SUBJECT: Mineworker was crushed between the couplings of a rail car and the tractor used to move loaded cars on a rail spur

SUMMARY

A 63-year old mineworker died on August 7, 2001 from injuries received when he was crushed between the couplings of a rail car and the tractor used to move cars on a rail spur. OKFACE investigators concluded that to prevent similar occurrences, employers should:

- Ensure that any crewmember that enters the space between a cut of cars to adjust knuckles/drawbars does so only after the cars to be coupled are separated by no less than 50 feet.
- Ensure that equipment and work areas used by employees are properly designed for their intended use and are safely maintained.
- Ensure that prior to entering the space between a cut of cars, any crewmember that must enter the hazard area first inspects the cars, applies a sufficient number of hand brakes where necessary to prevent movement of the cars, and determines that the cars are completely stopped.
- Provide communication devices to employees performing tasks in which voice communication is impeded and visual contact is not continuously maintained.
- Establish written policies, procedures, and safe and healthful work practices for all high-risk tasks.
- Reinforce established safety training regarding workplace hazards and the controls established to protect personnel from those hazards.
- Develop and implement a formal occupational health and safety management system that is focused on continual improvement.

INTRODUCTION

A 63-year old mineworker died on August 7, 2001 from injuries received when he was crushed between the couplings of a rail car and the tractor used to move cars on a rail spur. The decedent had been employed for 17½ years at a surface mine from which stone is removed, crushed and shipped for use in construction. The current employer had acquired the facility approximately three years prior to the incident.

Figure 1. View of the Rail Spur, the Five-Car Cut, and the Tractor

OKFACE investigators reviewed the death certificate, the medical examiner's report, internal company reports and witness statements, the Mine Safety and Health Administration (MSHA) investigation report, and newspaper articles on the incident. While conducting the survey, FACE investigators interviewed two employer representatives who investigated the incident. An investigator with the Oklahoma Department of Mines was also interviewed, however, because the incident occurred outside of the mine permit area, a formal report was not completed by the Oklahoma Department of Mines.

The worker who died in the incident was part of a three-man crew attempting to relocate five loaded rail cars on a rail spur in preparation for their shipment by the rail carrier. The mine operator used the rail spur, located near the mining and crushing operations, to position and load rail cars with crushed stone from the mine. The tracks, rail bed and switches were maintained in good condition; however, there was a dip in the rail bed at the track switches. The rail cars were ballast-type cars, each having a gross weight of approximately 133 tons and were equipped with air-actuated friction brakes. Each Monday, Wednesday, and Friday, the railroad delivered to the mine approximately 20 empty cars that were loaded and shipped each Tuesday, Thursday, and Saturday. Mine employees used a 1964 Caterpillar model 660 pneumatic-tire tractor to move the empty and loaded cars on the rail spur. After purchasing the tractor in 1979, the mine owner had modified the vehicle for use in moving rail cars by adding a Janney automatic railcar knuckle coupler on the front of the vehicle and a compressor behind the tractor cab for charging rail car brakes. A flat metal plate had been welded approximately four inches above the coupler to prevent disengagement of the coupling caused by vertical displacement of the tractor as it traveled on rough terrain; however, the device was reportedly ineffective and accidental uncoupling was a frequent occurrence. The coupler was not equipped with a lever, similar to those mounted to railcars, to permit remote manipulation of the coupling mechanism.

The decedent was employed as a driller at the mine, but the rail work he was performing at the time of the incident was a routine work assignment. OKFACE investigators determined that the surface mine operator, which employed 49 people at the site, had a written safety program that met applicable Occupational Safety and Health Administration (OSHA) and MSHA regulatory requirements; however, it did not specifically cover the procedure that resulted in the fatality.

