

FACE AK-93-24

TO: CDR Louis Smith, NIOSH, Division of Safety Research

FROM: Gary Bledsoe, AKFACE

SUBJECT: Welder Dies as a Result of a Fishing Vessel Explosion -- Alaska

SUMMARY

On May 26, 1993, a 40-year-old, male welder (victim) was killed as a result of traumatic impact injuries during the explosion of a fishing vessel undergoing repairs. The victim was welding a broken light bar inside the 30-foot fishing skiff in front of the control console prior to the explosion. At the time of the explosion, the victim was standing on an aluminum deck plate near the welding job. Another worker was performing a grinding operation (in preparation for repairing a broken speedometer transducer cable mount) on the vessel's stern. Sparks from the grinder apparently entered an open bilge drain and ignited gasoline vapors in the bilge. The subsequent explosion moved forward, through the bilge to the marine toilet. From this point the blast forces traveled under the false deck and blew off the welded down deck plate where the victim was standing. The aluminum deck plate (4 foot X 4 foot, 10 inch X 1/4 inch) struck the victim, causing massive impact injuries. Co-workers immediately called 911 and provided initial first aid efforts. They applied pressure to the groin area to prevent bleeding and covered the victim with a blanket. One worker noted that the victim had stopped breathing, and another worker immediately applied CPR. The victim started breathing again and EMTs began to arrive at the scene. The victim died at the site shortly after emergency rescue personnel arrived.

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

- ensure that hazard assessments are conducted by employees prior to beginning any job or work task, especially those operations in which overtly hazardous chemicals or physical energies are present (e.g., gasoline, solvents, high voltages).
- ensure that a safety program is conducted at the work site that includes a general hazard assessment, evaluation of work tasks to establish safe working procedures, regular safety training, and ongoing safety meetings. Even small work sites should have an individual designated for collateral safety duties.

- ensure that employees are knowledgeable about the hazards of gasoline and other chemicals used at the work site. When chemical spills occur procedures should be carried out to minimize the impact of explosive vapors, mists, aerosols, or dusts.
- ensure that a safe process for welding, grinding, or conducting other operations that produce ignition sources near vessel gasoline tanks or other flammable materials should be developed and immediately implemented.

INTRODUCTION

On May 26, 1993, a 40-year-old male welder died after being struck by an aluminum deck plate which was blown off the false deck of a 30-foot commercial fishing skiff in an explosion. The vessel had been undergoing repairs in a workshop prior to the next commercial fishing season. The worker was performing a welding repair job prior to the explosion. The explosion's ignition source was most likely a grinding operation at the vessel's stern, which ignited gasoline vapors in the bilge. The Alaska Division of Public Health, Section of Epidemiology was notified by the Alaska Department of Labor on the day of the fatality. An investigation involving an Injury Prevention Specialist from the Alaska Department of Health and Social Services, Division of Public Health, Section of Epidemiology and a Public Health Advisor from the NIOSH, Alaska Activity ensued on June 1, 1993. The incident was reviewed with Alaska Department of Labor officials (AKDOL), witnesses, and the vessel owner. The site was visited, measurements were made, and photographs of the fatality site were obtained. Appropriate documents (AKDOL reports, etc.) were obtained during the investigation.

The employee was a contract welder, who began work at the boat repair facility on May 25, 1993. The victim also had experience in "pile driving" and commercial fishing. At this time little is known about his specific training in welding. Most of his experience seems to have been in pile driving; he was a member of the local Pile Driver and Diver's union. The employer was a local commercial fisherman, who repaired and built his own vessels in the off-season. He has been in business for over ten years.

INVESTIGATION

A contract welder was repairing a light bar on a 30-foot commercial fishing skiff. He had been working at the site for two days, performing repairs on the vessel during the off-season. Another worker at the repair facility was preparing a broken speedometer transducer bracket on the starboard side of the stern. He was grinding the bracket prior to a re-weld repair job. On the previous day, the workers had tipped the vessel on its side to weld new skid runners on the hull. After doing this job, they discovered that a rubber hose on the fuel transfer box had been leaking gasoline. The fuel transfer box provided a mechanism for transferring gasoline from the two 75-gallon tanks on the vessel. They replaced the leaking hose, installed new hose clamps, and cleaned up the obvious spilled fuel. It is currently believed that an unknown amount of gasoline drained into the vessel's bilge during this operation. However, since the tanks had been drained, it is believed that the

quantity of gasoline in the bilge was relatively small. The bilge drain plug on the right side of the vessel's stern had been removed, and remained open during the grinding operation. Employees believe the bilge plug was removed the previous fall as the vessel was stored for the winter. As the worker prepared the bracket for re-welding, the right-angle grinder slipped downward at an approximate 130 degree angle from the transverse axis of the stern. The grinder (without safety guard) came within approximately 4 inches of the open bilge drain. At this time, an explosion occurred that blew the victim (welder working on the deck) 6-8 feet into the air.

