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CONDENSER

THE LOCATION LANDSCAPE

How Local Regulations, State Operating Environments, and U.S. Geography are Shaping Building Decisions

Understanding Compliance

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I was talking recently to a professional acquaintance who told me that he is encountering more and more facility managers that ask him, "What is the minimum that we have to do to comply with 29 CFR 1910.119 and 40 CFR Part 68?"

He said others often go so far as to make a statement, "If we reduce our charge of ammonia in our refrigeration system, we won't have to do any of the processes and paperwork spelled out in 29 CFR 1910.119 and 40 CFR Part 68." When asked the nature of their question/comments, these people often go on to say, "We simply can't afford the resources to deal with all of that paperwork." Unfortunately, these people are looking at the costs of compliance when they should be looking at why the regulations were created in the first place.

As far back as the dawn of the industrial age, there have been accidents that had a tremendous cost both in terms of the financial well being of the company, but more importantly in terms of injury or the loss of human life. In 1921, a silo at the BASF plant in Oppau, Germany that contained Ammonium Sulfate and Ammonium Nitrate fertilizer exploded when small dynamite charges were used to loosen the mixture in the silo, as it had a propensity to bind and clog. Between five and six hundred people were killed and around 2,000 more were injured. From the book entitled, "German Industry and Global Enterprise: BASF: The History of a Company" by Werner Abelshauser, Wolfgang von Hippel, Jeffrey Allan Johnson, and Raymond G. Stokes, simple damage costs are estimated to be 570 million Marks for the plant itself and 100 to 120 million Marks for the damage in the surrounding towns. In addition, the book indicates that 3.4 million Marks were paid as compensation to the families of the accident's victims.

On June 1st, 1974, an explosion rocked the Nypro plant when a coupling holding a temporary pipe in place ruptured, releasing an estimated 30 tons of flammable cyclohexane vapor. Cyclohexane was a precursor chemical used in the production of Caprolactum, an ingredient in Nylon 6. Twenty eight people were killed, and 36 were injured on site.

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A few years later, on July 10, 1976, six tons of dioxins were released due to an overpressure in a reactor that occurred when the batch reaction process was shut down mid-cycle to comply with an Italian law that required shutdown of manufacturing operations over the weekend. As the facility shut down operations, the steam that was being used to heat the reactor rose in temperature due to lower loads on the steam system.

This overheated portions of the reactor and when the agitator was shut off, caused highly localized heating that resulted in a runaway decomposition reaction that increased pressure in the reactor until the vessel's safety relief valve lifted. The release of chemicals poisoned a seven square mile area around the plant, and while there were no human fatalities, 3,300 animals were found dead over the next several days, and 80,000 animals were slaughtered to keep them from entering the food chain.

One hundred and ninety-three people were treated for skin lesions as a result of exposure to the high levels of dioxins. In the 40+ years since the accident, the region has experienced elevated levels of long term health effects, including cardiovascular and respiratory diseases. Costs estimates for the cleanup and compensation are estimated to be 20 billion lire. In 1986, two former employees of the company were sentenced

to prison after exhausting their appeals for a conviction on charges of being responsible for the disaster and failing to provide adequate safety measures to prevent it.

Fast forward to 1984. On the night of December 2nd, roughly 30 metric tons of Methyl Isocyanate were released from a storage tank at a Union Carbide chemical plant in Bhopal, India, after a runaway reaction, believed to be due to the introduction of water into the tank, caused the pressure to rise uncontrollably in the tank, lifting the vessel's safety relief valves. Over 500,000 people suffered injuries in the shanty towns surrounding the plant and thousands were killed. Mitigation systems, such as a refrigeration system for the tank, a vent gas scrubber, and a vent gas flare stack that could have prevented or minimized the tragedy were offline at the time of the accident due to improper maintenance.

As a result of the accident, Union Carbide paid $470 million to the Indian government to pay for medical issues that are related to the exposure that may develop in the survivors. The company also paid $17 million to construct a hospital in Bhopal. Seven former employees of the Indian subsidiary were convicted of causing death by negligence and sentenced to two years in prison and fines of 100,000 rupees each. Warren Anderson, the CEO of Union Carbide at the time of the accident was charged with manslaughter in 1991, but the U.S. refused to extradite him. A class action suit against him was dismissed in 2012 after having been filed in 1999 under the U.S. Alien Tort Claims Act.