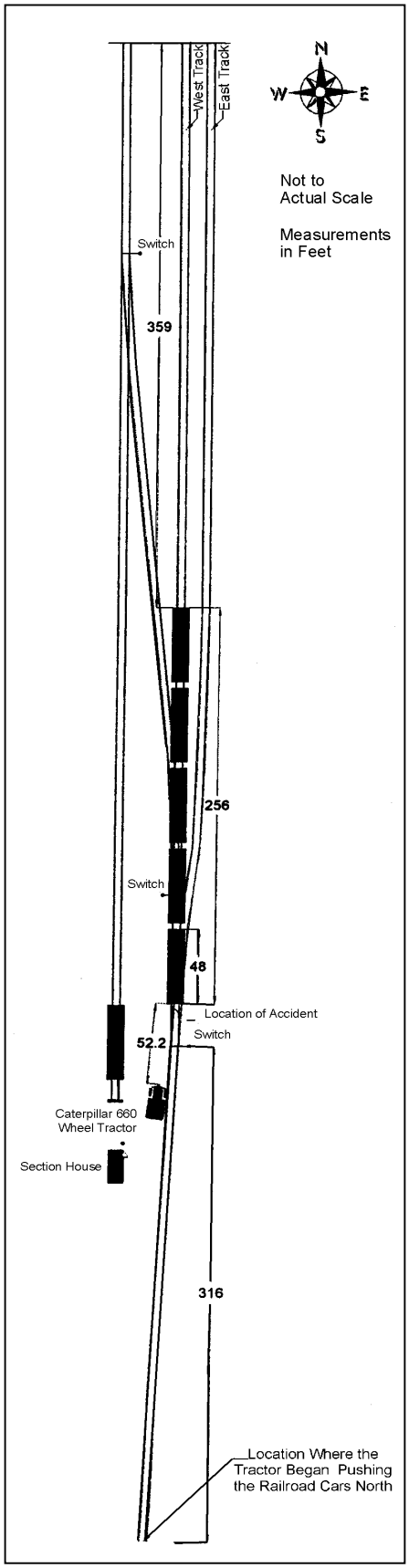

Figure 2. Incident Diagram

The employer provided all employees with classroom safety training, monthly safety meetings, and on-the-job safety training, including task-specific training and retraining in accordance with 30 CFR Part 46, *Training and Retraining of Miners*. Curriculum materials used for the training included videotapes, manuals and MSHA training modules. The training program included skill proficiency measurement, and the employer maintained records of employee participation. The decedent had completed related safety training provided by the company prior to the incident. The employer also had a substantial and reportedly successful safety incentive program in place.

Figure 3. Tractor and Rail Car

INVESTIGATION

The temperature at the time of the incident was approximately 77ºF, there was no wind, and there had been no precipitation that day. Shortly after reporting for work at about 6:00 a.m. on the day of the incident, a three-man crew, consisting of a brakeman, a tractor operator and the decedent, was attempting to move five loaded cars from the east rail of a spur to the west rail for later pick-up by the rail carrier. The operator of the Caterpillar tractor ("mule") positioned the tractor on the north end of the five-car "cut" and pushed it south down the track past a rail switch. The spur was located on a slight grade of approximately two percent sloping from north to south. Once the cut was past the switch, the brakeman set the brake on the northern-most rail car and lightly engaged ("taunted") the brakes on the second and third cars (as identified from the north end of the train), and the decedent uncoupled the tractor. The decedent changed the switch position to direct the cars onto the west track while the tractor operator moved the tractor to the south end of the cut of cars.

Figure 4. Coupling Knuckle on the Front of the Tractor

The tractor operator positioned the tractor to couple it to the southern-most rail car and then began to push the cut northward up the grade. The tractor rolled into a dip in the rail bed and the resulting vertical displacement caused the tractor to uncouple from the rail car. The decedent directed the tractor operator by use of hand signals to stop and back the tractor away from the cut. The operator began backing the tractor away from the southern-most car and the decedent signaled him to stop the tractor at a point where the knuckles on the rail car and tractor were approximately three feet apart. The decedent entered the space between the tractor and rail car, an area in which he was

not visible to the tractor operator, to open the tractor coupling. When the decedent failed to emerge from the area in front of the tractor, the operator leaned forward to a position where he could see that the decedent had become trapped between the tractor and rail car couplings. The operator backed the tractor approximately 52 feet down the track from the rail car and attempted to summon help by radio.

Curious as to why the train was not moving, the brakeman left his position in the northern-most rail car and proceeded toward the south end of the cut. Upon observing the operator trying to summon help, the brakeman ran to the nearby rail carrier section house and instructed the occupant to call 911. The railroad employee called 911, and emergency medical responders arrived in less than 10 minutes. The victim was declared dead at the scene and was transported to a local funeral home where the body was viewed by the Medical Examiner.

CAUSE OF DEATH

The Medical Examiner listed the immediate cause of death as crush injury to the chest.

RECOMMENDATIONS

Recommendation #1: Employers should ensure that any crewmember that enters the space between a cut of cars to adjust knuckles/drawbars does so only after the cars to be coupled are separated by no less than 50 feet.

Discussion: The employee's entry into the hazardous area between the rail car and the tractor was the underlying cause of the fatal incident. Before entering the space between the cut or rail cars and the tractor, the decedent signaled the tractor operator to stop the tractor at a distance of approximately only three feet from the nearest rail car. The decedent was the senior employee on the crew and as such determined the position at which to stop the tractor; however, the point at which he signaled the operator to stop the tractor left a separation of only a fraction of the 50 feet minimum distance recommended by the Federal Railroad Administration. The slack between the 3rd and 4th and the 4th and 5th cars released downhill toward the tractor while the employee occupied the hazardous area within the "gauge" (the area between the rails), unexpectedly trapping and crushing him. The proximity of the tractor to the cut of cars was an underlying cause of the fatal incident.

Recommendation #2: Employers should ensure that equipment and work areas used by employees are properly designed for their intended use and are safely maintained.

Discussion: The employee's entry into the hazardous area between the rail car and the tractor was the underlying cause of the fatal incident. The welded plate above the tractor's knuckle coupling reportedly did not effectively prohibit accidental uncoupling. Accordingly, re-design of the coupling and/or improved maintenance of the rail bed may have prevented the uncoupling incident that necessitated the employee's entry into the hazard area. Additionally, the tractor coupling was not equipped with a control lever similar to those installed on rail cars; therefore, the decedent was required to enter the hazard area to open the coupling and allow re-coupling of the tractor to the rail car. Installation of such a device may have prevented the fatal incident by removing any need for a crewmember to approach the coupler in order to open it.

