameters to be analyzed for). The soil in the sample pan is divided into quarters. Each quarter is mixed, then all quarters are mixed into the center of the pan. This procedure is followed several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion and occasionally turning the material over
 - The extent of mixing required will depend on the nature of the sample and should be done to achieve a consistent physical appearance prior to filling sample containers
 - Once mixing is completed, the sample should be divided in half and containers should be filled by scooping sample material alternatively from each half
 - Potential Problems

- (1) The higher the moisture or clay content, the more difficult it is to homogenize the sample
 - (2) A true homogenization of soil, sediment, or sludge samples is almost impossible to accomplish under field conditions
- An alternative to field compositing is to collect and turn into the laboratory discrete soil samples and have the lab perform the compositing activities in the lab per instructions documented on the chain-of-custody
6. If a composite sample is not required, then the soil can be transferred directly into the sample containers. Attach a sample label to the container using the predetermined project sample numbering system and the sample identification numbers generated for the specific locations
7. Log the soil using the USCS and other logging technics as appropriate.
8. Record required field logbook and sample custody information as specified in the Field Documentation SOP. Package the samples and prepare for transfer or shipment in accordance with the Environmental Sample Handling SOP
9. Mark the sample location with a numbered stake or other type of marker. If possible, photograph the sample location
10. Sketch the sample location in the field logbook. If the proposed sampling point was relocated due to conditions encountered in the field, indicate both the original and actual sample locations on the site map, and record the reason for its relocation in the logbook
11. Decontaminate sampling equipment in accordance with the Equipment Decontamination SOP
12. After a sampling round is complete, survey all sample locations to determine the ground surface elevation and horizontal coordinates if determined appropriate. This can be done using a surveyor or hand held GPS depending on required levels of accuracy.

Soil Sampling with a Hand Auger

The equipment used for this manual method of soil sampling consists of an auger, a series of extensions, and a T-handle. The auger is used to bore a shallow hole to the desired sampling depth. The auger is then withdrawn, and the sample is collected by inserting a manual drive sampler containing a brass or stainless steel sample sleeve, and driving ahead of the auger hole. The typical sampler is a single shoe that contains one 6-inch sleeve.

The following procedure is provided for manual collection of soil samples with a hand auger.

1. Don clean disposable nitrile or latex surgical gloves to prevent cross- contamination and to provide personal protection. New gloves should be donned for sample collection at each new location or whenever gloves are torn or otherwise compromised
2. Check and clear each subsurface soil sample location prior to intrusive activities using as-built drawings, geophysical surveys (e.g. ground penetrating radar), or have clearances performed by the local utility company
3. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). If a surface soil sample is to be collected, the environmental engineer/geologist shall follow the procedure for surface soils presented above. Before advancing the auger, it may be advisable to remove the first 3 to 6 inches of surface soil over a radius of approximately 6 inches around the borehole if surface soils are loose.
4. Attach the auger bit to a drill rod extension, and attach the T-handle to the drill rod
5. Decontaminate the auger following the Equipment Decontamination SOP
6. Begin augering, periodically removing and depositing accumulated soils into an appropriate investigation-derived waste storage or transfer container. Temporary storage on plastic sheeting is appropriate
7. After reaching the desired depth, slowly and carefully remove the auger from the borehole so as soil from the sides of the bore hole is not released to fall into the bottom of the borehole, and paying attention to recover as much loose soil as practical from the bottom of the borehole
8. Decontaminate the split-barrel sampler and sleeves (if required) in accordance with the Equipment Decontamination SOP. Place the decontaminated sampler sleeve into the sampler barrel. The sampler barrels are generally 6 inches in length and can hold one 6-inch sleeve. Assemble the sampler by aligning both sides of the barrel and then attaching the drive shoe and head to the barrel's bottom and top, respectively. Some drive samplers are a two-piece unit – the shoe, which contains the sleeve and the head. For these samplers, the head is aligned with the shoe and threaded onto the head. The impact driver is attached onto the head. Extensions may be added between the impact driver and the sampler if needed
9. If a lined soil sampler is to be used, decontaminate the sample sleeves according to the Equipment Decontamination SOP. Store decontaminated sample sleeves in aluminum foil or on clean plastic sheeting as project requirements dictate prior to assembling the split-barrel sampler
10. Carefully lower the drive assembly into the borehole, then drive it until the sleeve is advanced into the undisturbed soil below the borehole

11. Retrieve the sampler from the borehole and disassemble it. Remove the sleeve containing the sample and process the sample as directed in the Sample Documentation SOP
12. For sample sleeves, seal the ends of each sample sleeve with TeflonTM sheeting and tightly fitting plastic end caps. The end caps shall then be held in place with silicone tape or other U.S. EPA-approved sealing tape. Electrical or duct tape **shall not** be used
13. For sampling using EPA Method 5035, samples may be collected directly from the sleeve with the EnCoreTM sampler, or aliquots placed into VOA vials and preserved as appropriate per the laboratory
14. If another sample is to be collected at a greater depth in the same borehole, reattach the auger bit to the drill and assembly, and follow the steps above. Decontaminate the auger and all sampling equipment between samples
15. Attach a sample label(s) to the container(s) using the sample numbering system described in the Project Work Plan and the sample identification numbers generated for the specific locations
16. Abandon the borehole according to applicable state, county, and local regulations.

Subsurface Soil Sampling with a Drilling Rig

When subsurface soil sampling is required at depths exceeding 5 feet bgs, a drilling subcontractor is typically used to help obtain the samples. Several drilling methods may be employed to collect the samples. Regardless of the drilling method, a 2-inch or 2.5-inch internal diameter split-spoon sampler is often used to collect samples at depth. The split-spoon sampler is attached to the appropriate drive-weight assembly, is positioned at the desired sampling depth and driven by repeated blows of a 140-pound hammer with a free-fall of 30 inches in general accordance with ASTM D1586 or with a pneumatic air hammer. Generally, split-spoon samples are 18 inches in length, but longer samples are also available.

Soil samples to be submitted to an analytical laboratory for testing may be collected in an unlined split-barrel sampler and transferred to sample containers as appropriate for shipment to the laboratory. However, the preferable method is to collect soil samples using a split-spoon sampler lined with three, 6-inch long brass or stainless steel sleeves. This method allows for the collection of samples for chemical and physical properties or geotechnical analysis. Soil samples to be analyzed for metals shall be collected in stainless steel sleeves.

Some of the procedures included in the following subsections are performed by the drilling subcontractor. Any procedure that deals with the apparatus (e.g. drill rig, samplers, drill rods) and services (e.g. drilling the boring and collection of soil samples) provided by the drilling subcontractor is operated by that subcontractor, who is qualified to do so.

Split-spoon sampler

1. Don clean disposable surgical powder-free nitrile or latex gloves to prevent cross-contamination and to provide personal protection. New gloves should be donned for sample collection at each new location or whenever gloves are torn or otherwise compromised
2. Clear the ground surface of any surface debris (e.g., twigs, rocks, litter) or pavement prior to initiating drilling and sampling operations
3. Decontaminate the split-barrel sampler and sleeves in accordance with the Equipment Decontamination SOP
4. Place the decontaminated sampler sleeve(s) into the sampler barrel. Assemble the sampler by aligning both sides of the barrel and then attaching the drive shoe and head to the barrel's bottom and top, respectively
5. Attach the soil sampler to the drill rod assembly and advance it to the desired sample depth
6. Retrieve the sampler from the borehole and disassemble it. If sample sleeves are used and full recovery is achieved, typically, the middle sleeve shall constitute the soil sample for analytical analysis. The ends of the middle sleeve should be quickly noted for lithological descriptions, the sample prepared for shipment and the remaining soil from the remaining sleeves used to characterize the soil for that drive interval. If the soil is the lithologically the same throughout the interval, the less disturbed sample should be used for analytical analysis. The number of sleeves to be sent depends upon project analytical requirements. The top sleeve or top portion of the sampler is often material that has fallen back in the borehole and is not characteristic of the sample depth. If inadequate sample recovery is obtained, use material from the bottom sleeve first, followed by whatever material is in other sleeves, or attempt to recollect the sample. Sleeve samples shall also be packaged and handled in accordance with the Environmental Sample Handling SOP
7. When collecting subsurface soil samples, advance the drill bit and rod assembly to the top of the next desired sampling interval. After removing any excess cuttings from the borehole and tripping the drill bit out of the borehole, attach the empty decontaminated soil sampler to the drill rod assembly and lower it into the borehole
8. Mark the drill rods in successive 6-inch increments so that the advance of the soil sampler can be easily observed by the environmental engineer/geologist. Advance the split-spoon sampler the required distance (generally 18 inches) with blows from the hammer
9. Count the number of blows applied for each 6-inch increment of sampler advance into subsurface soils and record this information on the borehole log in accordance with the Field Documentation SOP and SCS' standard boring log. Sampler refusal is generally indicated if more than 50 blows are required to advance the sampler six

- inches
10. If a geotechnical sample is required, mark each of the sample sleeves to indicate stratigraphic “top” and “bottom,” respectively. Log the exposed soil and/or remaining/excess soil
 11. Without disturbing the sample, seal the ends of each sample sleeve with Teflon sheeting and tightly fitting plastic end caps. The end caps may then be held in place with silicone tape
 12. If another soil sample is to be collected at a greater depth in the same borehole, drill to the desired depth, decontaminate and reattach the split-spoon sampler to the drill rod assembly, and follow Steps 5 through 8 above
 13. Label sample sleeves using the sample numbering system described in the Project Work Plan and the sample identification numbers generated for the specific locations. The sample identification number for split-spoon samples shall include the sample depth, accounting for the appropriate incremental depth based on the location of the sleeve within the split-spoon sampler. Record other required field logbook information.

Continuous sampler (Physical characterization only – not for analytical sampling)

1. Don clean, disposable powder-free nitrile or latex surgical gloves to prevent cross-contamination and provide personal protection. New gloves will be donned for sample collection at each location, or whenever gloves are torn or otherwise compromised
2. Using the drilling equipment (e.g., hollow stem augers), advance the soil boring to the depth immediately above the sampling interval
3. Attach the continuous sampler to the rods or cable and insert into the hollow-stem augers (or casing) and lower it to the bottom of the borehole
4. Advance the sampler ahead of the augers into the undisturbed sampling interval
5. Retrieve and split open the sampler
6. Log the samples.

Field Sampling Using EPA 5035

Collection and storage of soils for VOC analysis using current US EPA methodology has changed since the promulgation of SW846 Method 5035. The EnCore™ Sampler is one of three collection options promulgated from the change in SW846 Method 5035. The other two collections are Acid Preservation and Methanol Preservation. The other two methods are employed only if field constraints are such that samples cannot be shipped and received by a laboratory within 24 to 36 hours of sampling, or if the laboratory prefers one of the alternate methods and supplies the sample containers for such sample collection. EPA Method 5035 calls

for the preservation of samples if analysis cannot occur within 48 hours. To allow adequate time for the laboratory to preserve the samples if necessary, the laboratory should receive them within **24 to 36 hours** of **collection**. This section describes the proper procedures and methods to be employed in the collection and shipment of soil samples collected under EPA Method 5035.

Innovative Technologies (1-888-411-0757) is at this time the only supplier of the Encore™ sampler.

Collection of samples for Low Level Analyses (> 1 µg/Kg)

Each sample point requires two 5-gram(g) samplers, one 25g sampler or one 5g sampler for screening and/or high level analysis, one dry weight cup, one T-handle and paper towels. The number of samplers required may be different from these typical numbers based on the QAPP requirements for the project. The procedure is as follows:

1. Remove sampler and cap from package and attach T-handle to sampler body. Make sure that the sampler is locked into place in the T-handle
2. Quickly push sampler into a freshly exposed surface of soil until the sampler is full. The sampler is full when the o-ring is visible in the hole on the side of the T-handle
3. Use paper towel to quickly wipe the sampler head so that the cap can be tightly attached
4. Push cap on with a twisting motion to attach cap
5. Place sampler into the package
6. Fill out label and attach to the package, where specified for the label
7. Repeat procedure for the other two samplers
8. Collect dry weight sample – fill container. If other samples (non- Encore™) are collected for the same sampling interval, the dry weight sample may be designated and analyzed using the other sample
9. Store samplers at 4 degrees Celsius
10. Ship sample containers with plenty of ice to the laboratory. Samples must arrive at the laboratory **within 40 hours** of collection.

Acid Preservation Sampling for Low Level Analyses (≥ 1 µg/kg).

This procedure should be done in the field only if field constraints prevent shipment to the laboratory such that the laboratory cannot perform the analysis within 48 hours (or samples will not arrive within 24 to 36 hours of collection).

Each sample point requires the following equipment:

1. One 40ml VOA vial with acid preservative (for field testing of soil pH)
2. Two pre-weighted 40ml VOA vials with acid preservative and stir bar (for lab analysis)
3. Two pre-weighted 40 ml VOA vials with water and stir bar (in case samples effervesces)
4. One pre-weighted jar that contains methanol or a pre-weighted empty jar accompanied with a pre-weighted vial that contains methanol (for screening sample and/or high level analysis)
5. One dry weight cup
6. One 2 oz jar with NaHSO₄ acid preservative (in case additional acid is needed due to high soil pH)
7. One scoop capable to deliver about one gram of solid sodium bisulfate
8. pH paper
9. Weighing balance that weighs to 0.01 gram (field balances may not reliably weigh to 0.01 gram)
10. Set of balance weights used in daily balance calibration
11. Gloves for working with pre-weighted sample vials

The field chemistry procedure for testing effervescing capacity of soils is as follows:

1. Place 5 grams of soil into vial that contains acid preservative and no stir bar
2. Do not cap this vial as it may EXPLODE upon interaction with the soil
3. Observe the sample for gas evolution (due to carbonates in the soil)
4. If vigorous or sustained gas evolution occurs, then acid preservation is not acceptable to preserve the sample. In this case, the samples need to be collected in the VOA vials with only water and a stir bar. The vials with acid preservative CANNOT be used
5. If a small amount or no gas evolution occurs, then acid preservation is acceptable to preserve the sample. Keep this testing vial for use in the buffering testing detailed below. In this case, the samples need to be collected in the VOA vials with the acid preservative and a stir bar

The field chemistry procedure for testing buffering capacity of soils is as follows:

1. If acid preservation is acceptable for sampling soils than the sample vial that was used in the effervescing testing can be used here for testing the buffering capacity of the soil
2. Cap the vial that contains 5 grams of soil, acid preservative and no stir bar from Step #1 in the effervescing testing
3. Shake the vial gently to attempt to make a homogenous solution
4. When done, open the vial and check the pH of the acid solution with the pH paper
5. If the pH paper reads below 2 then the sampling can be conducted in the two pre-weighted 40 ml VOA vials with the acid preservative and stir bar. Since the pH was below 2, it is not necessary to add additional acid to the vials
6. If the pH paper reads above 2, then additional acid needs to be added to the sample
7. Use the jar with the solid sodium bisulfate acid and add another gram of acid to the sample
8. Cap the vial and shake thoroughly again
9. When done, open the vial and check the pH of the acid solution with a new piece of pH paper
10. If the pH paper reads below 2 then the sampling can be conducted in the two pre-weighted 40 ml VOA vials with the acid preservative and stir bar and one extra gram of acid
11. Make a note of the extra gram of acid needed so the same amount of extra acid can be added to the vials the lab will analyze
12. If the pH paper reads above 2, then add another gram of acid and repeat this procedure one more time.

The procedure for collection of samples is as follows:

1. Wear gloves during all handling of pre-weighed vials
2. Quickly collect a 5 gram sample using a cut off plastic syringe or other coring device designed to deliver 5 grams of soil from a freshly exposed surface of soil
3. Carefully wipe exterior of sample collection device with clean paper towel
4. Quickly transfer to the appropriate VOA vial, extruding with caution so that the solution does not splash out of the vial
5. Add more acid if necessary (this is based on the buffering testing discussed on the previous section)

6. Use the paper towel and quickly remove any soil off of the vial threads
7. Cap vial and weigh the jar to the nearest 0.01 gram
8. Record exact weight on the sample label
9. Repeat sampling procedure for the duplicate VOA vial
10. Collect dry weight sample – fill container
11. Store samples at 4 degrees Celsius
12. Ship containers with plenty of ice and per DOT regulations to the laboratory.

Encore™ Sampler Collection For High Level Analyses (> 200µg/Kg)

Each sample point requires the following equipment:

1. One 25g sampler or one 5g sampler. (The sampler size used will be dependent on who is doing the sampling and who is doing the laboratory analysis)
2. One dry weight cup
3. One T-handle
4. Paper towels.

