

FACE: 85-05  
DATE: January 6, 1985  
CAUSE: Confined Space (Poisoning, Fire)  
SUBJECT: Confined Space Incident Kills Two Workers -- Company Employee and Rescuing Fireman

On November 15, 1984, a male worker died after entering a toluene storage tank. During the rescue attempt, one fireman was killed and several were injured when the tank exploded.

A toluene storage tank (10 feet in diameter and 20 feet high) had to be drained and cleaned. While the tank was empty, the company planned to install a clean-out portal at the bottom of the tank. On the 15th, a supervisor and an unskilled laborer drained the tank to its lowest level, leaving 2 to 3 inches of toluene and sludge at the bottom. The only entry into the tank at this time was a 16-inch diameter opening at the top. The supervisor and the worker (an immigrant who may have lacked fluency in English) planned a "dry run" entry into the tank from the top. The worker was provided with a SCBA, but the top opening was not wide enough to enter while wearing the apparatus, and so the worker was to enter while the SCBA was loosely strapped, and put it on when inside. Also, the available ladder did not fit through the opening and so the supervisor tied a knotted rope to a vent pipe and lowered it into the tank. While picking up the SCBA, the supervisor heard the worker in the tank, turned, and saw the worker standing on the bottom of the tank. The supervisor attempted to lower the SCBA to the worker, but the worker was mumbling and unresponsive. The worker then fell down, and the supervisor left for help.

The Fire Department rescue and hazardous materials teams arrived 10 minutes after notification. The firefighters were unable to pass a firefighter in full rescue gear through the top opening, and decided to cut through the side of the tank. They were aware of the possibility of explosion. The cut was made with a gasoline-powered disk saw. The cutting area was sprayed with water inside and outside the tank to quench sparks. At some point, firefighters stopped spraying the inside of the tank. The outside spray was interrupted temporarily to put out a fire in flammable liquid residue on the ground next to the tank. The tank then exploded. Additional factors contributing to the confined space part of the incident include: The company had no confined space entry procedures, and the supervisor and worker had no training. Additional factors contributing to the explosion include: possible confusion in the Fire Department chain of command, and the position of the firefighters making the cuts. Note that with a tank of these dimensions, only 56 ounces of toluene are needed to create a flammable atmosphere -- toluene that would cover the bottom of the tank to a depth of 0.01 inch. Recommendations:

- o Written confined-entry procedures should be developed and used. Respiratory protection is essential. Confined spaces should be evaluated by a qualified person before entry. Workers need proper training. A prior accident should have alerted the company that procedures needed to be reevaluated. A ground access port (as was planned) would have prevented the incident.
- o The Fire Department needs more extensive procedures for responses to

explosive and hazardous materials. Departments should establish registries of confined spaces and toxic/explosive substances. Research is needed on the best way to enter tanks such as this one. When hazardous tasks are performed, only essential personnel should be in the immediate area. Workers cutting into a tank such as this one should avoid standing immediately in front of the opening.