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"Overview of Managing MSW Landfills with Ongoing Subsurface Reactions"

"Reaction" landfills are unique situations, but not unprecedented within the waste industry. Landfill reactions or "heat producing events" at some sites, may or may not have started as a waste mass fire. Heat producing events have been a concern at landfills for many decades, without having much written about them. These "reactions" can vary in size from small localized events to larger events affecting multiple acres or even, in some cases, entire landfills. This paper is to inform the regulatory and waste communities on a need for a more flexible, investigative approach in managing all aspects of heat producing events.

In reviewing landfill heat producing events that have occurred in the past 10 years, the data in this paper will be used to demonstrate common data trends and indicators at "reaction" sites. These indicators can be useful in identifying and characterizing reactions including trends in temperatures and gas concentrations, including ratios of CH4/CO2, leachate pH, and landfill settlement data. Other parameters have traditionally been monitored, but have shown to provide little to no value in characterizing or identifying the reaction, or in developing and designing appropriate remedial steps.

As has been demonstrated at multiple case study landfills, the data collected at gas collection wellheads with a hand-held gas meter is sufficient to identify the presence, extent, and development of a landfill reaction. This includes methane, carbon dioxide, oxygen, and balance gas, along with wellhead temperature and pressure. Additional gas composition data of value include carbon monoxide and hydrogen. Most of this data can be determined real time in the field using hand-held instrumentation and detector tubes, offering the value of real time determinations without the delay inherent in laboratory testing turn-arounds. Confirmatory characterization of these field-determined gas concentrations through periodic laboratory testing has proven to be sufficient, when used with total gas flow data, leachate volumes and pH, and periodic topographic surveys to track settlement data.

More elaborate laboratory testing for VOCs or other trace constituents in the landfill gas, or more detailed testing of leachate has not proven useful. Unfortunately, these additional tests have been ordered by regulatory agencies, and have been found to add little to the database that can further determine or confirm the root cause of the reaction or the appropriate remedial approach.

The authors will show through specific case study data that the reduced data set described above was ultimately sufficient to recognize the development and extent of the reaction and to identify needed remedial approaches, and that additional investigations and extraordinary data collection efforts offered minimal or no benefit.

Once the data has been evaluated, design and construction elements appropriate for reaction landfills may include conventional landfill caps, exposed geomembrane liner, enhanced gas collection, and enhanced or accelerated leachate collection and treatment. O&M efforts appropriate for reaction landfills may include enhanced operation, monitoring, and maintenance of the gas collection, gas treatment, flare, and leachate collection and treatment systems – all of which may have to be done under conditions of elevated temperature and/or pressure. To

address odor issues, an enhanced gas collection system may be needed, while accelerated landfill settlement may require re-grading, enhanced cap maintenance and storm water management.

Finally, the current regulatory responses for landfill fires are often not appropriate for landfill reactions, and thus a more flexible regulatory approach is essential. Rigid permitting requirements or the need to confirm the underlying cause of the reaction before remedial actions are implemented can hinder a timely response that is necessary to address certain situations. The NSPS regulations for municipal solid waste landfills themselves established a framework for HOVs that clearly contemplated traditional landfill fires, not the waste reactions that have developed at such reaction landfills. Unfortunately, the NSPS regulations offer no direction or framework for dealing with elevated temperatures in an HOV regulatory status.

Most states treat area-wide landfill reactions the same as a localized and single-well-specific traditional landfill fire, with the expectation that the fire can be quickly remediated and elevated temperatures returned to usual levels with days or weeks. As the industry is aware, this is not possible with area-wide landfill reactions. It is important that the mindset of regulators when they encounter such a landfill reaction is not focused on quick extinguishment (which is not possible), and with that failure, the need to mount an expansive investigation. The remedial approaches the industry has found to be effective for area-wide landfill reactions should not be delayed in favor of such an investigation.

Where exhaustive investigations have been required, reaction landfills can still be forced to go through conventional permit and permit modification processes, before the landfill owner can proceed with the containment and management approaches that often provide relief and benefit. During the delay, these remedial approaches are prohibited, and the reaction can expand faster with more odors and other impacts than would otherwise occur.

We will demonstrate that better understanding of these reaction landfills by regulators and an allowance for expedited remediation strategies as those described here, would reduce nuisance conditions that often impact the community.