The procedure for collecting soil samples is as follows:

1. Remove sampler and cap from package and attach T-handle to sampler body. Make sure that the sampler is locked into place in the T-handle
2. Quickly push sampler into a freshly exposed surface of soil until the sampler is full. The sampler is full when the o-ring is visible in the hole on the side of the T-handle
3. Use paper towel to quickly wipe the sampler head so that the cap can be tightly attached.
4. Push cap on with a twisting motion to attach cap
5. Place sampler into the package
6. Fill out label and attach to the package, where specified for the label
7. Collect dry weight sample – fill container. If other samples (non- Encore™) are collected for the same sampling interval, the dry weight sample may be designated and analyzed using the other sample
8. Store samplers at 4 degrees Celsius

9. Ship sample containers with plenty of ice to the laboratory. Samples must arrive at the laboratory **within 40 hours** of collection.

Methanol Preservation Sampling for High Level Analyses ($\geq 200 \mu\text{g/kg}$).

This procedure should be done in the field **only** if field constraints prevent shipment to the laboratory such that the laboratory cannot perform the analysis within 48 hours (or samples will not arrive within 24 to 36 hours of collection).

Methanol preservation of each sample point requires the following equipment:

1. One pre-weighted jar that contains methanol or a pre-weighted empty jar accompanied with a pre-weighted vial that contains methanol
2. One dry weight cup
3. Weighing balance that weighs to 0.01 gram (field balances may not reliably weigh to 0.01 gram)
4. Set of balance weights used in daily balance calibration
5. Gloves for working with pre-weighted sample vials
6. Paper towels

The procedure for collection of soil samples is as follows:

1. Wear gloves during all handling of pre-weighed vials
2. Weigh the vial with methanol preservative in it to 0.01 gram. If the weight of the vial with methanol varies by more than 0.01 gram from the original weight recorded on the vial - discard the vial. If the weight is within tolerance it can be used for soil preservation below
3. Tare the empty jar or the jar that contains the methanol preservative
4. Quickly collect a 25 gram or 5 gram sample using a cutoff plastic syringe or other coring device designed to deliver 25 gram or 5 gram of soil from a freshly exposed surface of soil. The 25 gram or 5 gram is dependent on who is doing the sampling and who is doing the laboratory analysis
5. Carefully wipe the exterior of the collection device with clean paper towel
6. Quickly transfer the soil to an empty soil jar that contains methanol. If extruding into a jar that contains methanol be careful not splash the methanol outside of the vial. Again, the type of jar received is dependent on who is doing the laboratory analysis
7. If the jar used to collect the soil plug was empty before the soil was added,

immediately preserve with the methanol provided – using only one vial of methanol preservative per sample jar

8. Use the paper towel and remove any soil off of the vial treads and cap the jar
9. Weigh the jar with the soil in it to 0.10 gram and record the weight on the sample label
10. Collect dry weight sample – fill container
11. Store samples at 4 degrees Celsius
12. Ship containers with plenty of ice and per DOT regulation to the laboratory

Bulk Soil Sampling

Large volumes of soil are generally not required for environmental investigations. However, soil samples may be collected in bulk with a backhoe from test-pits or trenches to a maximum depth of approximately 15 to 25 feet. A bucket auger may be used to collect bulk soil samples to maximum depths of 250 feet if the soils are unsaturated.

If bulk sampling is required for a given project, the procedure for sample collection will be provided in the project Work Plan. In general, any bulk sampling conducted on a project will follow the procedures discussed under the sections above. Whether samples will be composited, collected under EPA 5035, or into sample sleeves will be determined and described in the project Work Plan.

QUALITY ASSURANCE/QUALITY CONTROL

In order to assess the accuracy and precision of the field methods and laboratory analytical procedures, quality assurance/quality control (QA/QC) surface and subsurface soil samples are collected during the sampling program according to the project Work Plan. QA/QC samples may be labeled with QA/QC identification numbers or fictitious identification numbers if blind submittal is desired, and are sent to the laboratory with the other samples for analyses. The frequency, types, and locations of QA/QC samples are specified in the project Work Plan. Examples of QA samples are equipment rinsate samples, duplicate samples, matrix spike/matrix spike duplicate samples, performance evaluation samples, and laboratory blind duplicate samples.

Equipment Rinsate Samples

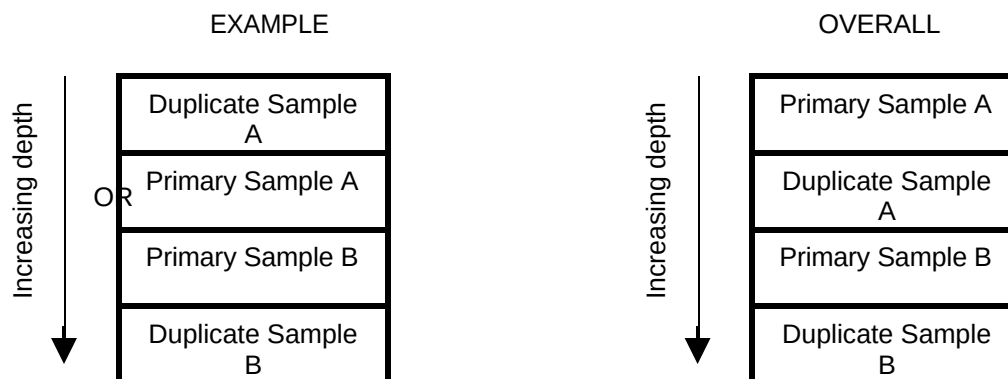
An equipment rinsate sample is intended to check if decontamination procedures have been effective and to assess potential contamination resulting from containers, preservatives, sample handling and laboratory analysis. Procedures for collection are as follows:

1. Rinse the decontaminated sampling apparatus with deionized water. Allow the rinsate to drain from the sampling apparatus directly into the sample bottle

2. Add any preservatives associated with the soil sample analytical methods to the rinsate sample
3. Specify (on the COC) the same analytical methods for rinsate samples as is specified for the soil samples
4. For validation reasons, assign the rinsate sample an identification number and label as rinsate samples, not as blanks
5. Place the rinsate sample in a chilled cooler and ship it to the laboratory with the other samples.

Duplicate Samples

Duplicate samples are collected to assess the precision of field and laboratory components of field samples and matrix heterogeneity. Duplicate samples are similar to split samples and should be collected like split samples. Project specifications will determine if the duplicate samples are homogenized. If so, proceed with the instructions for homogenization in Section 6.2.1. Otherwise, the collection of duplicate samples will be collected in the next consecutive sample. For example, if a 18-inch long split-spoon contains three 6-inch long full sleeves of soil. The middle sleeve is designated as the primary sample, then the next sleeve, either the top or bottom sleeve must be the duplicate sample. The collection of duplicate samples is more complex, when more sleeves are needed for analyses. For example, for the same split barrel and three full sleeves of soil, two sleeves are necessary for the primary analyses (i.e. A and B). In this scenario the duplicate is the next sleeve. The middle sleeve can be designated as Primary Sample A, the top sleeve as the duplicate for Primary Sample A and the third sleeve as Primary Sample B. The duplicate for Primary Sample B must be collected from the top sleeve in the next split barrel, which means the sampler must be driven again into the soil from the point where the last sampler stopped. The example and the overall relationship of collection of the primary and duplicate soil samples are illustrated below.



To maximize the information available in assessing total precision, collect duplicate samples from locations suspected of the highest contaminant concentration. Use field measurements (such as HNu data) or visual observations, past sampling results, and historical information to select appropriate locations for duplicate analyses.

The duplicate sample is handled and preserved in the same manner as the primary sample and assigned a sample number, stored in a chilled cooler, and shipped to the laboratory with the other samples. Whenever possible, the sample identification numbers for the characteristic sample and its duplicate are independent such that the receiving laboratory is not able to distinguish which samples are duplicates prior to analysis.

Matrix Spike/Matrix Spike Duplicate Samples

An extra volume of sample media may be collected during the sampling event for performance of matrix spike (MS)/matrix spike duplicate (MSD) analyses by the laboratory to assess laboratory accuracy, precision, and matrix interference. Following shipment of the samples to the laboratory, the laboratory prepares MS and MSD samples by homogenizing the soil matrix collected in the field and splitting the material into three separate sets of containers. Note that sample aliquots for volatile analysis are not homogenized. The laboratory spikes the split samples with appropriate analytes prior to performing the extraction in order to evaluate the total of the spiked compound and whatever quantity of the compound may be present in the sample. Results of the analyses are compared with the results of the primary sample and the known concentrations of the spike compounds. The percent recovery and relative percent difference are calculated and results are used to evaluate the precision and accuracy of the analytical method for various labeled "extra volume samples for MS/MSD." The sample volumes required for these analyses should be coordinated with the laboratory and are described in the project Work Plan.

Performance Evaluation Samples

Performance evaluation or pre-spiked soil samples may be used to assess laboratory extraction efficiency and accuracy in constituent identification and quantification. Because these samples are helpful in assessing the potential bias of analytical methods, they are also commonly used to evaluate the accuracy of non-standard methods or mobile laboratory procedures. These samples are generally prepared by an independent laboratory and shipped in pre-sealed containers to the field to be included with the samples sent to the laboratory performing the analysis of site soil samples. As for field blanks, these spiked samples are generally limited to organic constituents. The analytes of interest and corresponding analyte concentrations for the spike samples must be specified in the request to the independent laboratory providing the samples in accordance with the project Work Plan. These samples are assigned an identification number, stored in a chilled cooler, and shipped blind to the laboratory with the other samples.

Laboratory Blind Duplicate Samples

If appropriate, or required by program Quality Assurance, laboratory blind duplicate samples may also be used to assess laboratory accuracy in constituent identification and quantification. Laboratory blind duplicate samples consist of two or more representative sample volumes from one heterogeneous soil sample obtained from one sampling location. Equal volumes of representative aliquots from the mixture are submitted to two or more laboratories for analysis.

The results of each laboratory are compared as a check on the laboratory accuracy. Because two samples are analyzed, environmental variability and precision (from one location to another) are included in this assessment.

The laboratory blind duplicate sample volume collected by the sampling team is preserved, packaged and submitted for analysis in the same manner as the other characteristic samples in accordance with the project Work Plan.

Other Sample Types

Ambient or background samples are used to assess the range of concentrations of potential contaminants and naturally occurring inorganic compounds in the vicinity of the site which are not the result of site activities. These samples are collected from areas not believed impacted by historical site operations (i.e., away from source areas and upwind).

The ambient or background samples are collected at the locations and depths specified in the project Work Plan. If the locations are not specified, a nearby park or other area void of industrial activity, for example, may be suitable for collection of ambient samples. The soil type should be as close as possible to the onsite characteristic samples. If appropriate, information can be obtained from various state and local agencies (e.g. USDA Natural Resources Conservation Service) that could aid in selection of ambient soil sampling locations. Ambient soil samples should be collected following the same procedure as that used for the onsite soil samples.

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TEST PIT SOP

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OBJECTIVES

The primary objective of this standard operating procedure (SOP) is to define the techniques and requirements for collecting soil samples and for characterizing the type of soil and debris from the unconsolidated subsurface zone using a backhoe or equivalent equipment.

Trenches and test pits will be excavated using a backhoe or equivalent equipment for visual observations of subsurface conditions and to access the subsurface for soil characterization and sampling.

Equipment operator – All backhoe trenching and test pits will be performed by a company operator or subcontractor.

Project Manager/Field Team Leader-The field team leader (FTL) is responsible for ensuring that field personnel collect trenching and test pit subsurface soil samples in accordance with this SOP.

Site Geologist/Soil Scientist/Engineer–The person responsible for directing and overseeing test pit activities including test pit locating, excavation, sample collecting, logging, health and safety monitoring and other documentation.

REQUIRED EQUIPMENT

- Site-specific plans
- Plastic zip-top bags
- Field logbook
- Personal protective clothing
- Indelible black or blue ink pens and permanent markers
- Plastic sheeting
- Nitrile or appropriate gloves
- Appropriate sample containers
- Slide hammer and appropriate sample sleeves
- Bags of ice
- EnCore sampler and T-handle
- Sample labels
- Decontamination supplies
- Chain of custody forms

- Kimwipes or paper towels
- Insulated cooler(s)
- Custody seals
- Global Positioning System (GPS) unit
- Teflon squares and sleeve end caps
- 300-ft tape measure and/or measuring wheel
- Trash Bags
- Hand shovel(s)
- Disposable plastic spoons and knives
- Monitoring/screening instruments as required by the health and safety plan.

BACKHOE SAMPLING

- Backhoe with a sufficient length boom (extendable boom preferred) to extend to 10 to 15 ft bgs
- Samples collected to a depth of 5 feet (ft) will be collected from the side walls of the trench/test pit using a slide hammer and stainless steel sleeves, as long as the side wall can be safely accessed at that depth. In some instances, safely
- reaching the sidewall at 5 ft bgs may not be possible and the bucket of the backhoe will be used to access soil material
- Samples collected deeper than 5 ft bgs will be collected directly from the backhoe bucket using a slide hammer and appropriate sample sleeves of soil material contained in the bucket that is not in contact with the bucket walls
- VOC samples will be subsampled from the sample sleeves using 5035 appropriate sampling devices.

Notes:

1. ***Personnel will not enter an excavation of any depth.***
2. ***Soil sample procedures are to follow the Soil Sampling SOP in addition to this SOP and other project plans and requirements.***
3. ***Health and safety procedures are to follow project specific Health and Safety Plan.***

PROCEDURES

1. A minimum of 48-hours prior to sub surface exploration, the project site and sample locations are to be appropriately marked and Underground Surface Alert (USA) shall be contacted dig ticket received as required by law.
2. Don the appropriate personal protective clothing as indicated in the site-specific health and safety plan
3. Locate sampling point(s) and document pertinent information. Confirm GPS coordinates of each location if appropriate.
4. Look for marks made by utility companies associated with USA.
5. Prepare sampling equipment as appropriate.
6. The depth of sampling will be verified with a tape measure.
7. Refer to the appropriate SOP for specific details regarding soil sample collection, equipment decontamination, and record keeping.

The following steps must be followed when collecting environmental samples using a backhoe:

1. Verify that the parts of the backhoe that will come in contact with the soil to be sampled have been properly decontaminated per the Equipment Decontamination SOP.
2. Excavate to the desired depth.
3. Avoid standing or positioning back-hoe on down-wind site of test pit to minimize breathing of soil borne dust.
4. Visually inspect and log the soil profile.
5. If it can be performed safely, collect soil samples from the sidewalls of backhoe trench/test pit at the specified depth using a slide hammer sampler and stainless steel sleeves. If the sample will be deeper than 5 feet bgs, the sample will be collected
6. from the backhoe bucket (from the middle of the bucket and untouched by the bucket) using a slide hammer and sample sleeves. Personnel will not enter excavations under any circumstances.
7. When sample collection has been completed in the trench, backfill the trench with the excavated material. Compact the surface of the former excavation/test pit with backhoe bucket and/or tires. Evenly spread any extra excavation spoils on the ground surface in the vicinity of the trench and test pit.
8. Once the trench has been backfilled, decontaminate backhoe in accordance with Equipment Decontamination SOP.

9. Place sampling PPE in a plastic trash bag and transfer decontamination fluids appropriately.
10. Complete field documentation procedures, being sure to record all relevant information before leaving the site.

APPENDIX D

CHAINS-OF CUSTODY, SHIPPING LABELS, AND CUSTODY SEALS EXAMPLE

CHAIN OF CUSTODY RECORD

COC No. _____

☐ 7041 Koll Center Parkway, Suite 135
Pleasanton, CA 94566
(925) 426-0080

☐ 3843 Brickway Blvd., Suite 208
Santa Rosa, CA 95403
(707) 546-9461

☐ 3117 Fite Circle #108
Sacramento, CA 95827
(916) 361-1297

PROJECT NAME:								LABORATORY NAME & ADDRESS:							
PROJECT NUMBER:															
LINE NO.	SAMPLE - I.D.	COLLECTION DATE	TIME	SAMPLER'S INITIALS	NUMBER OF CONTAINERS	CONTAINER SIZE AND TYPE	PRESER- VATIVE	MATRIX CODE	ANALYSES REQUESTED	FIELD FILTERED	QC - REQ	TAT	SAMPLING METHOD	DEPTH (FT.) BEGIN END	PID READING (ppm)
01														----	
02														----	
03														----	
04														----	
05														----	
06														----	
07														----	
08														----	
09														----	
10														----	
COLLECTED & RELEASED BY				DATE / /	TIME :	COOLER I.D.:				COMMENTS (see note on back):					
RECEIVED BY:				DATE / /	TIME :	RELINQUISHED BY:				DATE / /	TIME :				
RECORD RETURNED BY:				DATE / /	TIME :										
COURIER:						SHIPPING NUMBER:									

USE A BALLPOINT PEN, BLACK INK, AND PRESS FIRMLY. INSTRUCTIONS ARE ON THE BACK

The chain-of-custody provides formal documentation of the possession of samples from the time of collection until received at the laboratory. Internal laboratory custody procedures must be used to document possession of the samples while they are at the laboratory.

