FACE 92WY012

Rackman Burned in Refinery Explosion in Wyoming

SUMMARY

A 30 year old male rackman died in an out-of-state burn center approximately 16 hours after having been involved in a preventable explosion and fire at an in-state refinery. The victim was near the control valve of a vented, non-pressurized tank containing a combination of butane, propane and hot waste oil, when a fire and explosion occurred, burning 95% of the victim's body and injuring five other workers in the area. Emergency services responded quickly, and the victim was received by a local emergency room within 40 minutes of the incident, and enroute to a burn center around an hour and a half of the occurrence. City, county and state law enforcement agencies had begun traffic control, city and county fire equipment was on the scene, and an emergency management command post had been set up within 30 minutes of the incident. Potential at-risk persons in the area were evacuated, and resources including a free coffee and sandwich canteen were established.

Employers may be able to minimize the potential for occurrence of this type of incident through the following precautions:

- **Improved procedures for safety training for employees and contract employees**
- **Improved procedures for temporary storage of materials during storage tank repair**

INTRODUCTION

Shortly after noon on Monday, June 8, 1992, a rackman attempting to remove light ends from a non-pressurized tank holding a mixture of gases (including butane and propane) by introducing hot waste oil was burned when vapors from the vented tank ignited. An alkylation unit had broken down over the weekend, and employees had stored partially refined gases in both pressurized and non-pressurized storage tanks while repairs were being made to the unit. Some of the gas was stored in vented, non-pressurized tanks and some was diverted to pressurized tanks. Waste oil at temperatures of close to 200° was added to one of the tanks, creating a pressure build-up as it hit the colder tank. Nearby workers operating a pile driver on the refinery grounds saw material oozing down the side of one of the tanks and began vacating the area. As they were running from the property, they heard an explosion and were quickly enveloped by a fireball travelling in a southwesterly direction. The victim was at the immediate south side of the tank, and was engulfed by the fireball which caused severe burns over 95% of his body. He was transported by ambulance to a local hospital for treatment, and then flown out of state to a burn center approximately 50 miles from the incident scene.

INVESTIGATION

Through monitoring of local emergency radio transmission by state EMS personnel and reports from local radio coverage, the WY-FACE Project became aware of the incident within minutes of occurrence. The Project Coordinator was on the scene within 30 minutes of the explosion. Media reports on the afternoon of June 9, 1992 noted that the victim had died and, through a reciprocal notification agreement with the OSHA Administrator of the Wyoming Department of Employment, the WY-FACE Project was notified of this incident on the morning of June 10, 1992. Communications were initiated with first responders, hospital and company officials, photographs were taken and pertinent reports were requested.

Skies were partly cloudy at the time of the incident with an 8 mph breeze blowing from the south. Slop tanks temporarily contained a gas mix including butane and propane. A vented storage tank to the north was normally used for this storage, but had been diverted due to a defective valve seal. A pile driver crew was working to the southwest of the tanks, driving piling for a new flare tower. Due to the lunch break, the pile driver crew and the victim were the only workers on the scene at the time of the incident. The welding machine for the piledriver had been turned off for a period of time when the crew noticed liquid material oozing out the top of one of the tanks and down the side. They then turned the equipment off and began vacating the area in anticipation of danger.

The refinery's alkylation unit had gone down prior to the event and had been repaired and brought back into service the evening before the incident occurred. While the unit was down, olefins were stored in horizontal bullet tanks south of temporary storage tanks. When these tanks were full, the excess was sent to the flare for burnoff. As the olefin level grew to a point where it presented a hazard to the liquids in the blow down tank, a decision was made to use rail cars for storage. Only one car was readily available, and was filled, with excess transferred to the flare. Liquid levels remained high in the blowdown tank creating a danger of gravitation to the liquid mover and eventually to the slop tanks.

A decision was made to send the olefins to the slop tanks for temporary storage, and a log entry was made that transfer of waste oil to the slop tank should not be made without the approval of a supervisor. At 4:00 on the morning of the incident, temperatures were taken at the slop tanks where the olefins were stored, and were recorded at from 18° to 63°F. Both tanks had observable frost lines with vapors emitting through vent openings at the top of the tanks. Attempts had been made to transfer olefins from the slop tanks but, due to light ends in the tanks, the pumps had lost their prime and nothing could be pumped out. Around 6 a.m., a night crew member checked the lower explosive limit with a gas meter and cleared the area in light of a construction work permit involving a potential for hot sparks from a welder/pile driver operation scheduled that day.

