

Scrap metal cutter dies from injuries sustained in storage tank explosion

FACE 98-AK-021

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SUMMARY

On July 28, 1998, a 29-year-old scrap metal cutter (the victim) died from injuries sustained in an explosion. At the time of the incident, the victim had been cutting a vehicle frame for salvage with a torch. He was working 8 to 10 feet from a 1500-gallon storage tank, which he and a co-worker had unloaded from a truck earlier that day. At the time of the explosion, the co-worker was working 10 to 15 feet away from the tank. Escaping vapors from the tank were ignited by spatter from the cutting activities, causing the tank to explode. The victim was engulfed in flames, igniting his clothing and causing burns over 45% of his body. The co-worker extinguished the victim's burning clothing and helped him walk to the company's shop building. An office worker called 911. Emergency medical services transported the victim to a nearby medical center that transferred him to a medical center in Washington. He died 15 days later from complications associated with the burn injuries.

Based on the findings of the investigation, to prevent similar occurrences, employers should:

- **Develop, implement, and enforce a comprehensive safety program;**
- **Ensure a competent person inspects all work areas where hot work will be done;**
- **Ensure workers are capable of recognizing and avoiding hazardous situations;**
- **Ensure all storage tanks are inspected, tested, and appropriately labeled prior to moving them;**
- **Ensure appropriate storage (e.g., location and position) of used tanks.**

INTRODUCTION

At 3:30 PM on July 13, 1998, a 29-year-old male scrap metal cutter (the victim) was severely burned when vapors from a nearby storage tank were ignited, causing the tank to explode. On August 6, 1998, Alaska Department of Labor (AK-DOL) notified the Alaska Division of Public Health, Section of Epidemiology. An investigation involving an Injury Prevention Specialist for the Alaska Department of Health and Social Services, Section of Epidemiology ensued on August 13, 1998. The incident was reviewed with AK-DOL officials. Anchorage Police Department, Anchorage Fire Department (AFD), Medical Examiner and AK-DOL reports were requested.

The scrap metal company in this incident had been in business since 1950 and was privately owned. It employed eight workers including three yardmen. The victim was an experienced welder and had been employed by the company as a yardman/welder/cutter for 18 months. At the time of the incident, the victim and a yardman/welder trainee who had worked together for 4 to 5 months were cutting scrap materials for salvage.

The company did not have a written safety program. Safety training was on-the-job and addressed precautions to be used during cutting activities, personal protective equipment and clothing, work practices in and around the yard, and loader/forklift training. Informal safety meetings were held two or three times a week.

INVESTIGATION

The incident occurred in a scrap metal salvage yard at a privately owned industrial site. The yard was located off a dirt access road, adjacent to the company's office and shop building. The yard contained various types of metal and steel materials, primarily consisting of pipes and beams, stacked in piles and on racks. A driveway ran through the yard. "Hot work" areas, where materials were cut for salvage, were located along the driveway. The working surface in the yard was level and consisted of dry, compacted soil. The weather was considered a factor in

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this incident. It had been clear and warm with temperatures exceeding 70°F on the day of the incident and the preceding 3 days.

The storage tank involved in the incident was a cylindrical steel tank, approximately 10 feet long and 5 feet in diameter. Two small openings were located on the side. The tank capacity was estimated to be 1500 gallons. The tank was brought to the site 3 days before the incident from an equipment storage yard owned by another company (the client). It had been stored in the client's yard above ground for 2 to 3 years and had never been used by the client. The previous owner(s) and the use(s) of the tank could not be determined; however, a previous owner had most likely used the tank for underground fuel storage. AFD and AK DOL investigators presumed that the tank had been used to store motor vehicle fuel, such as gasoline.

During the week before the incident, the scrap metal company dropped off a flatbed truck at the client's yard. The client loaded scrap and other salvageable material including the storage tank onto the truck. At the end of the week, the client then called the company to collect the truck and its load. The client had already released several loads of scrap metal and was not aware that the company did not normally accept tanks. When the scrap metal company's driver returned on Friday afternoon to pick-up the loaded truck, he saw the tank but did not request it to be removed. He drove the truck back to the scrap metal company; the tank remained on the truck during the next 2 days.

On the third morning, the victim and his co-worker (the witness) were told by their foreman to unload the flatbed truck. The foreman cautioned them to unload the tank an "adequate distance" from the hot work areas and not to cut the tank. After the victim and the witness determined that the tank was empty, they manually rolled the tank off the truck. They did not notice any fumes while unloading the truck. The tank was located 20 to 30 feet from the yard entrance on the west side of the driveway (Figure 1). Its exact orientation was unknown. Although it was on its side, the evidence suggested that the openings, a port and a vent, were near the ground.

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About 2 ½ to 3 hours after the tank was unloaded, the victim and the witness began using welding torches to cut some of the materials in the yard. This was part of their daily routine. The welding/cutting equipment consisted of a torch connected by a length of hose to a tank (containing a propane/oxygen mixture) located on the back of a utility truck. Workers inspected all equipment and connections once a day, usually just before starting any cutting. The victim was working on the east side of the driveway, 8 to 10 feet from the tank. The witness was working approximately 4 feet from the victim, 10-15 feet from the tank (Figure 1). Approximately 15 minutes after they began cutting, as the witness glanced under his arm toward the victim, the tank exploded. The witness observed flames coming from the end of the storage tank that engulfed the victim and ignited his clothing. He helped the victim extinguish his clothing and then assisted him to the company's shop building.