To fill out this form, specify the project name and project number in the box at the upper left-hand corner of the form. In the box to the immediate right, indicate to proper shipping address of the laboratory that is to perform the analysis.

1) SAMPLE I.D.

Enter the Sample Identification Number.

2) COLLECTION

Enter the date (mo/day/yr) and the time (military) of sample collection.

3) SAMPLER'S INITIALS

Enter the initials of the person(s) who collected the sample.

4) NUMBER OF CONTAINERS

Enter the number of containers that are grouped together as one sample.

5) CONTAINER SIZE AND TYPE

Enter the size/volume and type (VOA, glass, poly, sleeve, etc.) of the containers(s). If three 40-ml VOA vials make one sample, the unit size would be 40-mL VOA.

6) PRESERVATIVE

Enter the code for the type of preservative used (if the analyses requested do not require preservative, write "none", all samples are shipped at 4° C):

HNO₃ = preserved with nitric acid
H₂SO₄ = preserved with sulfuric acid
HCl = preserved with hydrochloric acid
NaOH = preserved with sodium hydroxide

7) MATRIX CODE

Enter the Matrix Code for the matrix samples:

A = Air S = Solid
C = Cinders T = Tissue
G = Gas W = Water
L = Liquid

8) ANALYSES REQUESTED

Enter the analytical method requested. These should be consistent with the work plan/sampling analysis plan for this task (for example, EPA Method 8240, VOA CLP).

9) FIELD FILTERED

The sampler must indicate which samples are to be field filtered by placing an "F" in the box.

10) QC - REQUIRED

The sampler must indicate which samples are to have QC analysis performed. Enter the code for the type of QC requested:

S = Single Spiked Sample
M = Matrix Spike/Matrix Spike Duplicate

11) TURNAROUND TIME (TAT)

Record the requested TAT (eg., 30 days, 24 hrs.)

12) SAMPLING METHOD

Enter the type code for the sample taken:

B = Bailer	HP = Hydropunch
CC = Core Sampler	LV = Low volume air sampler
CS = Composite sample	LY = Lysimeter
DT = Driven tube	NA = Trip blank
EC = Encore sampler	NS = Non-submersible pump
G = Grab (also filter and equipment blank)	PR = Soil gas probe
GB = Geoprobe	SP = Submersible pump
	SS = Split spoon

13) DEPTH

Enter the number of feet (accurate to 1/10" below the surface the sample was collected).

14) PID READING

Enter the headspace PID reading for soil and air samples.

15) COLLECTED AND RELEASED BY

The person(s) who collected the samples must sign in this area when releasing the samples to sample control.

16) CUSTODY BLOCK

Whenever custody is transferred, the person receiving the samples must sign here. The person releasing the samples must also sign. Date and time are as in #2.

17) COOLER I.D.

Enter a unique one letter identifier for each cooler shipped on a given day. Be sure field QC are shipped with appropriate samples.

18) COURIER/SHIPPING NUMBER

Enter the courier/shipping number (e.g., FEDEX airbill number).

19) COMMENTS

This section is used for any additional information that might be useful to the laboratory (e.g., special handling requirements, suspected contaminants, additional compounds to be analyzed, etc.)

Example of Shipping Label

SCS ENGINEERS	<i>Sample Description:</i>	
	<i>Sample Location:</i>	<i>Sample ID:</i>
	<i>Date/Time:</i>	
	<i>Matrix/Sample Type/Preservative:</i>	
	<i>Sampled By:</i>	<i>Remarks:</i>

Example of Custody Seal

SCS ENGINEERS	<i>Custody Seal</i>	<i>Date</i> _____	<i>Signature</i> _____

APPENDIX E

FIELD CHECKLIST OF EQUIPMENT

Equipment Checklist

Quantity	Other
	bubble wrap - ft.
	Well Keys/gate keys
	Rope Ft
	Tape measure/ wheel/ line
	Stakes
	Zip lock bags - Sandwich size (box)
	Zip lock bags - gallon size (box)
	Garbage bags
	Paper towels - roll
	Field Support Misc
	Appropriate Instruments
	USA Utility Clearance Documents
	Wisk broom
	Attachment - A,B,C,D
	Bound Notebook
	Ice
	Ice chest
	Job file/Onsite information
	Paper
	Indelible ink pen (Sharpies)
	Pens and pencils
	Calculator
	Digital Camera
	COCs
	Health and Safety Plan
	Drinking water
	Core boxes with dividers
	No recovery spacers for core boxes
	batteries

Quantity	Water Sampling Containers
	One liter amber bottles
	40 ml VOA
	Glass soil jars
	1 liter plastic
	500ml plastic
	Bacti bottle
	Other containers
	General Equipment
	Tool box
	Folding table
	Shipping Air bills
	Drum labels
	Sample Labels
	Other Forms
	Log forms
	First Aid Kit
	Powder Free Nitrile Gloves
	Chalk Based Spray Paint
	Shade Canopy
	Bailers/ Cord
	Hand tools
	Poly sheeting - roll
	Clip Board
	Twine - roll
	Wash buckets
	Liquid-Nox/ Alconox
	Brushes

APPENDIX F
FIELD DATA SHEET

Daily Field Report

Page ____ of ____

Project Name/Number _____

[illegible]

APPENDIX C

UNANTICIPATED DISCOVERY PLAN



Unanticipated Discovery Plan

Seidenglanz Property
1245 Oro Dam Boulevard, Oroville
Butte County, California
(Assessor's Parcel No. 035-270-016)



Presented to:

CITY OF OROVILLE
1735 Montgomery Street
Oroville, California 95965
(530) 538-2433

Presented by:

SCS ENGINEERS
2167 Montgomery Street, Suite B
Oroville, California 95965
(530) 533-5898

August 17, 2016
Project Number: 01215033.00

Unanticipated Discovery Plan

**Seidenglanz Property
1245 Oro Dam Boulevard, Oroville
Butte County, California
(Assessor's Parcel No. 035-270-016)**

Prepared for:

CITY OF OROVILLE
1735 Montgomery Street
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Oroville, California 95965
(530) 533-5898

August 17, 2016
Project Number: 01215033.00

APPROVAL PAGE

Approved by: _____
Grant Manager, City of Oroville

_____ Date

Approved by: _____
Program Manager, SCS Engineers

_____ Date

Approved by: _____
Principal-in-Charge and QA/QC Officer
SCS Engineers

_____ Date

Approved by: _____
Brownfields Project Manager,
USEPA Region IX

_____ Date

Approved by: _____
Quality Assurance Manager, USEPA Region IX

_____ Date

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3.0 On-Site Responsibilities	1
4.0 Further Contacts and Consultation	2
5.0 Special Procedures for the Discovery of Human Skeletal Material.....	4
6.0 Documentation of Archaeological Materials	5
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PLAN AND PROCEDURES FOR THE UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES AND HUMAN SKELETAL REMAINS

PHASE II SUBSURFACE INVESTIGATION PROJECT
FORMER LAS PLUMAS MILL SITE,
1245 ORO DAM BOULEVARD,
OROVILLE, BUTTE COUNTY, CALIFORNIA

1.0 INTRODUCTION

On behalf of the City of Oroville (the City), SCS Engineers (SCS) plans to conduct Phase II Subsurface Investigation activities (Investigation) at the Former Las Plumas Mill Site at 1245 Oro Dam Boulevard, Oroville, California (the Site). The purpose of the Investigation is to characterize areas of potential environmental concern identified in Phase I Environmental Site Assessment (ESA) reports. The following Unanticipated Discovery Plan (UDP) outlines procedures to follow, in accordance with state and federal laws, if archaeological materials or human remains are discovered.

2.0 RECOGNIZING CULTURAL RESOURCES

A cultural resource discovery could be prehistoric or historic. Examples include:

- An accumulation of shell, burned rocks, or other food related materials;
- Bones or small pieces of bone;
- An area of charcoal or very dark stained soil with artifacts;
- Stone tools or waste flakes (i.e. an arrowhead, or stone chips),
- Clusters of tin cans or bottles, logging or agricultural equipment that appears to be older than 50 years; and,
- Buried railroad tracks, decking, or other industrial materials.

When in doubt, assume the material is a cultural resource.

3.0 ON-SITE RESPONSIBILITIES

STEP 1: STOP WORK. If any SCS employee, contractor or subcontractor believes that he or she has uncovered a cultural resource at any point in the project, all work adjacent to the discovery must stop. The discovery location should be secured at all times.

STEP 2: NOTIFY MONITOR. If there is an archaeological monitor for the project, notify that person. If there is a monitoring plan in place, the monitor will follow its provisions.

STEP 3: NOTIFY SCS PROJECT MANAGEMENT AND CULTURAL RESOURCES PROGRAM. Contact the SCS Project Manager and the Cultural Resources (CR) Program Manager:

SCS Program Manager:

Name: James Ritchie

Number: (650) 995-3312

Email: jritchie@scsengineers.com

CR Program Manager:

Name: Luis Topete

Number: (530) 538-2408

Email: topetela@cityoforoville.org

If you can't reach the CR Program manager, contact your project's assigned Cultural Resources Specialist or an alternate:

Assigned CR Specialist:

Name

Number

Email

Alternate CR Specialist:

Name

Number

email

The Project Manager or the Cultural Resources Program will make all other calls and notifications.

If human remains are encountered, treat them with dignity and respect at all times. Cover the remains with a tarp or other materials (not soil or rocks) for temporary protection in place and to shield them from being photographed. Do not call 911 or speak with the media.

4.0 FURTHER CONTACTS AND CONSULTATION

A. Program Manager's Responsibilities:

- Protect Find: The SCS Program Manager is responsible for taking appropriate steps to protect the discovery site. All work will stop in an area adequate to provide for the total security, protection, and integrity of the resource. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the discovery site. Work in the immediate area will not resume until treatment of the discovery has been completed following provisions for treating archaeological/cultural material as set forth in this document.
- Direct Construction Elsewhere On-site: The SCS Program Manager may direct construction away from cultural resources to work in other areas prior to contacting the concerned parties.
- Contact CR Manager: If the CR Program Manager has not yet been contacted, the Project Manager will do so.

B. CR Program Manager's Responsibilities:

- Identify Find: The CR Program Manager (or a CR Specialist if so delegated), will ensure that a qualified professional archaeologist examines the find to determine if it is archaeological.
 - If it is determined not archaeological, work may proceed with no further delay.
 - If it is determined to be archaeological, the CR Manager or CR Specialist will continue with notification.
 - If the find may be human remains or funerary objects, the CR Manager or CR Specialist will ensure that a qualified physical anthropologist examines the find. If it is determined to be human remains, the procedure described in Section 5 will be followed.
- Notify California State Office of Historic Preservation (SOHP): The CR Program Manager (or a CR Specialist if so delegated) will contact the involved federal agencies (if any) and the SOHP.
- Notify Tribes: If the discovery may relate to Native American interests, the Manager or Specialist will also contact the project's Tribal Liaison, or, if the project is not assigned a Liaison, the Executive Tribal Liaison.

Federal Agencies:

Agency: EPA
Name:
Title:
Number:
Email:

Agency:
Name
Title
Number
Email

Tribal Liaisons:

Project Tribal Liaison
Name:
Number
Email

Executive Tribal Liaison
Name
Number
Email

The Tribal Liaison, or CR Program Manager or Specialist, will contact the interested and affected Tribes.

Tribes consulted on this project are currently undetermined, but may include:

Tribe:

Name: Konkow Valley Band of Maidu
Address: 1185 18th Street Oroville, CA 95965

Tribe:

Name: Mechoopda Indian Tribe of Chico

Address: 125 Mission Ranch Blvd, Chico CA 95926

Number: (530) 899-8922

Email: mit@mechoopda-nsn.gov

C. Further Activities

- Archaeological discoveries will be documented as described in Section 6.
- Construction in the discovery area may resume as described in Section 7.

5.0 SPECIAL PROCEDURES FOR THE DISCOVERY OF HUMAN SKELETAL MATERIAL

Any human skeletal remains, regardless of antiquity or ethnic origin, will at all times be treated with dignity and respect.

If the project occurs on federal lands (e.g., national forest or park, military reservation) the provisions of the Native American Graves Protection and Repatriation Act of 1990 apply, and the responsible federal agency will follow its provisions. Note that state highways that cross federal lands are on an easement and are not owned by the state.

If the project occurs on non-federal lands, SCS will comply with applicable state and federal laws, and the following procedure:

A. Notify Law Enforcement Agency or Coroner's Office:

In addition to the actions described in Sections 3 and 4, the Project Manager will immediately notify the local law enforcement agency or coroner's office.

The coroner (with assistance of law enforcement personnel) will determine if the remains are human, whether the discovery site constitutes a crime scene, and will notify the SOHP.

B. Office of Historic Preservation

1725 23rd Street, Suite 100

Sacramento, California 95816

(916) 445-7000; fax: (916) 445-7053

C. Participate in Consultation:

Unless otherwise directed by the EPA, the SOHP will have jurisdiction over non-forensic human remains. The CR Manager and SCS personnel will participate in consultation.

D. Further Activities:

- Documentation of human skeletal remains and funerary objects will be as directed by SOHP, unless otherwise governed by the EPA.
- When consultation and documentation activities are complete, construction in the discovery area may resume as described in Section 7.

6.0 DOCUMENTATION OF ARCHAEOLOGICAL MATERIALS

Archaeological deposits discovered during construction will be assumed eligible for inclusion in the National Register of Historic Places under Criterion D until a formal Determination of Eligibility is made.

Cultural Resources Program staff will ensure the proper documentation and assessment of any discovered cultural resources in cooperation with the federal agencies (if any), SOHP, affected tribes, and a contracted consultant (if any).

All prehistoric and historic cultural material discovered during project execution will be recorded by a professional archaeologist on State of California cultural resource site or isolate form using standard techniques. Site overviews, features, and artifacts will be photographed; stratigraphic profiles and soil/sediment descriptions will be prepared for subsurface exposures. Discovery locations will be documented on scaled Site plans and Site location maps.

Cultural features, horizons and artifacts detected in buried sediments may require further evaluation using hand-dug test units. Units may be dug in controlled fashion to expose features, collect samples from undisturbed contexts, or interpret complex stratigraphy. A test excavation unit or small trench might also be used to determine if an intact occupation surface is present. Test units will be used only when necessary to gather information on the nature, extent, and integrity of subsurface cultural deposits to evaluate the Site's significance. Excavations will be conducted using state-of-the-art techniques for controlling provenience.

Spatial information, depth of excavation levels, natural and cultural stratigraphy, presence or absence of cultural material, and depth to sterile soil, regolith, or bedrock will be recorded for each probe on a standard form. Test excavation units will be recorded on unit-level forms, which include plan maps for each excavated level, and material type, number, and vertical provenience (depth below surface and stratum association where applicable) for all artifacts recovered from the level. A stratigraphic profile will be drawn for at least one wall of each test excavation unit.

Sediments excavated for purposes of cultural resources investigation will be screened through 1/8-inch mesh, unless soil conditions warrant 1/4-inch mesh.

All prehistoric and historic artifacts collected from the surface and from probes and excavation units will be analyzed, catalogued, and temporarily curated. Ultimate disposition

of cultural materials will be determined in consultation with the federal agencies (if any), SOHP, and the affected tribes.

Within 90 days of concluding fieldwork, a Technical Report describing any and all monitoring and resultant archaeological excavations will be provided to the Program Manager, who will forward the report to the Cultural Resources Program for review and delivery to the federal agencies (if any), SOHP, and the affected tribe(s).

If assessment activity exposes human remains (burials, isolated teeth, or bones), the process described in Section 5 above will be followed.

7.0 PROCEEDING WITH INVESTIGATION

Project execution outside the discovery location may continue while documentation and assessment of the cultural resources proceed. A SCS CR Specialist must determine the boundaries of the discovery location. In consultation with SOHP and affected tribes, Program Manager and Cultural Resources Program staff will determine the appropriate level of documentation and treatment of the resource. If federal agencies are involved, the agencies will make the final determinations about treatment and documentation.

Investigation may continue at the discovery location only after the process outlined in this plan is followed and SCS (and the federal agencies, if any) determine that compliance with state and federal laws is complete.