As the sun rose, tank temperatures increased from their overnight low, and vapors were released more rapidly. Around noon, the rackman and a member of management attempted to remove the light ends from the slop tanks by adding hot waste oils, according to procedures that had been conducted before with lesser quantities of hot oil.

The victim called the waste water treater to request the pump be turned on to transfer waste oil, and said that he was going to watch the tank while the waste oils were added. The introduction of the waste oil caused an even more rapid temperature increase and a physical reaction that found a soft seam on a tank. Olefins that were released by the pressure escaped through that seam opening. Within a minute or two, the victim called the waste water treater to shut off the pump. The operator shut the pump down and, within seconds, the explosion occurred.

Emergency Medical and Fire Services responded immediately and began remedial activities. Law enforcement personnel responding to the incident began immediate traffic control. City, county, state and company fire crews joined in fire fighting operations. Within 30 minutes of occurrence, a command post had been set up and was in operation. Company personnel and area residents were evacuated, and shut-down procedures were initiated. Work at the refinery had already been terminated for lunch break, with the exception of a welding operation to the southwest of the area. The welding crew had discontinued operation in response to a visible leak at the tank.

The victim was awake and responsive to voices during EMS transfer to hospital emergency room, suffering from 2nd and 3rd degree burns over 90-95% of his body. On arrival at the Emergency Room some 40 minutes after the incident occurred, his airway was intact with spontaneous respirations. He was tense, appeared frightened and somewhat combative. Approximately 50 minutes after arrival at the Emergency Room, he was removed by ambulance to an out-of-state burn center, arriving approximately 2 hours after the explosion. He died in the burn center a little over 16 hours after receiving the burns.

CAUSE OF DEATH

The Medical Examiner listed the cause of death as Severe Burns resulting in Cardiac Arrest

RECOMMENDATIONS/DISCUSSION

Safety training programs should be immediately reviewed and upgraded as necessary to provide employees and contract employees with improved knowledge and skills for prevention of risk from an explosion or fire. Worker training should include, but not be limited to, job safety analysis, risk hazard identification, and reporting of potential risk factors.

Such employee training procedures should be integrated into a comprehensive site safety program to include factor analysis of any potential hazards that might be created or enhanced by equipment or human error in the event of emergency or upset conditions, as well as an analysis of factors that might be subject to mechanical or human error under normal conditions. New procedures should be developed through a process to review and upgrade existing safety procedures through systematic investigation of all elements of process hardware and design, working conditions and job elements that might result in human error or hazardous event sequences, and system notification procedures to initiate corrective actions.

Improved arrangements should be made for temporary storage of hazardous materials under emergency or upset conditions. While the refinery was "between a rock and a hard spot", as quoted by a local newspaper from an OSHA investigator, and a variety of attempts were made to correct a hazardous situation and to control a series of events that compounded the hazard, the initial decision to store olefins in non-pressurized tanks was an unfortunate choice. A later decision to introduce hot oil to move light ends increased the potential for the explosion that followed.

FATAL ACCIDENT CIRCUMSTANCES AND EPIDEMIOLOGY (FACE) PROJECT

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), performs Fatal Accident Circumstances and Epidemiology (FACE) investigations when a participating state reports an occupational fatality and requests technical assistance. 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.

States participating in this study include: Georgia, Indiana, Kentucky, Maryland, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia.

NIOSH Funded/State-based FACE Projects providing surveillance and intervention capabilities to show a measurable reduction in workplace fatalities include: Alaska, California, Colorado, Massachusetts, New Jersey, Minnesota, Missouri, Wisconsin and Wyoming.

Additional information regarding this report is available from:

Wyoming Occupational Fatality Analysis Program
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Please use information listed on the Contact Sheet on the NIOSH FACE web site to contact In-house FACE program personnel regarding In-house FACE reports and to gain assistance when State-FACE program personnel cannot be reached.