

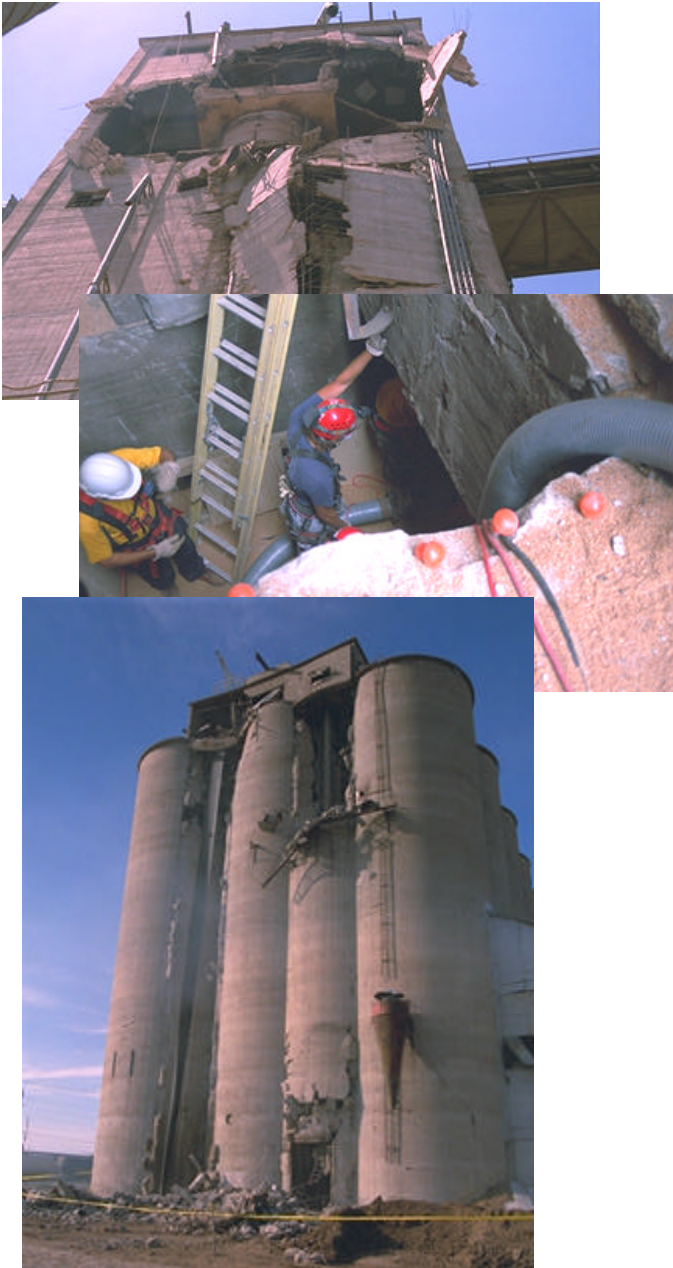
Fire Investigation Summary

Grain Elevator Explosion

**Haysville, Kansas
June 8, 1998**

A series of explosions in a large grain storage facility resulted in the deaths of seven people.

Dust explosions are a leading hazard in the grain industry. A lack of proper housekeeping and equipment maintenance can contribute to the accumulation of combustible dust. If combustible dust is suspended and ignited the resulting explosions can result in the loss of life and property.



**National Fire Protection Association
Fire Investigations Department**

On Monday, June 8, 1998, at approximately 9:20 a.m., a series of explosions occurred at a grain elevator facility in Haysville, Kansas (five miles south of Wichita). There were seven fatalities as a result of the explosions. Ten workers were injured by the blasts.

NFPA Fire Investigator Robert Duval arrived at the site on Tuesday, June 9, 1998, and joined a team of investigators from Sedgwick County; the City of Wichita, the Kansas State Fire Marshal's Office, and the Bureau of Alcohol, Tobacco, and Firearms.