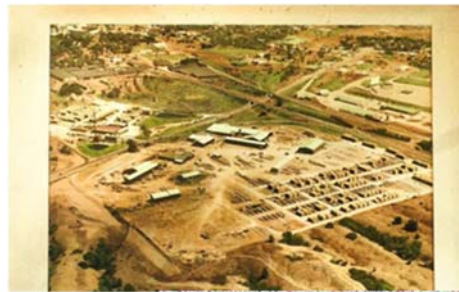
APPENDIX D
SITE-SPECIFIC HEALTH AND SAFETY PLAN

SCS ENGINEERS



Site-Specific Health and Safety Plan

**Seidenglanz Property
1245 Oro Dam Boulevard, Oroville
Butte County, California
(Assessor's Parcel No. 035-270-016)**



Presented to:

CITY OF OROVILLE
1735 Montgomery Street
Oroville, California 95965
(530) 538-2433

Presented by:

SCS ENGINEERS
2167 Montgomery Street
Oroville, California 95965
(530) 533-5898

August 17, 2016
Project Number: 01215033.00

Offices Nationwide
www.scsengineers.com

APPROVAL PAGE

Approved by: _____ Date _____
Grant Manager, City of Oroville

Approved by: _____ Date _____
Program Manager, SCS Engineers

Approved by: _____ Date _____
Principal-in-Charge and QA/QC Officer
SCS Engineers

Approved by: _____ Date _____
Brownfields Project Manager,
USEPA Region IX

Approved by: _____ Date _____
Quality Assurance Manager, USEPA Region IX

HEALTH AND SAFETY PLAN

1 GENERAL PROJECT SITE INFORMATION

SITE DESCRIPTION SUMMARY

SCS Project No: 01215033.00
Site Name: Seidenglanz Property
Site Owner: Mr. Robert (“Steven”) Seidenglanz
Site Address: 1245 Oro Dam Boulevard, Oroville, California
Assessor’s Parcel Numbers (APNs): 035-270-016
Client Contact: Mr. Donald Rust, Tel: (530) 538-2433

SCOPE OF WORK

Complete a geophysical survey, advance twenty-eight, 3-foot soil borings using a hand auger and collect soil samples, advance twenty-two soil vapor borings using a strataprobe and collect soil vapor samples, and advance eighteen soil borings using a strataprobe and collect soil and groundwater samples.

ONSITE ORGANIZATION AND COORDINATION

Program Manager	James Ritchie	650-995-3312 cell
Site Team Leader/On-Site Health and Safety Representative:	Paul Wisniewski	925-998-0826 cell
Primary H&S Representative:	Gary Pons, CIH	562-426-9544x3174 cell

2 EMERGENCY CONTACT AND NOTIFICATION INFORMATION

Nearest Hospital Address (See attached directions and map):	Oroville Hospital 2767 Olive Highway, Oroville, CA 95966
Police:	911
Fire :	911
Ambulance:	911
Emergency Procedure	Call 911 in case of emergency, Proceed to Oroville Hospital Emergency Room for emergency medical care.

3 JOB TASK SAFETY ANALYSIS AND PPE ASSESSMENT (JTSA)

Exhibit 3.4-1: JOB TASK SAFETY ANALYSIS AND PPE ASSESSMENT FORM

Job Task Safety Analysis Form				
Task Type	Engineering Services	Task Description Complete a geophysical survey, advance twenty-eight, 3-foot soil borings using a hand auger and collect soil samples, advance twenty-two soil vapor borings using a strataprobe and collect soil vapor samples, and advance eighteen soil borings using a strataprobe and collect soil and groundwater samples.	Location or Project: 1245 Oro Dam Boulevard	
			Date Revised: 3/8/2016	
			Project #: 01215033.00	
Analysis Team Member	Position Title		Reviewed by	Position Title
Alex Tuveson	Site Team Leader/On-Site Health and Safety Representative		Alex Tuveson	Site Team Leader/On-Site Health and Safety Representative
James Ritchie	Program Manager		Jim Ritchie	Program Manager
Special Training Required		40 hr HAZWOPER training for drilling contractor		
Applicable SAFE Checklist(s): Specify type and category number		SOP 8 – Safe Procedures for Drilling and Well Installation SOP 12 – Safe Procedures for Hand and Power Tools SOP 21 – Safe Procedures for Biological Hazards SOP 24 - Avoidance of Slips, Trips, and Falls Appendix E - Personal Protective Equipment		

This form is the certification that the hazard assessment has been performed for the workplace as required under 29 CFR 1910.132.

Job Task Step	Potential Environmental and Personnel Hazards ¹	Critical Actions	PPE Required
1. Marking drilling locations	None	None required	Head: None Body: Safety vest Foot: Steel--toe ANSI boots Hand: None Respiratory: None Hearing: None
2. Call Dig Alert and locate utilities	None	None required	Head: None Body: Safety vest Foot: Steel--toe ANSI boots Hand: None Respiratory: None Hearing: None
3. Hand auger mobilization of equipment	None	None required	Head: None Body: Safety vest Foot: Steel--toe ANSI boots Hand: None Respiratory: None Hearing: None
4. Delineation of work-zone	Vehicle traffic possible in Site vicinity	None required	Head: None Body: Safety vest Foot: Steel--toe ANSI boots Hand: None Respiratory: None Hearing: None
5. Drilling activities (hand auger and strataprobe)	Moving machinery, flying particles, organic vapors, pesticides, metals	Air monitoring with PID, trip/slip, stay upwind of vapors	Head: Hardhat (for strataprobe borings) Body: Safety vest Foot: Steel--toe ANSI boots Hand: Nitrile gloves Respiratory: None, APR available Hearing: Earplugs (for strataprobe borings)

6. Collect water, soil vapor, and geological soil sample	Moving machinery, organic vapors, pesticides, metals	Avoid pinches/punctures with hand auger, wear gloves, stay upwind of vapors	Head: Hardhat Body: Safety vest Foot: Steel-toe ANSI boots Hand: Nitrile gloves Respiratory: None, APR available Hearing: None

¹ See Table 1 for examples of Environmental hazards and Table 2 for Personal Hazards

Table 1: Potential Environmental/Safety Hazards with Possible Critical Actions	
Environmental conditions	1. Is there adequate lighting? Provide portable lighting, flashlights, hardhats with light attachments 2. Are there sources of heat or cold stress? Cold Stress: Use insulated coveralls or clothing, provide heaters or blankets. Heat stress: provide plenty of ice and fluids, monitor body temperature and pulse, provide cooling vests, provide cooling fans or mistifiers 3. Are there any radiation sources? Provide radiation protection, monitor for radiation, 4. Is there adequate ventilation to remove air contaminants? Provide ventilation fans or blowers 5. Is adequate air monitoring conducted? Conduct personal or real-time monitoring 6. Are there any biological hazards such as ticks, spiders, snakes, chiggers, etc potentially present in work area? Use DEET or other tick or insect sprays, cover exposed skin areas with clothing, tuck in pant leggings into boots
Injurious Contact	1. Can an employee or clothing come in contact with, struck by, caught between moving parts of machinery? Install guards or warning signs/barriers 2. Any there any pinch points between two moving parts or objects? Provide guards, barriers, or warning signs 3. Is there sufficient room to work and not be in the line of fire or in traffic area? Personnel provide traffic support, use traffic cones 4. Is there an object or machinery that can strike people? Provide barriers or use proper PPE 5. Is energy sources controlled and lockout/tagout? Provide lockout/tagout and check controls 6. Are machines guarded properly? Use proper guards
Overextension	See Exhibit 4.7-2 for evaluation of ergonomic hazards such as awkward postures, lifting, high hand force, repetitive motion, and repeated contact.
Slips, Trips, Falls	1. Is there a chance that ice, oil water or other slick material to accumulate on working surfaces? Use shoe overlays or slip-resistant boots, use absorbents. 2. Is the area clear of debris and litter? Provide proper housekeeping and inspect area before task 3. Are there any walking obstructions such as hidden ditches or hoses on ground? Identify obstructions with tape or other warning devices 4. Does the job require stairs, ladders or other elevated surfaces? Provide railings or fall protection 5. Is there a chance to fall from elevated level? Provide railings or fall protection
Other Safety Hazards	1. Correct tools for job available? Evaluate tools required 2. Is proper equipment lifting/moving equipment available? Provide manlifts, hoists, or cranes for lifting 3. Is critical equipment maintained? Check maintenance records 4. Is communications between groups adequate for safe performance? Provide radios or cell phones to employees
Drilling, excavation, confined space, operation of heavy machinery, operating power tools	See appropriate SAFE Checklist for Safe behaviors for each category type

Table 2: Personal Hazards and Guidance on PPE Selection

Personal System	Potential Hazards	Recommended PPE
Head	1. Potential for falling overhead objects? 2. Potential for contact with electrical conductors coming in contact with head?	Hardhats, ANSI Z-89.1 approved Non-conductive Hardhats Class A or B, ANSI Z-89.1 approved
Eye/Face	1. Exposed to flying particles or objects that can impact eye or face? 2. Exposed to flying sparks or molten metal? 3. Exposed to corrosive vapors or liquids? 4. Exposed to optical radiation?	Faceshield , ANSI approved goggles, minimal protection is safety glasses with side shields Faceshields or goggles Faceshield or chemical splash resistant goggles Welder faceshield with adequate optical density shades
Hand/Body	1. Exposed to possible cuts or abrasions? 2. Exposed to hot surfaces or heat sources? 3. Exposed to hazardous chemicals through dermal route?	Leather gloves or abrasion resistant gloves Leather or other heat resistant gloves/ Heat reflective coveralls Chemical resistant gloves and coveralls appropriate for chemicals of concern
Foot	1. Potential for objects falling or rolling over foot? 2. Potential for objects piercing foot? 3. Feet exposed to dangerous or corrosive chemicals? 4. Feet exposed to electrical hazard 5. Exposed to tripping hazards and uneven surfaces?	Steel-toe boots, ANSI Z-41 approved, metatarsal guards should be considered Steel-toe and shank boots, ANSI Z-41 approved Chemical resistant boots with steel-toe and shank Non-conductive safety boots, ANSI Z-41 approved Boots with high ankle support
Hearing	Exposed above 80 dBA	Hearing plugs or muffs with NRR sufficient to reduce exposures below 80 dBA
Respiratory	1. Oxygen deficient or IDLH atmosphere, or unknown atmosphere 2. Below 50 times PEL , but above 10 times PEL, or corrosive to eye/face 3. Above 10 times PEL, but below 50 times PEL, non-corrosive to eyes/face	SCBA or supplied air with escape bottle Full face cartridge or filter respirators, PAPR Half-face respirator

EVALUATION OF POTENTIAL PUBLIC EXPOSURE TO HAZARDS

A summary of the potential hazards, routes of exposure, and potential targets is presented in the following table. The duration of the hazard is also evaluated, and the proposed methods to prevent exposure are also given.

Potential Hazard	Duration of Hazard	Route of Exposure	Potential Target	Methods to Prevent Exposure
Petroleum and/or Organic Vapors above Action Levels arising from drilling	Immediate and long term	Migration through the air. Exposure of lungs, eyes, and skin to vapors.	Those working at the Site, involved in the drilling and those in the vicinity of the Site.	Enforcement of exclusion zone. Monitoring vapors and stopping test if "action" levels are exceeded.
Movement of drilling equipment and support vehicles around Site	Immediate	Movement of vehicles around area of drilling; collision with pedestrians or cars.	Those working at the Site, involved in the drilling and those in the vicinity of the Site.	Use of exclusion zones around the areas of drilling. Use of a designated set route between monitoring locations, use of lights and warning sounds on vehicles. Use of warning signs if available. Ground personnel will wear safety vests or equivalent.
Moving parts of drilling equipment.	Immediate	Moving mechanical parts.	Those working at the Site, involved in the drilling and those in the vicinity of the Site.	Use of exclusion zones around the areas of drilling equipment. Restriction of access to trained personnel only.
Slip/trip/fall	Immediate	N/A	Those working at the Site, involved in the drilling/hand auguring and possible unauthorized people at the site.	Use of exclusion zones around areas of drilling equipment. Restriction of access to trained personnel only. Use of signs, delineators, temporary fencing, and/or caution tape, as needed.

4 SAFE OBSERVATIONS

Table 1. SAFE OBSERVATION CHECKLISTS

Check applicable SAFE Checklists for site or project tasks or list the applicable SAFE checklists:

ES	
1.0 Driving Vehicle	X
2.0 Site Assessment Activities	X
3.0 Sampling Soil, Soil Vapor, Groundwater or Air	X
4.0 Well Installation/Excavation/UST Removal/Construction Observation – Heavy Equipment Use	
5.0 Landfill CQAI Well Installation – Heavy Equipment Use	

5 PHYSICAL HAZARDS

Underground/overhead utility lines, flying objects, pinch points, exertion strain, trips, slips, falls, moving equipment, and vehicle traffic.

6 CHEMICAL AND PHYSICAL AGENT HAZARDS

Based on knowledge of the Site and SCS' experience with similar operations and facilities, the constituents of potential concern (COPC) include;

- Metals, particularly arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. The presence of metals in the Site subsurface would most likely be associated with vehicle and equipment maintenance operations, wood treatment areas, and miscellaneous chemical use and storage areas;
- Petroleum compounds such as gasoline, diesel fuel, motor oil, fuel oil, and waste oil. The primary use or storage areas for these compounds include the former USTs, ASTs, vehicle and equipment maintenance operations, septic systems and miscellaneous chemical use and storage areas;
- Volatile organic compounds (VOCs) including chlorinated solvents, solvent stabilizers, and thinners. The presence of VOCs in the Site subsurface would most likely be associated with vehicle and equipment operations, septic systems, and miscellaneous chemical use and storage areas;
- Semi-volatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs). The presence of SVOCs at the Site would most likely be associated with former wood treatment areas, vehicle and equipment maintenance operations, wood disposal/burning areas (Teepee Burner) and miscellaneous chemical use and storage areas;

- Creosote, pentachlorophenol (PCP), dioxins and furans. The presence of creosote, PCP, dioxins and furans at the Site would most likely be associated with former wood treatment areas, vehicle and equipment maintenance operations, wood disposal/burning areas (Teepee Burner) and miscellaneous chemical use and storage areas; and,
- The presence of polychlorinated biphenyls (PCBs) at the Site would most likely be associated with electrical transformers present at the northern Site boundary.

Lead based paint (LBP) and asbestos containing materials (ACM) would most likely be present on the surfaces, insulation, roofing tar and as mastic on historic Site buildings.

Table 1. Chemical Hazards and Air Monitoring Plan

Chemical	PEL	TLV	IDLH	Monitoring equipment	Action Levels for monitoring equipment	Sample Location ID and Frequency	Procedures when Action Levels Exceeded
Benzene	1 ppm	2.5 ppm	500ppm	PID	25 ppm	Breathing zone/1 hour	Respirators will be required
Toluene	50 ppm	50 ppm	500ppm	PID	25 ppm	Breathing zone/1 hour	Respirators will be required
Ethyl benzene	100 ppm	100 ppm	800ppm (10% LEL)	PID	25 ppm	Breathing zone/1 hour	Respirators will be required
Xylene	100 ppm	100 ppm	900ppm	PID	25 ppm	Breathing zone/1 hour	Respirators will be required
Naphthalene	10 ppm	10 ppm	250ppm	PID	25 ppm	Breathing zone/1 hour	Respirators will be required
Gasoline	300 ppm	300 ppm	ND	PID	25 ppm	Breathing zone/1 hour	Respirators will be required

Various CPOCs are present at the Site. An action level of 25ppm, measured using a photoionization detector (PID), will be used as a baseline to establish safe working conditions.

7 SITE SECURITY AND CONTROL, DECONTAMINATION AND DISPOSAL MEASURES

SITE SECURITY AND CONTROL MEASURES

Work will be on private property. Access to the boring locations will be limited to authorized personnel during drilling, installation, and sampling.

VAPORS

If, during the drilling, a sustained reading of 25 ppm is observed, then drilling/fieldwork activities will stop, and the source(s) of the vapors will be identified. Vapor emissions will be reduced by covering the source(s) of the vapors with sheeting or soil, reducing the area being worked on at any time, or spraying the soil being excavated with water.

DUST

Based on our experience in monitoring the air during drilling at petroleum hydrocarbon sites, the generation of dust is unlikely. Therefore, no air monitoring for particulates will be performed.

NOISE

Site activities will be restricted to between the hours of 7 am and 5 pm, Monday to Friday. Noise levels are not anticipated to be excessive, so no noise control measures are proposed for these activities. Hearing protection such as ear plugs are suggested for workers within the exclusion zone.

DECONTAMINATION PROCEDURES

Equipment will be decontaminated using a triple rinse. Decontamination liquids will be stored in appropriate DOT 55 gallon drums and left onsite pending disposal.