Recommendation #3: Employers should ensure that prior to entering the space between a cut of cars, any crewmember that must enter the hazard area first inspects the cars, applies a sufficient number of hand brakes where necessary to prevent movement of the cars, and determines that the cars are completely stopped.

Discussion: The movement of the rail cars while the decedent occupied the area between the cars and the tractor was an underlying cause of the fatal incident. The slight grade in the track allowed the slack between the 3rd and 4th and the 4th and 5th cars to release in the direction of the employee, and given his position within the gauge resulted in his being crushed between the cut of cars and the tractor. The brake on the northern-most car had been applied and the 2nd and 3rd cars had been taunted, but the 4th and 5th cars were free to roll until all slack had been released. Had the employee inspected the cars and ensured that they were not in motion before and during his entry into the gauge, the fatal incident may not have occurred.

Recommendation #4: Employers should provide communication devices to employees performing tasks in which voice communication is impeded and visual contact is not continuously maintained.

Discussion: Inability of the tractor operator to see the developing hazard and warn the decedent or take direct action was a contributing cause of the fatal incident. Once the decedent entered the hazard area, the tractor operator was not able to see him or warn him of impending danger as the slack was released from the cut of cars. Improved communication, and/or the use of a spotter, is critical to protecting employees whose attention may be distracted from serious hazards to which they may be exposed while performing any task.

Recommendation #5: Employers should establish written policies, procedures, and safe and healthful work practices for all high-risk tasks.

Discussion: The employee's entry into the gauge between the rail car and tractor reportedly violated an unwritten policy. The employee was reportedly aware of the policy but violated it nonetheless, and the employee's position in the hazard area was an underlying cause of the fatal incident. The area between rail cars is widely recognized as hazardous because the coupling "knuckles" move both vertically and horizontally and the resulting "slack" of up to 15 inches per coupling can allow movement if the cars' brakes are not applied. Company personnel and OKFACE investigators speculated that the initial attempt to couple the tractor to the cut of cars was unsuccessful, prompting the decedent to motion the tractor operator back and enter the area to adjust the knuckles. Although the employer had an excellent safety program and safety record, the procedures for accomplishing the task being performed by the crew at the time of the incident were not written. The establishment and maintenance of written procedures, including safe work practices, serves to emphasize their importance to personnel who must perform the tasks.

Recommendation #6: Employers should reinforce established safety training regarding workplace hazards and the controls established to protect personnel from those hazards.

Discussion: The employer had a training program in place that met the requirements of MSHA and OSHA; nonetheless, the employee violated established policies and practices that had reportedly been communicated through previous training. Because workplace safety and health relies heavily on the worker's inclination to actively choose safe work behaviors, the employer must develop and implement mechanisms for continually promoting those behaviors. Refresher training can emphasize the critical nature of the hazards and risks to which a worker is exposed and ingrain the health and safety policies, procedures and work practices in the worker's behavior and work routine. Refresher training also reinforces the importance of hazards, risks, and controls to all work situations. Performance review, including periodic monitoring and appraisal of individual and team performance in hazardous operations, offers the employer an opportunity to identify and correct performance deficiencies before they result in an undesirable incident and to evaluate the effectiveness of the employer's safety training program. Refresher training and effective performance review may have affected the employee's decision to enter the gauge under the conditions that caused the fatality.

Recommendation #7: Employers should develop and implement a formal occupational health and safety management system that is focused on continual improvement.

Discussion: The dynamic nature of the contemporary workplace necessitates a management model that ensures continual improvement in virtually all aspects of the business. This principle is particularly critical with regard to the management of workplace health and safety, which must be integrated into all operational aspects of an organization's business plan. While implementation of a system such as OHSAS 18001 may or may not have directly affected outcome of the incident, it could have encouraged and facilitated the identification and correction of deficiencies that may have served as contributing causes. It would also encourage and facilitate the general improvement of occupational health and safety performance throughout the organization.

REFERENCES

1. 29 CFR 1910, *Occupational Safety and Health Standards*.
2. 30 CFR 46, *Training and Retraining of Miners*.
3. 30 CFR 56, *Safety and health standards—surface metal and nonmental mines*.
4. 49 CFR 214, *Railroad Workplace Safety*.
5. 49 CFR 218, *Railroad Operating Practices*.
6. British Standards Institution, Occupational Health and Safety Assessment Series (OHSAS 18001: 1999), *Occupational safety and health management systems*. Specification.
7. Federal Railroad Administration, Report Number DOT/FRA/ORD/-00/04, *Switching Operations Fatality Analysis*.

The Oklahoma Fatality Assessment and Control Evaluation (OKFACE) is an occupational fatality surveillance project to determine the epidemiology of all fatal work-related injuries and identify and recommend prevention strategies. FACE is a research program of the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research.

These fatality investigations serve to prevent fatal work-related injuries in the future by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in injury, and the role of management in controlling how these factors interact.

For more information on fatal work-related injuries, please contact:

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