SAFETY DIGEST
U.S. Chemical Safety and Hazard Investigation Board
20 Years of Driving Chemical Safety Change 1998 2018
CSB U.S. Chemical Safety and Hazard Investigation Board

Herrig Brothers Propane Tank Explosion

> **Incident Date: April 9, 1998**
> **Kinston, North Carolina**
> **6 Killed, 38 Injured**
> **Full Report Link on CSB Website**



Emergency Response as a Driver for Critical Chemical Safety Change

Inadequate or poor emergency planning or response has been a recurring finding in the CSB's investigations. One of the very early CSB investigations, the Herrig Brothers Farm Propane Tank Explosion, made an emergency response recommendation for training for firefighters, as did the recently closed West Fertilizer Investigation. To date, 14 CSB investigations have found deficiencies in a community's, facility's, or emergency responder's response to an incident at a chemical facility. The CSB has made 48 recommendations to attempt to prevent further emergency response incidents; to date, 36 of those recommendations have been closed. More information can be found at: http://www.csb.gov/recommendations/emergency-response-/

Incident Summary

On April 9, 1998, two volunteer firefighters were killed, and seven other people were injured, when a blazing 18,000-gallon propane tank exploded at the Herrig Brothers poultry farm in Albert City, Iowa. The propane tank fire started after an all-terrain vehicle crashed into unprotected propane piping at the farm. The above-ground piping ran from the propane storage tank to process equipment on the poultry farm. The collision severed one pipe and damaged another, triggering a propane leak under the tank. About five minutes later, propane vapor leaking from the damaged pipes ignited, engulfing the tank and heating the remaining propane inside. Because of the fire's size, firefighters could not approach a manual shut-off valve to stop the propane leak, so they decided to let the tank fire burn itself out. Firefighters began spraying surrounding buildings to prevent the spread of fire. Seven minutes later, the propane tank ruptured and debris was thrown over 100 feet. The fire and debris killed two firefighters and injured seven emergency response personnel in the vicinity of the propane tank.

Flawed Design

The propane piping was equipped with a safety feature designed to prevent a major release of propane. An "excess flow" valve installed on the tank was designed to close if the propane flow in the piping exceeded 200 gallons per minute- the type of

flow associated with a complete breakage of the pipe. However, the piping installed immediately downstream of the excess flow valve was too narrow to allow the flow rate to ever reach 200 gallons per minute, even with piping completely severed downstream. The excess flow valve never closed and the propane leak continued, feeding the fire until the propane tank heated enough to explode.

Firefighter Training

Firefighters on scene believed that in the event of an explosion of the propane tank, fragments would be thrown from the two ends of the tank. They believed that the sides of the tank would be relatively safe. As a result, firefighters were in close proximity to the propane tank when it exploded. When a vessel ruptures, however, debris can fly in any direction, not just from the ends. The firefighters had received training from the National Propane Gas Association that indicated that a burning propane tank should be approached from the side and that the risk of flying debris was primarily from the ends of the tank. The firefighters were also not aware of how quickly a propane tank could rupture, typically within 10-30 minutes of the start of a fire. Firefighters arrived on-scene about 15 minutes after the tank ignited, and the explosion occurred seven minutes later.



Safety Change

In the CSB's investigation report, a recommendation was made to the National Propane Gas Association to revise its training materials to provide appropriate instructions on responding to fires at vessels similar to the one at the Herrig Brothers facility. A similar recommendation was made to the Fire Service Institute of Iowa State University. The Fire Service Institute changed its training on responding to a propane tank fire to instruct firefighters to evacuate if the fire has been ongoing for 10 minutes or more, and of the dangers of debris in the event of an explosion. FSI also has trainees perform a live action simulation of a burning propane tank fire to ensure that the trainees adequately understand the lessons taught. The National Propane Gas Association made similar changes to its training material, which the NPGA distributed to locations containing propane tanks, and also to emergency responders. In March 2002, the CSB voted to close the recommendations to both the National Propane Gas Association and the Fire Service Institute of Iowa State University as "Closed-Acceptable Action." Increased training of emergency responders helps them respond effectively and safely, and will help prevent fatalities and injuries from future propane tank explosions.