8 APPLICABLE STANDARD OPERATING PROCEDURES (SOP) AND PROGRAMS

SOP 8 Safe Procedures for Drilling and Well Installation

SOP 12 Safe Procedures for Hand and Power Tools

SOP 21 Safe Procedures for Biological Hazards

SOP 24 Avoidance of Slips, Trips, and Falls

Appendix E Personal Protective Equipment

Appendix K Safe Observation Checklist for ES Professionals

ACKNOWLEDGEMENT PAGE

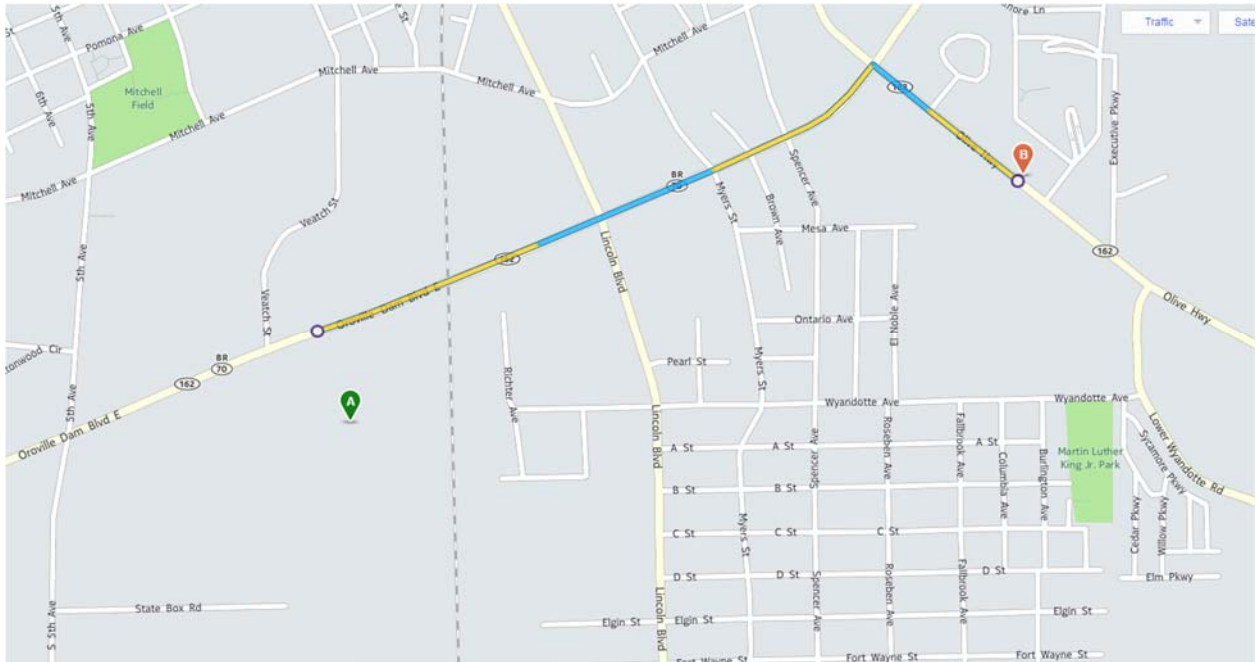
“I have read the attached Health and Safety Plan for the Subsurface Assessment for 1245 Oro Dam Boulevard, dated March, 2016. I have discussed any questions that I have regarding the materials with the person in charge of site safety for SCS activities on the project, and I understand the requirements.”

Name	Signature	Company	Date

Approved by: _____

Date: _____

HOSPITAL LOCATION AND DIRECTIONS:
Oroville Hospital
2767 Olive Highway, Oroville, CA 95966



1245 Oro Dam Blvd E, Oroville, CA 95965-5850

Head toward Lincoln Blvd on Oroville Dam Blvd E (CA-162)

Go for 0.8 mi



Turn right onto Olive Hwy (CA-162)

Go for 0.2 mi

Arrive at Olive Hwy (CA-162). Your destination is on the left.



2767 Olive Hwy, Oroville, CA 95966-6103

SOP 8

SAFE PROCEDURES FOR DRILLING AND WELL INSTALLATION

PURPOSE AND SCOPE

This procedure outlines the safe work practices associated with well drilling and installation. The procedure applies to all SCS employees and contractors involved in these activities.

SAFE WORK PRACTICES

General

Always complete a JTSA and PPE Assessment for drilling or well installation projects (see SOP 4).

- Excavation, well, or drilling permits may be required, and employees must comply with local requirements.
- The Construction Superintendent or Project Team Leader must determine safety precautions and PPE required. At a minimum, PPE Assessment will indicate that employees wear protective equipment such as hard hats, safety glasses, safety work boots, safety vests, gloves, respirators, or hearing protection, as required.
- Drilling equipment shall be operated only by qualified (by training and experience) personnel who are authorized by the contractor or SCS to operate subject equipment. The drilling equipment shall be operated, inspected, and maintained as specified in the manufacturer's operating manual.
- Drilling equipment shall be equipped with two easily accessible emergency shutdown devices, one for the operator and one for the helper. Fire extinguishers shall be available on the cab of the drilling machine and readily accessible by the ground drilling crew.
- NEVER approach an open borehole without appropriate fall protection. It is easy to lose your balance, particularly for holes on slopes—on a slope, approach the borehole from below the borehole (walking uphill).

Underground Utilities

- Underground utilities in the vicinity of the planned borehole or trench must be identified prior to commencement of drilling operations involving the drill rig and power augers.
- Locations that contain underground utilities should be drilled to a depth of 3 feet using a slam bar, hand auger, or post hole digger.

Above-Ground Utilities

- Above-ground utilities must be identified prior to commencing drilling activities.

- All operations must be cleared of power lines, telephone lines, video cables, guy wires, and other objects that may pose a hazard.

Moving Equipment

- Prior to bringing earth drilling equipment on the job site or before drilling equipment is moved, a survey shall be conducted to identify overhead electrical hazards and potential ground or terrain hazards, such as hazardous agents in the soil, or underground utilities. The location of any overhead or ground hazards shall be identified on a site layout plan of the project or site health and safety plan.
- Earth drilling equipment shall not be moved with the mast up.

Drilling Activity Setup

For boreholes greater than eighteen inches in diameter, the following requirements will apply:

- Create a controlled access zone no less than ten feet around the edge of the borehole. The controlled access zone shall be flagged or otherwise clearly marked with high-visibility material or barriers.
- Any person who enters inside the controlled access zone shall be required to wear a full-body harness with a lanyard that meets OSHA fall protection equipment requirements (see **SOP-10**). The lanyard must be connected to an anchorage point that is able to support at least 5,000 pounds per person attached. The lanyard shall be designed to prevent the employee from falling in the hole. A self-retracting lifeline is recommended for use as part of the fall protection equipment.
- Before a person is allowed in the controlled access zone, all machinery and equipment within the swing radius of lanyard must be removed or turned off to prevent any person from having their lanyard entangled or snared by moving or operating equipment.
- If the lanyards are attached to a vehicle or moving equipment, the equipment or vehicle will be locked out/tagged out to ensure that the equipment or vehicle is not accidentally started while the employee is anchored. Preferably, the vehicle keys should be in the possession of the person wearing the fall protection equipment.
- A safety grate that provides at least two feet of overlap over the borehole corners or edges and is designed and constructed to hold at least twice the weight of the materials and equipment (including piping clamped to the center of the grate) placed on the grate will be available at all times during drilling activities. The grate should be used to cover any open boreholes when persons are within the controlled access zone.
- Equipment shall be set-up on stable ground and maintained level. Cribbing shall be used when necessary. Outriggers shall be extended per the manufacturer's specifications.

Drilling Operations

- Weather conditions shall be monitored. Operations shall cease when electrical storms or high winds are imminent.
- Persons working near drilling equipment shall not wear loose clothing, jewelry, or equipment that might become caught in moving machinery.
- Auger guides shall be used on hard surfaces. (If impractical due to type of drill rig being used {full-size and/or crane-mount}, a risk assessment shall be performed by a qualified person, and documented in the JTSA as to why this requirement is not practical. additional precautions and/or controls shall be identified to insure an equal level of safety is being accomplished).
- The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment before starting or engaging equipment.
- Hoists shall be used only for their designed intent and shall not be loaded beyond their rated capacity. Steps shall be taken to prevent two-blocking of hoists.
- The equipment manufacturer's procedures shall be followed if rope becomes caught in, or objects get pulled into, a cathead.
- Borehole depth measurements shall be collected when the drill bucket is located at the top of (but still within) the borehole.

Backfilling and Installation of Piping in Gas Wells

- Before installing piping or backfilling a gas well greater than eighteen inches in diameter, place a safety grate on top of the borehole. The safety grate shall be placed on the borehole by either of the following methods:
 - Placing the drilling bucket on top of the borehole, then have employees place the grate against the drilling bucket. Once the grate is placed against the drilling bucket, remove the drilling bucket slowly and allow the grate to fall on top of the borehole.
 - Use an extended forklift, or similar piece of equipment, to place the safety grate on top of the borehole.
- Move the backfill materials as close to the borehole as possible. Limit the amount of lifting required to backfilled the gas well or borehole by placing the materials at a height of between the knees and waist of the employees backfilling the gas well. Eliminate any twisting of the back when backfilling gas wells with Bentonite or other materials.
- Minimize the generation of Bentonite dust by pouring water at the same time as backfilling with the Bentonite materials, or mix the Bentonite with water and then backfill the gas well. Some form of respiratory protection may be necessary.

- Keep all employees at a safe distance when lowering the gas well piping into the borehole.
- If employees are required to work over the borehole (e.g. to place a pipe centralizer), use a safety grate and provide ventilations fans to limit their exposure to landfill gases.
- All unattended boreholes or boreholes not completed for the day will be covered by the following method:
 - Keep the safety grate on top of the borehole and place a piece of plywood on top of the grate, then
 - Put at least six inches of soil over the plywood and grate, and place the drilling bucket on top of the soil, plywood and grate.
- Remove any borehole cover with the drilling bucket, forklift or other types of heavy machinery; NEVER manually removed the cover unless using a lanyard and full-body harness as required for any entry into the controlled access zone.

Landfills and Other Areas Where Combustible Gas May Be Present

- NO SMOKING.
- Suspicious or dangerous cuttings, such as asbestos; unknown chemicals in containers punctured by drilling operations; military munitions; or medical wastes should always be noted during drilling projects. In such situations, PPE must be modified as directed by competent personnel. Solid waste or contaminated cuttings should never be handled with bare hands.
- Work areas should be periodically monitored for methane, hydrogen sulfide, or other chemicals of concern. If such chemicals are encountered, corrective measures (e.g., forced ventilation) must be taken, as necessary.
- Valves and/or pipes should be closed or capped at the end of each work day to control combustible gas emissions.

Drilling Equipment Checks

Drillers should visually inspect the following equipment at least daily:

- All control mechanisms, for adjustment, wear, and lubrication.
- Air and hydraulic systems, for deterioration or leakage.
- Rope and pulley function.
- Hoist brakes, clutches, and operating levers.
- Kill switches.

SOP 12

SAFE PROCEDURES FOR HAND AND POWER TOOLS

PURPOSE AND SCOPE

This section describes hazards that can arise from the use of hand or power tools, safe work practices that can be implemented while using these tools, and Personal Protective Equipment (PPE: see **Appendix E**) and guards required for power equipment. The discussion applies to all SCS employees who use this equipment during the performance of their work.

SAFE WORK PRACTICES

Three strategies are essential for safe operation of hand and power tools:

- **Avoid Danger:** Inform yourself of situations or conditions to avoid while using hand and power tools, and learn to anticipate these situations before they can cause harm.
- **Protect Yourself:** Work safely and use PPE to protect yourself from hazards.
- **Defend Yourself:** Anticipate the unexpected, and understand how to remedy safety-related problems if they occur. **NEVER** leave running power tools unattended.

Avoiding Danger and Protecting Yourself

As an initial step, it is imperative that you understand how to operate equipment safely and are informed of its danger. Danger can be avoided or minimized if you:

- Do not operate tools until you are trained in their proper use.
- Know a tool's limitations and potential hazards.
- Know how to operate all controls.
- Learn to recognize problems.
- Avoid contact with moving parts by understanding danger zones of every tool you use.
- Never disable or remove a guard.
- Understand the tool's safety features and guards. Inspect guards before use.

If a guard is missing or is not working, tag out the tool for repair and notify your supervisor.

Preventing Contact

To avoid injury, work habits can be modified to keep you from encountering the danger that tools can create:

- Always move your hands back and away from tools.
- Never reach toward or across a tool.
- Never brush away sawdust, shavings, or turnings while the tool is running.
- Use clamps, vices, or other devices to hold and support the piece you're working on so you can have two hands free to control the tool.
- Try to predict where you and the tool would end up if you lost your balance or the tool slipped, and position yourself safely.
- Maintain control of a tool until it comes to a complete stop; do not set it down or swing it toward you.
- If a tool is too heavy to control comfortably, choose a lighter tool and or use a rest or set up a counterbalance to support the tool's weight.

Develop Proper Habits

Safe work habits will also help you to avoid danger, as follows:

- Avoid being struck by debris by keeping yourself and others out of harm's way and by wearing protective equipment.
- Avoid wearing loose clothing, jewelry, or non-protective shoes.
- Tie back or confine long hair and loose sleeves.
- Make sure tools are turned off before plugging them in.
- Remove batteries or make sure tools are unplugged or locked off before changing accessories or making adjustments.
- Use only grounded or double-insulated tools, and keep them dry.
- Never remove the ground prong on plugs.
- Stay out of wet areas unless you and the tool are properly protected.
- Use a Ground Fault Circuit Interrupter (GFCI).

- Never use regular power tools when explosive quantities of vapors, dust, or gases are present. Monitor as necessary when using equipment or tools in these environments. Many hand and power tools have the potential to create sparks. See SOP 5 – Work Permits when working near hazardous materials or chemical processes, landfill gas systems, and confined spaces.

Inspecting Tools

Inspecting tools helps protect you from accidents, and should be part of proper maintenance of equipment:

- Inspect all handles, cords, switches, plugs, prongs, and guards.
- Look for cracks in the casing and for loose screws.
- Make sure guards work correctly and don't stick.
- Check grips and triggers, and be sure auxiliary handles are firmly attached.
- Look for wear and other problems with padding and other anti-vibration features.
- Check blades, bits, and other accessories to make sure they are the correct size and shape for the tool and job.

Defending Yourself from Harm

“Defense” against danger involves anticipating or recognizing potentials for harm in the work environment, and developing habits to avoid the threat:

- Survey the area to make sure it's safe to proceed with work.
- Check the area for power lines, electric wires, pipes, and other mechanical hazards.
- Find out what's behind walls or other locations hidden from view.
- Make sure there's enough light.
- Clean the area to provide enough room to work.
- Pick up as you go.

Other guidance involving power tools depends on the tool's structure, its potential for danger, intended use, and other factors, as follows:

Power Cords

- Get the right type and length of extension cord for the job.
- Plug cords into a permanent or portable GFCI.
- Avoid connecting two extension cords together and never overload a receptacle.
- Secure cords to prevent damage to the cords and to avoid hazards for people in the area.

- Keep cords away from heat, water, oil, sharp edges, and moving parts.
- Never use the cord to carry a tool or to unplug it.
- Inspect cords for damaged or frayed conditions; do not use cords if damaged or frayed.

Saws

- Always use the right blades for the job, and make sure they're sharp.
- Adjust blades so that they project about 1/8 inch beyond the material you're cutting.
- Check the blade's alignment and tightness before plugging in and starting the saw.
- Do not cut pieces so small that they cannot be properly secured.
- Remove nails, staples, and loose knots before cutting.
- Make sure your footing is secure and the cord is out of the way of the cut.
- After turning on saw, let blade reach full speed before it contacts the piece being cut.
- Use both hands to hold the saw, and don't force it.
- Don't reach under or around the material you're cutting.
- Don't put down the saw until the motor has stopped.

Drills

- Select the right bit or attachment for the job.
- Don't use bits or attachments that are dull, bent, or damaged.
- Tighten the chuck securely and remove the key.
- Secure the article being drilled.
- Never reach under or around the stock being drilled.
- Wait until the drill stops turning before setting it down.
- Never carry the drill or move it by the cord.

Grinding

- Check to see where sparks might fall.
- Keep the area clear of debris.
- Allow the wheel to reach full speed.
- Move the work piece slowly across the wheel face. Or if using a portable grinder, move the grinder slowly across the work.
- Use locking pliers or a clamp to hold small pieces.
- Make sure grinding wheels fit freely and are not forced on the spindle.
- Wear eye and face protection while using grinding machines.
- Secure guards in place before using the machines.

Pneumatic Tools

- Protect yourself and others from flying debris and noise.
- Protect hoses, filters, and gauges from damage.

- Never use compressed air to clean or blow away dust or debris unless attached blow gun is regulated at 30 psi or less..
- Never point tools toward yourself or others.
- Never pull the trigger unless the tool's nose piece is directed at a safe work surface.