Now let's jump a little closer to home. On October 23, 1989, an explosion rocked the Phillips 66 chemical plant in Pasadena, TX, throwing debris 6 miles and killing 23 people. An additional 314 people were injured. During routine maintenance to clear a choke on the drop leg on a reactor used in the manufacture of High Density Polyethylene (HDPE), air lines that control the valve operation were incorrectly attached, causing the valve to open when it should have remained closed. This caused approximately 39 tons of flammable vapors to be released, which exploded upon reaching an ignition source. The resulting blast caused $715.5 million in damage with an additional estimate of $700 million in business interruption. Subsequent to the explosion, Phillips 66 agreed to pay $4 million in fines as part of a settlement with the Occupational Safety and Health Administration. This accident was the straw that broke the camel's back in the U.S. and led to the promulgation of OSHA's Process Safety Management standard (29 CFR 1910.119) and EPA's Chemical Accident Prevention Provisions (40 CFR Part 68).

Now many in our industry might say, "Those are chemical plants. We don't have accidents like that with ammonia refrigeration." Perhaps not on that scale, but here's some food for thought. On December 11, 1983, a large ammonia leak occurred at the Borden Ice Cream plant in Houston, TX. Firefighters responded to the scene. As they were suiting up to enter to try to contain the ammonia leak, it deflagrated, blowing out the sides of the building and showering the street with glass, bricks, ice cream, and wooden ice cream sticks.

Thankfully, no one was killed or severely injured. If the blast had occurred but a few minutes later, or the firefighters had attempted to enter but a few minutes earlier, the consequences would have been disastrous. However, the plant was never rebuilt. This was the first time that firefighters had experienced what happens when ammonia burns. It was followed by another incident shortly thereafter. On September 7, 1984, a large ammonia leak at Dixie Cold Storage in Shreveport, LA, resulted in a deflagration that killed one firefighter and severely injured another.

On August 23, 2010, thirty two people were hospitalized when 152 people were exposed to anhydrous ammonia after 32,000 lbs were released from the Millard Refrigeration Services facility in Theodore, AL. The release was due to a hydraulic shock event that ruptured a 12 inch suction header on the roof and a distributor on an evaporator inside the building. The company paid a $10,750 fine to OSHA after a protracted legal battle and the company was sold in 2014. While this event did not cause any fatalities, two more recent events did.

On March 23, 2016, a maintenance worker at Stavis Seafoods in Boston lost his life when a pipe nipple at the bottom of a Controlled Pressure Receiver cracked releasing liquid ammonia and overcoming the employee. As if one fatality is not bad enough, on October 17, 2017, three people, including one contract employee, died when an ammonia release occurred at the Fernie Memorial Arena in Fernie, British Columbia.

These are but a few examples of the accidents that have occurred in the ammonia refrigeration industry. The regulations that encompass process safety in the United States apply to facilities with over 10,000 pounds of ammonia in a process (or interrelated processes). If your facility has less than that, the General Duty Clauses found in the OSH Act and in the Clean Air Act, give OSHA and the EPA the power to enforce many of these regulations under the requirement of keeping employees and the public free from harm.

However, simple compliance and fine avoidance is not the reason that we should be implementing a robust Process Safety Management program. If we don't take steps to ensure that our system is designed, built, operated, and maintained safely, then the consequences could be severe, ranging from financial and business losses, through criminal or civil penalties, all the way to potential employee injury and loss of life.

This goes beyond the paperwork. It includes committing the necessary resources to keep your systems safe and includes not only money for maintenance and capital improvements, but also training for your maintenance mechanics and refrigeration operators. These resources are vital to keep your business operating without interruption. But more importantly, as managers in industry, whether you are a facility supervisor, or whether you are a Chief Operating or Executive Officer, it is your responsibility to ensure that your employees, your contract employees and visitors, and the public are safe. Isn't that what each of us mean when we say "Safety First?"

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