THE INTERAGENCY BOARD

Training Trigger: Jack Rabbit Project Chlorine Tests

June 2019

OPERATIONAL ISSUE

Observations and findings from the Jack Rabbit Project have yielded valuable data and information for emergency responders engaged in planning for or responding to a large-scale chlorine (Cl_2) release. The project involved a total of 9 chlorine test releases ranging from 5 to 20 tons.

FAST FACTS

- Chlorine is a heavier than air, greenish-yellow gas with a distinct bleach-like choking odor. It is classified as a DOT Hazard Class 2.3 poison gas.
- Chlorine is non-flammable but is a strong oxidizer and will vigorously support combustion—even in the absence of oxygen.
- Chorine may combine with water and water vapor to form hydrochloric acid.
- Chlorine is commonly transported in 100 or 150 pound cylinders, 1 ton containers, and 90 ton (~15,000 gallons) DOT 105J500W railcars.
- Chlorine is used to manufacture plastics, paper, medications, solvents, and pesticides. It is also used to sanitize pools, wastewater, and municipal drinking water.
- Chlorine gas was used as a weapon during World War I and has been used as a weapon in recent terrorism scenarios.

PHYSICAL AND CHEMICAL PROPERTIES

- Boiling Point- -29.2°F (-34°C)
- Vapor Pressure 85.3 psig (4,800 mmHg)
- Vapor Density 2.48
- Expansion Ratio ~500:1
- TLV/TWA 0.5 ppm (8 hours)
- IDLH 10 ppm
- AEGL 2 2.8 ppm (30 minutes)

FINDINGS AND OBSERVATIONS

The application and use of a Risk-Based Response process is a critical factor in successful management of a chlorine incident. Jurisdictions tasked with responding to a large-scale chlorine release (accidental/intentional) should consider the following:

- The type and nature of the container stress / breach / release will significantly influence the behavior of the plume.
- Pooling of liquefied chlorine may be found near the release site, with subsequent vaporization of the product.
- Common urban surfaces are not significantly impacted by Cl_2 exposure.
- The plume will be strongly influenced by wind speed and direction.
- Low wind conditions may allow for upwind movement of the vapor cloud.
- Significant lateral movement around structures near the release point may initially occur.
- The plume becomes neutrally buoyant as it reaches ambient temperature.
- Sheltering-in-place on upper floors within a building can be a viable protective action tactic (go up - go deep) (as validated by the Jack Rabbit Test data).
- Lower Cl_2 concentrations were measured indoors until the Cl_2 plume passed, after which outdoor Cl_2 concentrations were lower.
- Sheltering inside vehicles within 200 meters did not provide protection.
- Gas and diesel vehicles continued to operate in high Cl_2 concentrations, thereby allowing for lateral movement away from the source.
- DOT ERG protective action recommendations for Cl_2 are consistent with test results.

ADDITIONAL INFORMATION

- Utah Valley University – Jack Rabbit Project Website https://www.uvu.edu/esa/jackrabbit/
- "The Jack Rabbit Tests: Catastrophic Releases of Compressed Liquefied Gases." FIRE ENGINEERING (November 2016).
- "The Jack Rabbit II Projects Impact on Emergency Responders." FIRE ENGINEERING (Est. June 2019).

OTHER RESOURCES

- Chlorine Institute
- OxyChem Chlorine Handbook

This document is not inclusive of all results and findings of the Jack Rabbit project. Much of the science is still being analyzed internationally. As the IAB identifies new information on this topic, it will be posted in the "Documents" area of the IAB website. Please contact the IAB at info@interagencyboard.us with any comments, feedback and questions. Additional information on the InterAgency Board is available at http://www.interagencyboard.org