SOP 21

SAFE PROCEDURES FOR BIOLOGICAL HAZARDS

PURPOSE

The purpose of this section is to assist employees in recognizing natural biological hazards such as plants, animals, and insects. These include spiders, snakes, poisonous plants and vegetation, ticks, and rodent or animal droppings that could contain Hantavirus. The discussion offers guidance on how to avoid exposure to these hazards, as well as recommendations for treating illnesses or injuries associated with these hazards.

SCOPE

This discussion is applicable to all employees who may be exposed to biological hazards while working. Employees involved in field activities should become familiar with the basic natural hazards that can be encountered during investigations or other activities. With this knowledge, employees can better avoid dangerous situations. Examples of potential natural hazards are provided below.

Note that different types of biological hazards exist in different regions of the country. Although the examples provided in this SOP are common, they do not form an exhaustive list of every pest you may encounter.

INSECTS

- **Ticks:** Small arachnids that are larger than mites and come in a variety of forms and sizes. Ticks attach themselves to warm-blooded animals and extract blood from the host. It should be noted that ticks harbor at least two diseases:
 - **Rocky Mountain Spotted Fever** is carried by some ticks and can be fatal. Symptoms can include fever, headache, and chills, experienced a few days after being bitten by a tick. Wood ticks can carry this disease.
 - **Lyme Disease** is usually carried by the small deer tick. It may take as long as 72 hours of feeding to transmit infection, so brief contact with such ticks should not be cause for alarm. Symptoms may include red rash around the point of entry and/or flu-like ailments. Antibiotics are usually effective in relieving symptoms and in preventing progression of the disease to more serious stages. If left untreated for weeks or months, Lyme Disease can cause serious nerve and heart ailments, such as meningitis and myocarditis. Months or years after initial infection, affected people may develop arthritis that can last for years. If you are concerned about exposure to this disease, you can request that you be tested for this disease through your OHSC.

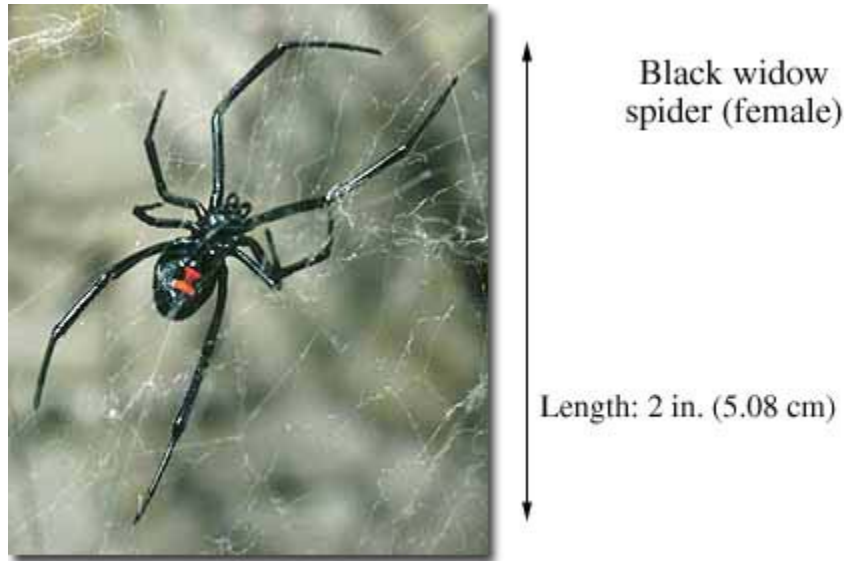
Ways to protect yourself from ticks:

- When in the woods, wear clothing that covers the skin and fits snugly around the wrists, ankles, and waist. In areas known to heavily infested, openings at the pant legs and wrists should be sealed with duct tape. Avoid contact with vegetation such as tall grasses and bushes as ticks may transfer from these locations on to you.
- Wear light-colored clothing to make it easier to spot ticks.
- Use tick repellents (DEET) when working in areas known or suspected to be tick-infested.
- Apply tick repellent to clothing, concentrating on areas most accessible to ticks (for example, shoe tops, socks, and pant cuffs).

After being in a tick-infested area, check closely for any small ticks on the skin (especially the scalp and hair) and clothing. Ticks not completely removed can increase the likelihood of infection. If you find an attached tick, remove it, exercising care not to squeeze the insect's abdomen, since this may cause expulsion of fluids into the wound. The following procedures can be effective in removing ticks:

- Use tweezers to **slowly** pull the tick out of the skin.
 - Grasp the tick as close to the skin as possible before removing.
 - **Do not** attempt to burn the tick off with matches or hot objects.
 - **Do not** attempt other home remedies, such as coating ticks with Vaseline.
 - Contact WorkCare (800.455.6155) if you have difficulty in removing the tick or at the first sign of symptoms.
- **Chiggers:** These are red six-legged mite larva approximately the size of a pinhead. Chiggers suck blood and cause intense itching or irritation. To eliminate chiggers, methods outlined above for protecting against ticks can be effective. Flowers of sulfur (sulfur powder sold in drugstores) are known to be chigger repellent.
 - **Fire Ants:** Any of a genus (*Solenopsis*) of fiercely stinging ants. Fire ants got their name because their sting literally burns like fire. Fire ant venom is much more potent than other insects' venom in that it contains a high concentration of piperidine, an alkaloid compound with a high pH that is 95% insoluble in water. Piperidine is related to piperine, the main active ingredient in black pepper. Fire ant venom also contains a smaller amount of protein than is normally found in stings.
- Do not disturb any ant mounds or nests as the ants will leave the nest or mound and climb up anything they find.

- If fire ants do crawl onto your skin, they first bite with their mandibles in order to anchor for the thrust of the sting. As soon as you feel this pinching sensation, quickly sweep the ants off before they actually sting and you can avoid most of the damage from an ant sting. If you must work in proximity to fire ants, wear rubber boots and gloves powdered with talc.
 - Immediately after being stung, wash off the area with alcohol, try not to scratch it so it doesn't get infected. Sometimes a white pustule will form the second day, but it will eventually be resorbed. Apply a hydrocortisone cream to the sting area to reduce inflammation. A thick paste of baking soda and water can also help right after the sting. Careful application of ice will help decrease pain, but can burn the skin if left on too long. If the pustule becomes infected, apply an antibiotic cream and keep the area clean and contact WorkCare (800.455.6155). Antihistamines may help with local reactions: burning and itching.
 - If other reactions occur soon after the stings, i.e., difficulty breathing, itchy rash, loss of consciousness, etc., get the person to an emergency room immediately and then contact WorkCare (800.455.6155). About 1% of the population have the potential for serious and dangerous reaction to fire ants. A physician can prescribe a single dose epinephrine auto injector device to carry with you in case of subsequent ant stings and anaphylactic reaction.
- **Bees and Wasps:** Some people are highly allergic to stings from these insects (if so, those people should ask a physician for an emergency sting kit, and carry it at all times). The following are first aid procedures for bee or wasp stings:
 - Remove the stinger by scraping it out with the edge of a knife blade, tweezer tips, or similar device. **Do not** squeeze the stinger.
 - **Do not** use tweezers to grasp the stinger to remove it, as this may inject more poison.
 - Cover the wound, apply a cold pack, and watch for allergic reaction (note: stingers remaining in the body are a problem with respect to bee stings, but not wasp stings).
 - Contact WorkCare (800.455.6155) or seek medical attention if an allergic reaction occurs.
 - **Spiders:** Venomous spiders indigenous to the United States include Black Widows and the Brown Recluse:
 - **Black Widows** are shiny black spiders with long legs, approximately 2 inches in size. Females have an hourglass-shaped red mark on the underside of their abdomens.



- **Brown Recluses** are brown spiders approximately 1 to 2 inches in size. They have long legs and a distinctive dark brown fiddle-shaped marking on the underside. These spiders produce a dangerous necrotizing agent.



Rule of thumb in relation to spiders: Avoid placing hands in dark holes or spaces. Wear protective gloves when working near such areas. Black widow and brown recluse spiders are usually found in holes or out-of-the-way places. Be alert to spider webs in the field, and try to avoid walking through them. If you think you have been bitten by a venomous spider:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood.
- Apply a cool, wet cloth to the bite, or cover the bite with a cloth and apply an ice bag to the bite.
- Do not apply a tourniquet. This may cause more harm than benefit.
- Try to positively identify the spider or catch it to confirm its type.

PREVENTION OF INSECT BITES

Insect repellent containing DEET is the most effective insect repellent. It is found in a variety of readily available products. There has been some concern about the negative effects of using this chemical, particularly for children, but none of the “natural plant” products (see below) are likely to be as reliable.

Essential oil of eucalyptus (*Eucalyptus globulus*) is a natural insect repellent. You can make a solution by adding five drops to a cup of water, and then dab it on the skin. Essential oil of citronella discourages insects when placed on exposed skin. A few drops of calendula (*Calendula officinalis*) ointment on the face, arms, and legs may keep insects away. It is also available as a commercially prepared product.

Other recommendations for avoiding insect bites are as follows:

- Apply insect repellent before going into the woods or other areas where you may come into contact with insects. Use insect repellents according to directions, particularly when applying the repellents to children.
- Apply repellents safely. Some insect repellents can only be applied safely to clothing rather than skin.
- Do not apply repellent near mouth, eyes, or openings in the skin. Wash hands following application to avoid accidental ingestion.
- Wash insect repellent off with soap and water after returning indoors.
- Wear light-colored, smooth-finished clothes that cover your body, such as long-sleeved shirts and long pants. Button long sleeves and tuck long pants inside boots. Avoid loose clothes that might entangle a biting or stinging insect.
- Always close vehicle windows when vehicle is parked or while driving through vegetation.

- Avoid flowering plants.
- If you have a severe allergic reaction (anaphylaxis) to insect bites or stings, have someone notify WorkCare (800.455.6155) and carry necessary antidote.
- Avoid swatting at insects or flailing your arms around them. Instead, retreat slowly and calmly when insects act threatening.
- Avoid wearing perfumed lotions, aftershave, or scented hair products during the warmer months.

POISONOUS PLANTS

Poison ivy, poison oak, and poison sumac cause a short-lived but extremely irritating allergic form of contact dermatitis. The leaves, stems, and roots of these plants contain the resin urushiol, even small amounts of which on exposed skin can trigger an inflammatory allergic reaction. Urushiol can be transferred by fingers or animal fur, and can remain on clothing, shoes, and tools for a number of months. Urushiol particles can also travel in the wind when the plant is burned in a fire. Scratching the rash does not spread the poison to other parts of the body, but can prolong discomfort and cause a secondary infection.

The rash from urushiol generally develops within 2 days, peaks after 5 days, and starts to decline after about a week or 10 days. While some people survive exposure without ill effects, complete immunity is unlikely. People who seem immune from poisonous plants at one time and place may find themselves vulnerable in other situations. Of primary concern are:

- **Poison Ivy:** A plant (*Rhus toxicodendron*) characterized by leaves arranged in threes, ranging from less than a foot to 5 feet in height when the plant is free-standing or taller when climbing. Poison ivy has greenish flowers and white berries, and its leaves turn yellow in the fall. When oils from the plant contact skin, they can produce a rash and intense dermal itching.



- **Poison Oak:** Characterized by alternate leaves with three or occasionally five veined, shiny leaflets, poison oak thrives throughout the United States. In autumn, the leaves turn a deep red color. Exposure to the oily sap contained in all parts of the poison oak (roots, stem, leaves, flowers, and the fruit [berries]) may cause skin irritation ranging from mild to severe. Between 50 and 85 percent of the population is allergic to poison oak, resulting in a more severe reaction when exposed. Primary contamination results from contact with bruised or broken plant parts that release toxicodendrol, an oily resin containing urushiol. Because the



lacquer-like resin does not dissolve in water, it is difficult to wash off and its toxicity persists for a long time.

- **Poison Sumac:** A shrub (*Toxicodendron vernix*) characterized by pinnate leaves that have red stems and leaf veins, clusters of greenish yellow flowers that produce ivory-white fruit with a fleshy outer skin, and poisonous oils that irritate the skin.



Treatment for Exposure to Poisonous Plants

If you think you have been exposed to poison ivy, oak, or sumac, wash all exposed areas thoroughly. If you can do this within 5 minutes of contact, you may often avoid allergic reaction.

You can also treat most cases of the rash with applications of calamine lotion, Burrow's Solution, or over-the-counter topical remedies containing antihistamines or hydrocortisone. Cold compresses--15 to 30 minutes several times a day--are useful for itching and blistering; cool showers are also effective. A cortisone shot may relieve the itching, particularly within 24 hours of exposure.

Oral corticosteroids or antihistamines may also relieve the symptoms, but both drugs can have unwanted side effects. If you have complications from a severe case, you may need to see a doctor.

If you do contact any of these poisonous plants, be sure to clean your clothing, tools, or any gear that you may have had with you. Because urushiol can remain on clothing or other items for extended periods of time, touching these items can cause reinfection at a later date.

Prevention of Exposure to Poisonous Plants

The best way to prevent exposure to poisonous plants is to learn to recognize these plants, and avoid contact with them.. Barrier ointments or lotions from outdoor suppliers help if you are working around heavy vegetation.

ANIMALS

- **Rabid Animals:** Some mammals may carry rabies, and rabid animals tend to approach people instead of avoiding them. Beware of nocturnal (night dwelling) animals (such as raccoons or opossums) active during the day.
- **Dogs:** Realize that dogs encountered in the wild tend not to be "man's best friend," even if they look like "Lassie." Two or more dogs together constitute a pack (with a tendency toward fierce behavior), and can pose significant threat. Roaming animals, particularly large dogs that instinctively hunt by sight (such as collies or shepherds), are cause for concern. Some breeds (cocker spaniels and English Springer spaniels) are notorious for erratic fits of violent behavior. Other dogs are bred as guard dogs or fighting dogs (Dobermans, Rottweilers, Boxers, and Bulldogs). Dogs that are unconfined are more likely to contract rabies. Beware of dogs that foam at the mouth

or show their teeth. Upon encountering such a dog, do not make any sudden moves. Do not make direct eye contact with the dog. Back slowly away from the animal, and never turn your back on unknown dogs

- **Alligators-** The American alligator was once very common in rivers, creeks, and backwater sloughs of East and South Texas, Florida, and other southern states. It is not uncommon for alligators to bask along the banks of a pond or stream for extended periods of time. These alligators are usually warming their bodies; they are not actively hunting. Often times a basking alligator may be seen with its mouth open; this is a way to cool its body temperature down, since alligators do not pant or sweat. An approaching human should cause these alligators to retreat into the water. (In some cases, the alligator may be protecting a nest) However, an alligator may be considered a nuisance if it leaves the banks of the water body to spend time near homes, livestock pens, or other structures. Alligators have a natural fear of humans, and usually begin a quick retreat when approached by people.



- **Bears-** Black bears can be found across most of North America, whereas grizzly/brown bears are found only in the northwestern states, Alaska and western Canada. Black bears that reside in the Southwest primarily live in the pine forests and chaparral(brush) zones, and occasionally wander into lower elevations. Black bears should always be considered unpredictable and potentially dangerous. A black bear will usually detect your presence and flee the area before you notice unless the bear has been conditioned to people and their foods.. If you work in bear country, always work in groups and carry a Bear Deterrent Spray.
- **Cougars (Mountain Lions)-** The cougar, as known as mountain lion, may select a range located anywhere from the shore of the sea up to the higher elevations of mountain slopes, reaching up to elevations up to 11,000 feet in California. The cougars can be found in western states such as California, Oregon, Washington, and Arizona, but can be found in other states. Cougars also. prefers densely forested areas in coastal swamps such as those of southern Florida, and it tends to choose vegetated ridges, rocky cliffs and ledges, and other solid covers in inland areas such as those of the Southwest desert basin and mountain range country.

Prevention of Animal Bites

As a rule of thumb, it is a good idea to carry a large stick for self-defense (the stick can also serve as a hiking aid on some sites). Methods for preventing attack include:

- Do not disturb animals while they are eating, sleeping, or nursing. Animals that have given birth can be very aggressive when protecting their young.
- Do not approach or play with unfamiliar or stray pets.

- Do not run past a dog, because dogs naturally tend to chase and catch things.
- Many animals give warning before they attack. Be aware of unusual noises or growling from animals.
- Firearms should not be carried or used on the job site for protection against animals.

If you see a threatening dog:

- Notify animal control and, if possible, speak with the owners.
- Stay still. Do not run.
- Do not make direct eye contact with or stare at the dog. Staring may be interpreted by the dog as a threat and aggression.
- Do not smile at the dog, since showing your teeth may be taken as an aggressive action by the dog.
- Don't scream. If you say anything, speak calmly and firmly.
- If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck. Protect your face.
- Do not touch wild animals or provoke them to attack.
- Do not handle sick or injured animals.