Hearing the explosion, an employee inside the building called 911 at 3:33 PM. Emergency Medical Services arrived at 3:34 and transported the victim to a nearby medical center. Within hours, the victim was transported to a Washington medical center where he died 15 days later from his injuries.

In this incident, weather was a contributing factor. Warm, sunny days preceding the explosion probably raised the temperature inside the tank to above the ambient or outside temperature, causing residual fuel to volatilize (change to a gaseous state) at a faster rate. Since fuel vapors are heavier than air, they begin collecting at the lowest level inside the tank and can escape from openings. A flame or other ignition source coming in contact with the vapor would have ignited it. Following the incident, spatter (bits of molten metal thrown off by gas bubbles bursting as metal liquefies during cutting) was found near the tank.

CAUSE OF DEATH

The medical examiner's report listed the cause of death as bilateral pulmonary consolidation of adult respiratory distress syndrome due to thermal burns.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should develop, implement, and enforce a comprehensive safety program.

Discussion: A comprehensive safety program should identify and reduce or eliminate worker exposure to hazardous situations and provide proper training to help workers do their job safely and efficiently. Employers should review each job or task to determine the extent and significance of worksite and equipment hazards and consider the types of safety precautions to promote safe work practices.

Recommendation #2: Employers must ensure that a competent person inspects all work areas where hot work will be done.

Discussion: In this incident, the workers thought that the tank's position and distance from their work areas was "adequate." Although the tank was empty, it was not labeled and had not been tested for combustible or flammable vapors. 29 CFR 1910.252 (a)(2)(iv) requires the work area to be inspected before cutting or welding takes place. The inspection must be done by a person who is 1) capable of identifying existing and predictable hazards at the work area or working conditions that are hazardous or dangerous, and 2) authorized to make prompt corrective actions. Employers should also ensure that a competent person inspects all newly received materials and supplies prior to being handled by workers.

Recommendation #3: Employers should ensure workers are capable of recognizing and avoiding hazardous situations.

Discussion: All cutting and welding processes can produce sparks and spatter. Gas bubbles trapped inside of molten metal expand and burst, throwing off bits of molten metal. While a spark is a small, fine particle that can travel 30 feet or more, spatter is larger, hotter, and can travel several feet. Cutting hazards, including sources of potential combustible materials, substances, and vapors, need to be recognized and guarded against to assure worker safety. If there is doubt about the combustibility of materials, they should either be removed, spatter shields should be erected, or the location of the hot work area should be moved.

Recommendation #4: Employers should ensure that all storage tanks are inspected and appropriately labeled prior to moving them.

Discussion: In this incident, the storage tank was brought to the salvage yard without any inspection. Companies should not accept tanks without documentation of inspection. Inspection should include testing to determine if a tank has contained flammable or combustible substance and to assure that it has been thoroughly cleaned and is free of vapors prior to its removal, transport, repair, or sale. The American Petroleum Institute recommends that all tanks that have held flammable or combustible liquid (or whose service history is unknown) be clearly labeled with this information. Tank owners should strictly adhere to this practice. In addition, companies that are involved with the removal, transport, repair, or sale of storage tanks should inform all persons with whom they do business of this policy.

Recommendation #5: Employers should ensure appropriate storage (e.g., location and position) of used tanks.

Discussion: In this incident, there was a worker with an ignition source (a welding torch) within 8 to 10 feet of a storage tank which likely had the port and vent located near the ground. Combustible or flammable vapors that are heavier than air can escape from openings and flow along the ground. Employers should ensure that all storage vessels and tanks are stored away from potential ignition sources and are vented properly. Tanks should always be positioned or placed with the vent at the top. Used tanks should be vapor freed, either by filling with water or inert gas, before being placed in storage. Openings should be tightly plugged or capped.

REFERENCES

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Figure 1. Diagram of yard area before the explosion (not to scale)

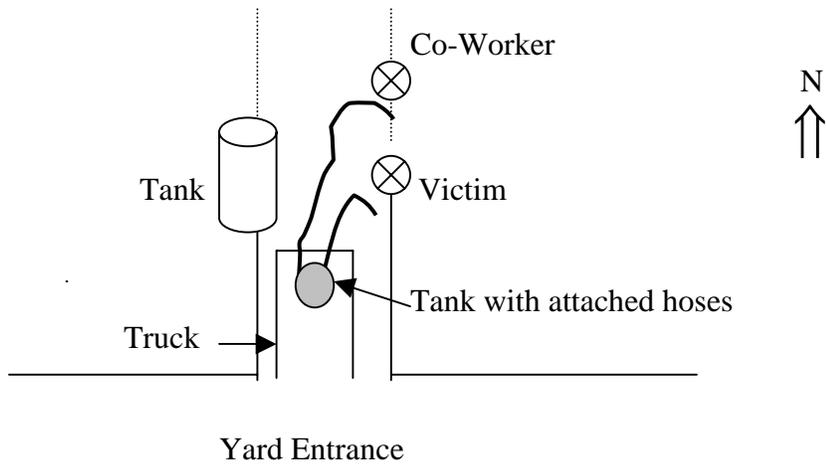


Figure 2. Work area, looking to the north



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Fatality Assessment and Control Evaluation (FACE) Project

The Alaska Division of Public Health, Section of Epidemiology performs Fatality Assessment and Control Evaluation (FACE) investigations through a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR). The goal of these evaluations is to prevent fatal work injuries in the future by studying the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

Additional information regarding this report is available from:

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