A co-worker ran to the victim, who was lying face down. He noticed a severe leg injury as he rolled the victim onto his back. Co-workers called 911 and covered the victim with a blanket. Another co-worker applied pressure to the groin to control the bleeding, and another person noticed that the victim had stopped breathing. Mouth-to-mouth respiration was applied, and the victim began breathing on his own. Emergency responders arrived shortly after the successful resuscitation, and continued the rescue effort. However, the victim died on the scene within minutes of their arrival. The worker engaged in the grinding operation was not injured in the explosion.

CAUSE OF DEATH

The autopsy report attributed the victim's death to "impact injuries, pelvic and lower extremities."

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that hazard assessments are conducted by employees prior to beginning any job or work task, especially those operations in which overtly hazardous chemicals or physical energies are present (e.g., gasoline, solvents, high voltages).

Discussion: A formalized system of hazard assessment was not used at the victim's worksite. Prior to beginning a job or work task, work groups should meet to review any potential worksite hazards. In this case, workers noted that gasoline had spilled from the fuel transfer unit, and described being able to smell gasoline vapors on the following day, when the incident occurred. A brief inspection of the vessel may also have resulted in the discovery of the open bilge drain. This was the most likely point of entry for sparks from the grinder. Daily assessment should also include inspections of tools and materials for hazardous conditions. Such an inspection may have resulted in the recognition of the hazard associated with use of an unguarded grinder. Daily hazard assessments enable knowledgeable persons to evaluate the interactions of work processes and the safety of planned work procedures.

Recommendation #2: Employers should ensure that a safety program is conducted at the work site

that includes a general hazard assessment, evaluation of work tasks to establish safe working procedures, and ongoing safety meetings. Even small work sites should have an individual designated for collateral safety duties.

Discussion: The company did not utilize an ongoing general safety program. Such a program should include: 1) general hazard assessment, 2) evaluation of work tasks for existing hazards, 3) development of safe work procedures, 4) ongoing safety training that includes regular safety meetings for employees, and 5) a hazard communication program. To develop an effective program, it is critical that an individual be given responsibility and authority to conduct safety program activities. Small companies should consider the use of appropriately-trained collateral-duty safety personnel, when budgetary limitations prevent the use of fulltime safety professionals. Small companies should also consider developing a hazard communications program to inform at-risk employees of commonly encountered worksite hazards. Regular safety meetings are a useful training tool, and an opportunity to discuss immediate worksite safety issues.

Recommendation #3: Employers should ensure that employees are knowledgeable about the hazards of gasoline and other chemicals used at the work site. When chemical spills occur, procedures should be carried out to minimize the impact of explosive vapors, mists, aerosols, or dusts.

Discussion: A general safety program, as described in recommendation #2, provides a mechanism to inform employees of potential hazards related to chemicals and physical energies encountered at the worksite. However, procedures need to be developed to handle unexpected hazards, such as gasoline spills. Hazardous material handling protocols should be reviewed by qualified safety personnel, and distributed to all at-risk employees. Reference materials are available from the Alaska Department of Labor and OSHA, as well as a number of independent safety specialists in the state. The State University system also offers a number of health and safety-related courses. Consultation on techniques of designing protocols is also available from the above agencies and organizations.

Recommendation #4: Employers should ensure that a safe process for welding, grinding, or conducting other operations that produce ignition sources near gasoline tanks and other flammable materials be developed and implemented immediately.

Discussion: Although workers were aware that gasoline had spilled from the fuel transfer unit, they did not perceive the risk of vaporized gasoline in this situation. The high vapor volume of gasoline (24-32 cubic feet at 75°F) can result in the creation of highly flammable atmospheres, especially within relatively small volume spaces (e.g., vessel bilges). Vapors rapidly diffuse to fill the volume of containers or spaces. Employer and workers must be aware of methods for conducting routine work procedures safely. A simple method of rendering gasoline contaminated spaces safe is to clean them with soap (containing surfactants or detergents) and water. Water should be avoided when cleaning tanks and other spaces containing hydrophilic chemicals, such as anhydrous ammonia. Under no circumstances should work procedures, which create ignition sources, be conducted on or

near compartments containing flammable vapors. Spilled flammable materials should be soaked up by the use of absorbent/detergent materials, as used by hazardous material response teams for gasoline spills. Such operations must be conducted in well-ventilated work areas or the open air.

References

1. Discussions with Marine Engineer, U.S. Coast Guard, Juneau, Alaska.
2. General Safety Code, Volume II, Occupational Safety and Health Standards (01.0903), Alaska Department of Labor, September 30, 1990.
3. Hazard Communication, Occupational Safety and Health Standards, Alaska Department of Labor, October 1, 1988.