If you have a close encounter with an alligator:

- Back away slowly. It is extremely rare for wild alligators to chase people, but they can run up to 35 miles per hour for short distances on land. Never make the mistake of thinking that an alligator is slow and lethargic. Alligators are extremely quick and agile and will defend themselves when cornered. A female protecting her nest might charge a person who gets close to the nest, but she would quickly return to the nest after the intruder left.
- If you hear an alligator hiss, it's a warning that you are too close. NEVER feed an alligator.
- Avoid walking near water and streams where alligators may be present. If you walk near the water and an alligator comes straight toward you, run as fast as you can in a straight line, preferably in a path with obstructions that will slow the alligator down. If it comes out of the water, it is definitely a nuisance alligator that needs to be reported to local animal control. In many cases, these are alligators that have been fed by people or have been allowed to get human food.

- Always seek immediate medical attention even for a small alligator bite, since all bites can result in a serious bacterial infection that may be life-threatening.

If you have a close encounter with a bear during field activities:

- Stop, stay calm and quiet, and make no sudden moves.
- Break eye contact - do not stare in the bear's eyes, as this is a sign of aggression.
- Stand your ground - do not turn your back on the bear - sometimes a bear will bluff charge several times. Have your Bear Deterrent Pepper Spray ready, but do not spray unless you are sure the bear is close enough to spray in the face.
- Look for signs of agitation and aggression - When a bear is standing on its hind legs, it is usually just trying to get a better look and smell of you. When a bear is upset it may have its ears back- it may lower its head and swing it from side to side- it may paw at the ground- it may make huffing or woofing noises- it may snap its teeth- or not show any signs at all, and just drop and charge with no warning.
- Back away slowly, speaking in a calming, monotone voice - you want to show the bear that you are being submissive and want to get out of "its" territory. Do not turn your back and always have your Pepper Power ready.
- If the bear comes at you - spray the Bear Deterrent Pepper Spray aiming for the bear's face or spray a fog out that the bear has to run through to get to you.
- Being close to a sow with cubs is always a dangerous situation.
- Keep a cool head - Try to stay calm, do not yell or scream.
- Some bears, even grizzlies, will climb trees after you. Also a grizzly can reach 10 feet up a tree while standing on the ground.
- Right before a grizzly bear makes contact in a surprise attack at close range (and you don't have pepper spray), roll into a ball or lie face down, try to protect your neck and face, and pray. Don't stick your arm out, kick, scream, or fight. Try to protect the vulnerable parts of your body while remaining as still as possible, this will actively be helping the bear remove the perceived threat. Surprising a territorial male bear or a sow with cubs will almost always be a threatening situation.



- Some bears, mostly young bears unfamiliar with the dangers of human contact, have been known to actually stalk humans. If you believe this is the situation you are in, and have not just surprised the bear, it is recommended that you defend yourself aggressively.
- If the bear mauls you continuously, despite yourself being passive, you may have to fight back. Try using any available weapon - a knife, rock, fist - and concentrate on hitting the bear's head, eyes and nostrils.

If you encounter a cougar, the following are some safety tips to avoid attack:

- Stand your ground, make eye contact, and back away very slowly; don't bend down, crouch, attempt to hide, turn your back, or run, as these behaviors are likely to trigger an attack. In other words, don't behave like prey.
- Don't corner the cougar – make sure that it has enough room to escape.
- If you have children with you, pick them up but don't bend down to do so.
- Speak firmly in a loud, confident voice.
- Make yourself look larger by raising your arms, opening your jacket, or waving branches or sticks.
- Make noise – clap your hands.
- Throw something at the cougar that you have handy, such as a water bottle (but don't bend down for a stone or other object).



Although an attack is unlikely, if the cougar does follow through, fight back aggressively. Many people have managed to drive attacking cougars away using garden tools, fishing rods, rocks, sticks, other handheld items, and even their own fists. If knocked down, get up and stand up if possible, and continue fighting.

If you need to rescue a trapped or injured animal, get help from Animal Control personnel. If no help is available, wear the heaviest gloves and clothing that you have. Do not move quickly when approaching animals, and talk in a low, gentle voice to reassure them.

SNAKES AND LIZARDS

A bite from a poisonous snake or lizard requires emergency care. If you have been bitten by a snake or lizard that you know or suspect might be poisonous, **call 911 or other emergency services immediately and contact WorkCare (800.455.6155)**. Do not wait for symptoms to develop.

If you are not sure what type of snake or lizard bit you, **call the poison control center immediately (1-800-222-1222)** to help identify the snake or lizard and to determine the next steps to take. Medication to counteract the effects of the poison (antivenin) can save a limb or your life.

It is important to stay calm and lie still as much as possible after a suspected poisonous snake or lizard bite. Vigorous physical activity may increase the flow of venom to the bloodstream.

Poisonous snakes or lizards found in North America include pit vipers (family Crotalidae), such as copperheads, rattlesnakes, and water moccasins (also called the cottonmouth); coral snakes (family Elapidae); and the Gila monster and Mexican beaded lizard:

- The **Northern Copperhead** is characterized by a coppery-red head and an hourglass pattern consisting of dark chestnut crossbands that are wide at the sides and narrow at the center of the back. Small dark spots are frequently present between crossbands, and dark rounded spots exist between the crossbands at the base of the belly. Young Northern Copperheads are paler in color and have bright yellow tail tips. They also have a narrow dark line that extends from both sides of the eye and divides the dark head from the pale mouth. Rocky, wooded hillsides and mountainous areas are typical habitats. Abandoned and rotting slab (the outer strips of logs) or sawdust piles also attract these snakes.

The symptoms reported after a copperhead bite can include: pain and swelling in the area of the bite (swelling may take several hours to develop). The severity of the signs and symptoms developed after a bite varies with the amount of venom injected, size of the snake, age and size of the victim, prior health status of the victim, location of the bite, and the bacteria present in the snakes mouth. *The poison center should be contacted as soon as a suspected bite occurs.*

- The **Timber Rattlesnake** can have either one of two different color patterns:

- **Yellow phase:** Black or dark brown crossbands on a ground color of yellow, brown, or gray; the crossbands, which may be V-shaped, break up anteriorly to form a row of dark spots down the back, plus a row along each side of the body.
- **Black phase:** A heavy stippling of black or very dark brown hides much of the lighter pigment; completely black specimens are not unusual in the uplands of the Northeast.



Western diamondback rattlesnake

Young rattlesnakes are always cross-banded, as in the yellow phase, but with darker colors.

The Timber Rattlesnake is the only rattlesnake in the populous Northeast. Although it is still common in some mountainous regions (for example, the Blue Ridge

Mountains), it has almost completely disappeared from many places where it was once abundant (such as the Washington metropolitan area). As its name indicates, this is a snake of timbered terrain, preferring areas of secondary growth where rodents abound.

- The **Mojave Green Rattlesnake** is the most dangerous snake in North America – 30 times more toxic than Western Diamondback and has two types of venom:
 1. Hemotoxin – destroys blood cells and tissue
 2. Neurotoxin – destroys nerve cells and may stop breathing process.

The snake is more aggressive than other rattlesnakes and generally 2 to 5 feet in length with a thick body. The snake can be identified by the diamond pattern on its back fading to a ring pattern at the tail.

Mojave Green Rattlesnake



- The **Western Diamondback Rattlesnake** is the largest western rattlesnake. It has a plump body, a short tail, and a broad, triangular head that is very distinct from the body. This snake can be yellowish gray, pale blue, or pinkish, and has dark diamond shape marks down its back. There is also a rattle at the end of its tail.

The severity of a rattlesnake bite is gauged by how rapidly symptoms develop, which depends on how much poison was injected. Signs and symptoms of a pit viper bite include:

- Immediate and severe burning pain and swelling around the fang marks, usually within 5 minutes. The entire extremity generally swells within eight to 36 hours.
- Purplish discoloration around the bite, usually developing within two to three hours.
- Numbness and possible blistering around the bite, generally within several hours.
- Nausea and vomiting.
- Rapid heartbeat, low blood pressure, weakness, and fainting.

- Numbness and tingling of the tongue and mouth.
- Excessive sweating.
- Fever and chills.
- Muscular twitching.
- Convulsions.
- Dimmed vision.
- Headache.

- **Coral snakes** are found in tropical regions of North America, and are often confused with nonpoisonous milk snakes because they look similar. The physical characteristics of a coral snake include:



Coral snake



Milk snake

- Red, yellow, and black bands along the length of the body.
- Round pupils and a black nose.
- Fangs: Coral snakes tend to chew on their victims for a few seconds and may leave tooth marks with or without fang marks.
- Length up to 3 feet (0.9 m).

Coral snake venom causes the following signs and symptoms:

- Minor pain may initially be the only symptom.
- Within 90 minutes, a feeling of weakness or numbness may occur in the bitten extremity.

Additional symptoms may appear up to 12 to 24 hours after a bite. Symptoms may include:

- Increased salivation and drooling.
- Drowsiness or euphoria.
- Slurred speech.
- Nausea and vomiting.
- Numbness and tingling (paresthesia).

Symptoms that occur less often are double vision, difficulty breathing, sweating, muscle aches, and confusion. In rare cases, a person may die from a coral snake bite.

- The **cottonmouth** (or water moccasin) is a poisonous snake found in southeastern and south-central North America. Cottonmouths usually leave distinctive double fang marks on the skin, although on rare occasions they may produce one or three puncture marks. The physical characteristics of a water moccasin include:



Cottonmouth (water moccasin)

- Distinctive white coloring inside the mouth.
 - Pitlike depressions behind the nostrils.
 - A triangular head with slit-shaped pupils and fangs.
 - A single row of plates or scales on the undersurface of the snake.
 - Length up to 6 feet (1.8 m).
- The **Gila Monster** is one of only two species of seriously venomous lizards. The Gila monster and the closely related **Mexican beaded lizard** are the only known venomous lizards in the world. These heavy bodied lizards are easily distinguished from non-venomous species by the bead-like surface and yellow or coral colored pattern of their skin. They are described as shy and retiring reptiles, not prone to attacking humans unless they are significantly agitated. Arizona laws protect these fascinating animals from being captured or held in any manner. These large reptiles have a well-deserved reputation for clamping down on a victim with their teeth and not letting go. Most serious bites occur when the Gila monster's lower jaws secure a firm hold on the victim that lasts for several minutes.

The bite is described as extremely painful, although initial pain is generally confined to the area of the bite. Victims may also experience localized swelling, nausea, vomiting, high blood pressure, weakness, faintness, excessive perspiration, chills and fever.

What To Do if Bitten

If you are bitten, it is important to remove the lizard as soon as possible. One of the more practical ways to do this is to pry open the lizard's mouth with a strong stick--but be sure to allow the lizard a solid foothold on the ground while you are trying to pry it off.

The brittle teeth of the gila monster may remain imbedded in the wound and **must be removed by a medical professional**.

- First aid in the field may include
- irrigating the wound with plenty of water
- immobilizing the affected limb at heart level,
- reassuring the patient.
-

Gila Monster**Mexican Beaded Lizard****Treatment of Snake Bites**

If you are bitten by a snake or lizard that you know or suspect is poisonous, **call 911 or other emergency services immediately and contact WorkCare (800.455.6155)**. Do not wait for symptoms to develop. Symptoms may progress rapidly from mild to severe.

Medication (antivenin) to counteract the effects of the poison can save a limb or your life. Antivenin is given as soon as a health professional determines it is needed, usually within the first 4 hours following a bite. Antivenin may be effective up to 24 hours after the bite.

Immediate on-site treatment should not delay transport for emergency evaluation. Remain calm. Lie down and stay as quiet and still as possible after being bitten. Any physical activity may increase the flow of venom through the bloodstream.

If you are not sure which type of snake or lizard bit you, **call a poison control center immediately (1-800-222-1222)** to help identify the reptile and to determine the next steps to take. If signs of shock are present or the bite victim is not breathing, administer CPR.

Remove any jewelry on the bitten limb. The limb might swell, making it more difficult to remove the jewelry after swelling begins.

With a pen, mark the edge of the swelling around the bite every 15 minutes so that the progression of swelling can be evaluated.

Apply a splint to the arm or leg that was bitten to limit motion and the flow of venom into the bloodstream. If possible, keep the bitten area at or slightly lower than the level of the heart.

Drink fluids (not alcohol) in frequent, small amounts unless vomiting occurs. This will help to prevent dehydration and reduce the risk of shock.

Extraction Devices

Extraction devices are designed to remove snake venom with suction if the device is applied within 3 to 5 minutes after a bite. For best results, leave the device on for 30 minutes. When using an extraction device, **do not** cut the skin over the bite. Extraction devices are not likely to be beneficial if they are not placed within 3 to 5 minutes after a bite.

Extraction devices come with different-sized suction cups that attach to the barrel of a syringe. The suction cup is applied over the bite, and the vacuum suction of the syringe draws out fluid and venom. As the fluid and venom fill the syringe, suction is lost. These devices can be emptied and then reapplied during transport to emergency care.

Extraction devices may cause skin and tissue damage at the application site. Treatment may be needed to prevent infection.

Extraction devices are only a temporary first aid measure. Using an extraction device does not guarantee that venom will be removed. A person who has been bitten by a poisonous reptile still requires immediate transport to emergency care. If you were bitten by a known or suspected poisonous snake or lizard, **call 911 or other emergency services immediately**. Medication (antivenin) to counteract the effects of the poison can save a limb or your life.

Prevention of Snake or Lizard Bites

Many snake and lizard bites can be prevented. Find out which local snakes and lizards are common to your area. Learn what they look like, whether they are poisonous, and where you are most likely to encounter them.

If you see a snake or lizard, do not disturb it. Keep in mind that the striking range of a snake is about half its length.

Avoid picking up or handling snakes. Even a severed snakehead can release venom through reflexes for up to an hour after the snake dies.

Watch for snakes around wood or rock piles or caves. Wear protective shoes, boots, and clothing when you are working in areas with these types of hazards.

If you are frequently in an area where there are poisonous snakes, consider carrying an extraction device, an elastic rolled bandage, and splinting materials (such as a SAM splint) in the site's first aid kit. Also carry a cellular phone, if you have one available, to use in the event of an emergency.

ROUGH TERRAIN

Unstable footing can be created by a variety of conditions, such as steep slopes, wet rocks or leaves, uneven ground concealed by overgrown vegetation or leaves, and rapidly moving streams. Dense overgrowth may include briery plants and partially concealed vegetation, such as woody or briery vines, that can cause cuts and/or facilitate tripping, if not noticed.

SOP 24

AVOIDANCE OF SLIPS, TRIPS, AND FALLS

PURPOSE

This section describes ways to avoid and prevent accidents involving slipping, tripping, and falling in the workplace. These hazards have caused more injuries at SCS than any other contributing factor. With most of the suggestions provided below, common sense dictates safe practice. This discussion applies to all field employees in OM&M, Construction, Energy, and Engineering, and all office personnel.

HAZARDS FROM SLIPPING

Slipping occurs when there is not enough friction or traction between feet and ground surface. The most common causes of slipping are:

- Wet surfaces.
- Worn shoe soles.
- Spills.
- Weather (hazards from ice and snow).
- Wet surfaces.

To avoid slipping on wet surfaces:

- Avoid (take detours around) the area of a floor that is wet. Standing water could also indicate or camouflage a missing drain or cover.
- For areas that are always wet, maintain proper drainage, or use a doormat to create slip-free transition areas between wet and dry surfaces. If possible, use non-skid strips, mats, gratings, and gritty floor coatings for these areas.
- For temporarily wet surfaces, dry surfaces when possible by mopping or cleaning one side of the space at a time, so people passing through the room will have a dry area on which to walk. Post warning signs for passersby to make them aware of wet areas.
- Walk with feet pointed outward, shorten strides to keep a center of balance, and wear slip-resistant footwear. This footwear usually has soft rubber soles and heels, with rubber cleats for traction.
- Remember that wet shoes on dry floors can be just as slippery as dry shoes on a wet surface.

Worn Shoe Soles and Inclement Weather

Only shoes with good soles and holes that provide traction and ankle support should be worn. When ordering boots for fieldwork, sole patterns that give slip resistance appropriate for job

tasks should be selected. Overshoes or shoe overlays provide proper traction in icy or snowy conditions, whose hazards can best be observed by wearing sunglasses. Work in snow and ice should be performed slowly, taking care while exiting vehicles to hold on to the vehicles for support.

Spills

To avoid slipping, spills should be cleaned up immediately and the floor dried. If cleaning is not immediately possible, warning signs should be posted to draw attention to the spill area to warn people of the hazard. Walking surfaces and work areas should be well lit. If machinery leaks, a drip pan should be used to collect fluids, or absorbents to clean the walking surface. Suitable agents for cleaning grease and oil spills should also be used.

Other Hazards

Rugs secured to the floor or made with skid-resistant backing are optimal. When these types of rugs are not available, removing rugs also removes dangers from slipping. Debris, including dust particles, pencil shavings, or pieces of paper should likewise be removed. If irregular surfaces caused by loose gravel or sloping are encountered, employees should slow down and pay attention to the placement of their feet, and look for obstructions and holes.