The grain elevator was one of the largest in the world. The facility contained 246 concrete silos, each measuring 30 feet (9.1 m) in diameter and over 120 feet (36.6 m) in height. Each silo could hold approximately 70,000 bushels (2,464 m³) of grain, making the total capacity of the facility nearly 21 million bushels (739,200 m³), including the 7 million bushels (246,400 m³) contained in the headhouse bins. At the time of the incident, the facility was filled to about 33 percent of capacity. The facility measured over 2,700 feet (823 m) or approximately one-half mile in length. Wheat was the main product being stored in this facility.

The explosions occurred as the facility was being prepared for the early summer harvest of wheat in the Midwest. Workers were preparing the facility for the harvest by cleaning the gallery houses at the top of the silos as well as the conveyor tunnels under the silos. Routine maintenance, which included greasing bearings on the four conveyor lines, was also taking place throughout the facility.

An unknown ignition source ignited dust within the facility and resulted in a series of explosions that killed seven workers and severely damaged the entire structure. The actual ignition source may never be known

due to the damage that occurred in the central portion of the facility (in the tunnels beneath the silos and in the space under the headhouse). Information regarding the events that took place in these areas prior to the explosions will be difficult to obtain since all of the employees working in this area at the time of the explosions were killed.

Following the initiating event, several explosions occurred throughout the facility (statements of witnesses regarding the number of explosions ranged from two to five). The first explosion caused dust within the facility to be placed into suspension in the air thereby contributing to a series of subsequent explosions.

The rescue and recovery efforts that followed the explosions involved local, state, and federal resources. The Sedgwick County Fire Department was assisted at the scene by the City of Wichita Fire Department, Oklahoma City Fire Department Rescue Team, personnel and equipment from both Fort Riley Army Base and McConnell Air Force Base, as well as the Federal Emergency Management Agency (FEMA) who provided a Urban Search and Rescue (US&R) Team from Lincoln, Nebraska. Several other local fire departments from the Sedgwick County area also provided technical rescue and support personnel and additional equipment.

The rescue efforts continued for five days. The efforts were originally focused on rescuing four workers that were last seen in the tunnels in the south portion of the facility before the blast. Upon entering the tunnels beneath the silos the rescuers were confronted with tons of grain. The distribution chutes below each silo had been destroyed in the blasts, allowing

grain to spill into the tunnels. The technical rescue teams from the local fire departments along with the US&R team from Lincoln, NE had to construct shoring beneath each silo to stem the flow of grain, and allow the removal of the grain by vacuum, as they searched. The effort was scaled back on Saturday, June 13, 1998. Rescuers then focused on making the facility safe to conduct a recovery operation for the one remaining worker who was located on July 22, 1998. Smoldering fires that had continued to burn in several silos remote from the area where rescuers were operating were extinguished.

The entire facility suffered varying degrees of damage. Production at the facility is back in partial operation utilizing about one-half of the original capacity of the facility. The headhouse has been demolished. Temporary, exterior bucket elevators are being used to transport the grain product.

Grain elevator explosions and fatalities associated with those explosions have been reduced in recent years. As new facilities are constructed, modern methods of dust collection, and fire/explosion suppression and prevention are implemented, reducing the hazards posed by fire or explosion.

However, the potential for these hazards continues to exist at many older facilities where modern technology has not been implemented. These facilities must rely on the human factors of proper housekeeping and preventive maintenance programs to limit the potential for fire or explosion.

The basic method of limiting the explosion hazard is to reduce the potential fuel load. This is accomplished through a comprehensive housekeeping program, where dust accumulations are promptly and regularly cleaned. This should include a complete dust collection system as well as

manual housekeeping, such as removing dust from inaccessible places where dust collection systems cannot reach.

The fact that dust provides a powerful fuel source must be stressed in training employees and contractors in the hazards of dust handling and collection. A combination of respect for the power of dust explosions and appreciation for the effect that a thorough housekeeping and maintenance program will have on reducing the potential of an explosion is an important factor in employee training.

Dust will always be present in grain handling facilities. The control and removal of this dust and the control or removal of potential ignition sources are the keys to eliminating the explosion hazard.



Figure 1: Photo showing damage to headhouse structure (NFPA)

Written by Robert Duval, Fire Investigator
NFPA Fire Investigations Department

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