In addition to these hazards, walking from one type of surface, such as from carpets to marble floors or grass to gravel surfaces, can shorten the length of steps. Employees should adjust their steps and adapt balance until they can regain equilibrium and feel stable on the new surface. Slip-resistant shoes can be beneficial in preventing slips.

HAZARDS FROM TRIPPING

Tripping occurs when feet strike an object that causes the loss of balance. Commonly, this happens from:

- Clutter and uncovered cables.
- Uneven walking surfaces.
- A hole or stump in the ground.
- Obstructed views of the walking surface.
- Poor lighting.
- Obstacles around corners.

Clutter and Uncovered Cables and Piping

Good housekeeping, which includes keeping floors and walkways free of clutter and obstacles, should regularly be practiced. **Nothing** should be put on walkways to cause an obstruction. Cords or cables should be routed around walkways, if possible, but if not, cables or cords should be covered and secured with heavy-duty tape or cable covers. Mats, rugs, or carpets should not have curled edges or wrinkles, and should be secured by tacking or taping them down. Warning signs or barriers should be posted around temporary piping laid on walking surfaces, to notify employees of possible tripping hazards posed by piping on the ground. In the office or other

storage spaces, personnel should remember to close bottom drawers of file cabinets or tool carts as soon as they are with work.

Uneven Walking Surfaces, and Holes and Stumps in the Ground

To avoid tripping, established walkways should be used as often as possible. Areas for walking can be scanned for obstacles and surface hazards, and footing secured while walking through wet grass, around holes or stumps, or in muddy areas. Canes or long sticks can also be used to identify holes or obstructions in areas with high grass.

If you cannot go around an obstruction, try to step over it (instead of on it). Stumps, logs, rocks, piles of lumber, etc. can be slippery, and they may also contain animals or insects.

Obstructed Views and Poor Lighting

Carrying small loads helps to reduce the risk of obstruction and the dangerous consequences from tripping or falling as described above. If employees are required to enter unlit areas, flashlights can be used and the pace of walking slowed. Sunglasses should be avoided in low-light areas, and, because eyes need time to adjust while personnel go from well-lit areas to dark spaces, this adjustment must be considered. To improve vision, burned-out light bulbs and faulty lighting should be replaced as soon as possible.

Obstacles Around Corners

Personnel in offices or buildings should walk carefully around corners and look for obstacles on the floor. Safety mirrors near corners help to show oncoming traffic or obstacles obscured by corners.

HAZARDS FROM Falling

Falling from heights can cause serious injury or death. Employees should always use proper ladders and fall protection while working at heights greater than 3 feet (see **SOP 10**). Makeshift ladders or chairs should **never** be used to reach for objects at elevated heights (see **SOP 13**).

Additional Suggestions

To ensure safety on stairs, make sure one hand free is free while climbing, and hold on to the handrail. Each step up or down should be made deliberately, planting your foot firmly before putting weight on it. Carrying large loads that block vision, or heavy items requiring the use of both hands while traveling down or up the stairs, should be avoided. When climbing down from heavy machinery or trucks, the use of the three-point of contact rule (three of your four limbs should be placed on hand or foot rails of machinery or vehicles while exiting: this means one hand and two feet, or two hands and one foot). Walking backwards on a dock is also not advisable.

Appendix E

Personal Protective Equipment (Other Than Respiratory)

PURPOSE AND SCOPE

This program is established to ensure that Personal Protective Equipment (PPE), manufactured with safe design and durable construction, is provided for work performed outside the office. The program addresses equipment intended to protect the head, face, eyes, hands, feet, and entire body. Employees required to wear this equipment will receive training in its proper use, selection, limitations, care, maintenance, and disposal. This discussion applies to all personnel for whom this equipment has been prescribed.

HAZARD ASSESSMENT

On projects or sites involving fieldwork, a Job Task Safety Analysis (JTSA) and PPE Assessment must be completed (see **SOP 4**). This analysis, provided for each task, will determine whether or not PPE is required. The JTSA and PPE Assessment forms will document that hazard assessments are being performed and certified.

PROTECTION of the head

Hardhats must be worn whenever the potential of being struck on the head by falling or flying objects or debris, or by overhead piping, occurs. Possible electrical shock and exposure of the head to sources of electricity are further reasons for the mandatory wearing of hardhats. Examples of work requiring hardhats are landfill construction, excavation and trenching operations, activities involving heavy machinery such as forklifts, confined space entry, and monitoring at facilities with overhead piping. Hardhats must meet the requirements of **ANSI Z89.1-1986, "American National Standard for Personnel Protection-Protective Headwear for Industrial Workers - Requirements**. Hardhats meeting this requirement are distinctively marked with the ANSI insignia.

Hardhats are divided into three industrial classes:

- **Class A** hardhats provide impact and penetration resistance, along with limited voltage protection (up to 2,200 volts).
- **Class B** hardhats provide the greatest protection against electrical hazards, with high-voltage shock and burn protection as well (up to 20,000 volts). They also provide protection from impact and penetration hazards by flying or falling objects.
- **Class C** hardhats provide lightweight comfort and impact protection, but offer no protection from electrical hazards.

Class A or B hardhats must be used whenever potential contact of the head with electrical conductors is present.

Employees must follow the manufacturer's information with regard to tightening the head band to achieve proper fit for the helmet. Most suspension systems do not allow for adjustment, but if provided, the required distance between the webbing and the shell of the helmet should be maintained. Suspension systems from other manufacturers should not be used, nor should the system be turned around to allow hat to be worn other than as specified by the manufacturer.

Employees must inspect the hardhat shell for cracks, dents, cuts, holes, burns, or other material damage. Webbing, headband, and suspension attachment points should also be inspected for signs of cuts, tears, and frayed material. Any hardhats that are not in good condition will be discarded. The manufacturer's recommendations for cleaning should be followed (most manufacturers recommend using soap and water only).

EYE AND FACE PROTECTION

Eye and face protection must be used whenever hazards, or potential hazards, are present during work. **Table E-1** lists some of these hazards by task.

Table E-1. Hazards and Tasks

Hazard Type	Examples of Hazard	Common Related Tasks
Impact	Flying objects, such as large chips, fragments, particles, sand, and dirt.	Chipping, grinding, machining, masonry work, woodworking, sawing, drilling, chiseling, powered fastening, riveting, and sanding.
Heat	Anything emitting extreme heat.	Furnace operations, pouring, casting, hot dipping, and welding.
Chemicals	Splash, fumes, vapors, and irritating mists.	Acid and chemical handling, degreasing, plating, and working with blood.
Dust	Harmful dust.	Woodworking, buffing, and general dusty conditions.
Optical Radiation	Radiant energy, glare, and intense light.	Welding, torch-cutting, brazing, soldering, and laser work.

The Occupational Safety and Health Administration (OSHA) offers guidance regarding proper face and eye protection at http://www.osha.gov/SLTC/eyefaceprotection/hazards_solutions.html. Faceshields are considered secondary protection, but must be used in addition to primary protection such as safety glasses with sideshields or goggles.

When protecting against liquid splashes or caustic liquids, safety goggles that are indirectly ventilated or non-ventilated must be worn. Direct-ventilated goggles protect only against flying particles or dust, and should not be used as protection against liquid or caustic splashes.

Employees exposed to eye or face hazards while wearing prescription lenses must use eye protection that incorporates the prescription into its design or that can be worn over prescription lenses. All eye and face devices must comply with **ANSI Z87.1-1989 “USA Standard for Occupational and Educational Eye and Face Protection”** requirements. Those that meet these requirements are distinctively marked with the ANSI Z97.1-1968 insignia.

Fitting, Storage, and Cleaning of Eye Protection

Eye glasses or shields that are pitted and scratched and significantly impair vision must not be used and should be disposed of. Eye and face devices should be cleaned and disinfected before each use. Warm water or antiseptic wipes will disinfect and clean these devices. Eye and face devices must be stored in a clean, non-dusty environment that protects against direct sunlight. They must be reasonably comfortable when worn under designated conditions, fit snugly, and not unduly interfere with the movements of the wearer.

HAND AND BODY PROTECTION

Hand protection will be provided for all tasks presenting the following hazards:

- Skin absorption of harmful substances.
- Severe cuts or lacerations.
- Severe abrasions.
- Punctures.
- Thermal burns.
- Chemical burns.
- Harmful temperature extremes.

Table E-2 lists gloves that can protect against the hazards listed above.

Table E-2. Glove Selection for Physical Hazards

Physical Hazard	Required Performance Characteristics	Glove Type
Severe cut or laceration	Cut resistance	Metal mesh, aromatic polyamide fiber
Punctures	Puncture resistance	Leather; thick elastomer
Thermal burns	Insulating value	Heavy cotton or other heavy fabrics
Chemical burns	Permeation resistance	Rubber, neoprene or VITON gloves
Harmful temperature extremes	Insulation and flame resistance	Aluminized gloves, NOMEX or other fire-retardant fabric

When selecting gloves or other bodily protection against liquids with the potential to absorb into or irritate the skin, the following factors should be considered:

- Duration of exposure.
- Permeation rate of the chemical through the glove or clothing material.
- Breakthrough time of the chemical through the glove or clothing material.

Permeation rates and breakthrough times of chemicals relative to glove materials can be found in the following reference: **“Guidelines for the Selection of Chemical Protective Clothing,” American Conference of Governmental Industrial Hygienists**. This reference is available from the corporate Health and Safety Director. Glove materials must have a breakthrough time exceeding the duration of the task. For materials with similar breakthrough times, those with the lowest permeation rates will be selected.

FOOT PROTECTION

Employees must wear foot protection to guard against hazards related to feet, including falling, rolling, or piercing objects, exposure to dangerous or corrosive chemicals, exposure to electrical charges, tripping, or uneven surfaces. **Table E-3** lists protection required for some of these hazards.

Table E-3. Foot Protection Selection Guidelines

Hazard	Boot Selection
Potential for objects falling or rolling over foot	ANSI Z-41.1-1967 approved boot
Exposed to tripping hazards and uneven surfaces	Footwear with high ankle support
Potential for objects piercing foot	ANSI Z-41.1-1967 approved boot
Feet exposed to dangerous or corrosive chemicals	Chemical resistant footwear or booties
Feet exposed to electrical hazard	Non-conductive ANSI Z-41.1-1967 approved boot

Footwear meeting the requirements of ANSI Z41.1-1967 does not have to be constructed with a steel toe or shank. Materials such as fiberglass, and other lighter-weight materials capable of passing the compression and impact tests required by the ANSI Z41.1-1967 standard, are acceptable. Footwear passing mandatory ANSI tests will be marked on the boots as having met the ANSI Z41.1-1967 requirements.

Footwear protecting against chemical hazards will be selected based on the same performance criteria as hand and body protection, including chemical permeation rates, breakthrough times of chemicals through the footwear materials, and task duration.

Appendix K

Safe Observation Checklist for ES Professionals

SAFE Observation Form for Environmental Services/Engineering/Solid Waste Staff Field Activities

I. General Information:		
Date _____	Project Number/Name _____	Office/Profit Center _____
Location of Observations _____	Observed By _____	Check if Self-Observation ☐

For the following sections, provide clear, concise, and complete responses. Each observation should answer the following questions: Who, What, When, Where, Why, How.

II. General Description of Observed Activity(ies) or Work Conducted (as identified under Specific Project Tasks on Page 2): _____ _____ _____

III. Describe <u>SAFE</u> Behavior(s)/Procedure(s) Observed (as identified on Page 2): _____ _____ _____

IV. Describe <u>AT-RISK</u> Behavior(s)/Procedure(s)/Condition(s) Observed (as identified on Page 2): _____ _____ _____

V. Describe Immediate Corrective Action(s) Taken or Note Estimated Completion Date(s):
☐ Corrected on the spot: _____ _____ _____
☐ Corrective action(s) to be completed (include estimated completion date[s]): _____ _____ _____

►Specific Project Tasks – Check ONLY those that are applicable to this evaluation:

- ☐ Site assessments and inspections
- ☐ Manual sampling – soil, soil vapor, groundwater, surface water, leachate, air, etc
- ☐ Excavations, borings, sampling, and well construction – soil, soil vapor, groundwater, LFG, etc
- ☐ Asbestos, lead-based paint, mold, etc inspections, sampling, & abatement
- ☐ Underground storage tanks
- ☐ Landfill investigations and waste sorts
- ☐ Confined space
- ☐ Construction Quality Assurance (CQA)
- ☐ Geotechnical sampling and measurements
- ☐ Soil Vapor Extraction (SVE) systems installation, operation, & maintenance
- ☐ Compressed gas cylinders – proper transport, use, and storage
- ☐ All-terrain vehicles, utility vehicles, and watercraft
- ☐ Other (List): _____

►Critical Behaviors – Check ONLY those applicable behavior(s) actually observed during this evaluation:

1. Driving

Yes No

- ☐ ☐ Inspects vehicle before leaving
- ☐ ☐ Drives in safe manner (seat belts, following distances, alertness, traffic and pedestrians, lane changes, mirrors, etc)
- ☐ ☐ Pulls over to use cell phone for calls or texts and avoids other distractions (eating, reading, GPS, etc)

2. Safety Preparation

- ☐ ☐ Reviews HASP, JTSAs, & hospital route
- ☐ ☐ Evaluates capability to safely complete tasks, obtains assistance as necessary
- ☐ ☐ Attends site safety briefings & tailgate meetings
- ☐ ☐ Establishes and reviews hand signals
- ☐ ☐ Wears hardhat, safety boots, and safety vest
- ☐ ☐ Wears other PPE appropriate for site conditions (safety glasses, earplugs, etc)
- ☐ ☐ Is an Exposure Assessment necessary?

3. Site Conditions

- ☐ ☐ Prepares for weather conditions (hot, cold, wet, storms, snow, etc)
- ☐ ☐ Drinks plenty of liquids and takes adequate breaks
- ☐ ☐ Watches for hazardous wildlife (snakes, bees, spiders, scorpions, insects, bears, etc)
- ☐ ☐ Checks for hazardous vegetation (poison ivy, oak, sumac, etc)
- ☐ ☐ Checks for slip, trip, & fall hazards and watches footing
- ☐ ☐ Uses care walking or driving in areas where the ground surface is obscured by vegetation
- ☐ ☐ Uses air monitoring devices to check levels of suspected contaminants or combustible vapors
- ☐ ☐ Assesses site security for potential hazards (hostile people, dogs, crime, etc), works in pairs, gets police checks, etc
- ☐ ☐ Is aware of and prepares for regional health hazards (ticks, mosquitoes, rodent droppings, etc)
- ☐ ☐ In traffic areas, sets up necessary traffic controls; faces traffic; wears appropriate reflective vest; uses vehicle signals, strobe, and/or reflective triangles

4. Ergonomics

- ☐ ☐ Uses equipment appropriate for the tasks and uses ergonomic tools
- ☐ ☐ Takes frequent breaks and performs stretches to relieve stress from repetitive motion
- ☐ ☐ Stops repetitive motion or physical activities if pain is experienced to prevent injury
- ☐ ☐ Uses proper lifting techniques & gets help where appropriate
- ☐ ☐ Carries equipment without straining, uses a cart for heavy equipment, and/or obtains assistance

5. Site Investigation/Remediation/Oversight/CQA

- ☐ ☐ Public and private subsurface utilities are located and work areas checked for overhead obstructions
- ☐ ☐ Checks for vehicle and equipment traffic
- ☐ ☐ Sets up and maintains exclusion zones as appropriate
- ☐ ☐ Makes eye contact with operators of heavy equipment before approaching, stays out of the swing radius of excavators and other heavy machinery, stays back from operating drilling equipment
- ☐ ☐ Works uphill or cross-grade, never downhill, and upwind from heavy equipment
- ☐ ☐ Stays out of trenches >5 ft deep unless there is proper sloping, shoring, or shielding, egress is available, and a Competent Person is in charge
- ☐ ☐ Stays away from edges of excavations and borings, makes sure spoils and equipment are 2+ feet away from edge
- ☐ ☐ Backfills or properly secures borings, excavations, etc if not in use or if left open overnight (fencing, covers, etc)
- ☐ ☐ Follows safe ladder procedures
- ☐ ☐ Uses fall protection harness tied to a secure spot where there are fall hazards (borings, excavations, etc); uses covers/grates over borehole openings or excavations
- ☐ ☐ Has been trained to perform in special site conditions (confined space, landfills, asbestos, etc.) if required. List below: _____

Attachment A. Excerpt from the OSHA Technical Manual Regarding Excavation Safety

Information from the OSHA Technical Manual regarding excavation safety is found on the company intranet site at:

<http://eye.scsengineers.com/TechnicalAdvisor/Health&Safety/index.htm>