How Does the Steel Industry Solve a Problem Like Mobile Equipment?

Hazards are ever-present in the steel plant environment, and a heightened awareness and emphasis on safety is a necessary priority for our industry. This monthly column, coordinated by members of the AIST Safety & Health Technology Committee, focuses on procedures and practices to promote a safe working environment for everyone.

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Comments are welcome. If you have questions about this topic or other safety issues, please contact safetyfirst@aist.org. Please include your full name, company name, mailing address and email in all correspondence.

Ever wonder when the first mobile equipment pedestrian interface injury happened? Logic would say that it was not long after human beings invented the wheel. Did society recognize the hazard that had just been created? Probably not, because all too often similar scenarios are being repeated.

Historical records and documented incidents between mobile equipment and pedestrians are difficult to find and quantify. What is certain is that injuries and deaths were happening and in large numbers. The industrial age in the U.S. started in 1790 when Samuel Slater opened his first industrial mill. As the pace of the Industrial Revolution increased, it is reasonable to expect that injuries and deaths also increased rapidly.

In 1907, accidents resulted in 4,534 railroad worker fatalities in the United States alone (although not all of these would be related to working around moving locomotives and equipment).

Working conditions did not start to improve until between 1910 and 1939 when legislation and public opinion started to drive toward safer workplaces. Fast forward another hundred years to current times, where the range of environments that now have mobile equipment and pedestrians working side by side are probably as large as it will ever get.

According to U.S. government statistics, there are approximately 155,761,000 people working in the U.S. today. A brief study of the workers and industry types indicates that at least 25% of these workers have a daily exposure to interactions with some form of mobile equipment, whether it is delivery trucks, forklifts, farming, construction or heavy industry mobile equipment.

Between 2011 and 2017, according to a U.S. Bureau of Labor Statistics national census, the number of people fatally injured in the workplace by incidents involving a vehicle or piece of mobile equipment averaged at 11%. For steel and related industries, this 11% fatality rate was also true in 2016 and 2017.

While fatalities from mobile equipment may not be a leading cause of death according to the U.S. Occupational Safety and Health Administration (OSHA), it is suggested that the leading causes of death stem from either a lack of understanding or training of the rules and requirements, or not adhering to the rules or procedures. The fatalities and injuries from mobile equipment can be linked to personal overfamiliarization with automobiles and a lack of controls.

If there is interaction with working at height, fall prevention and protection methods are implemented; if there is interaction with moving parts of machinery, guarding is installed; if there is interaction with stored energy, the control of hazardous energy is initiated. There is a gap with the interaction around mobile equipment and definite control measures.

The National Safety Council states the 2017 average cost of a fatality as US$1.15 million. That number does not include the indirect costs, which depending on the margins, could be between 2:1 and 17:1. However, at the end of the day, an employee did not return home in the same condition in which they arrived to work. For family, friends and coworkers, there is no financial price that equates to living with this loss for the rest of their life.

When assessing the challenges and risks associated with mobile equipment and pedestrian interface, there are two prominent hazards: people working too close to mobile equipment and pedestrians being in or entering mobile equipment blind spots. There are many jobs or tasks in which people are put in a situation where they are working in too close a proximity to a piece of mobile equipment.

This "close proximity" challenge can be found in almost every industry: steel, manufacturing, construction and agriculture. Blind spots are everywhere and they are created by physical fixed structures interrupting the operator view or parts of the equipment that obscure the view to the ground directly around the equipment. Blind spots can also exist from the contrast from sunlight to shaded areas.

The use of the Hierarchy of Controls is not a new concept in controlling hazards within the workplace. The Hierarchy of Controls method should be applied when assessing the hazards surrounding mobile equipment and pedestrian interfaces.

- Elimination — Separation of Mobile Equipment and Pedestrians: Elimination might not always be feasible, but it should at least be the starting point in the hazard control assessment process. Reroute the equipment roadways away from the people or redesign the work area to separate people from any mobile equipment movement.
- Substitution — Alternative Methods: Substitution can include using another method to move the materials, conducting a process that does not involve mobile equipment or reducing the amount of movement. For instance, use of conveyors instead of haul trucks to move the materials from point A to point B.
- Engineering Controls — Segregation/Isolation Between Mobile Equipment and Pedestrians: Engineering controls could be the use of physical barriers to keep mobile equipment and employees from interacting, such as the construction of designated protected walkways. When mobile equipment and employees must cross each other's path, it should be at a 90° angle to each other. Where pedestrian walkways cross a vehicular path, there should be a gate or obstruction to indicate the end of the walkway and potential for the presence of the mobile equipment hazard. Avoid mobile equipment moving in the same direction as pedestrians without a physical barrier, due to the potential for the pedestrian to be in the mobile equipment's blind spot. Just because the pedestrian is directly in front of a piece of equipment doesn't mean they cannot be obscured by the equipment blind spot, load, sun, shade or any number of other possibilities restricting operator visibility.
- Administrative Controls — Workplace Practices: Using a physical barrier to separate pedestrians and mobile equipment would be an example of an engineering control as highlighted earlier. If the physical barriers were replaced with a painted line, while still creating a designated walkway, this would be an example of an administrative control. The control of a painted line or walkway sign requires people to stay within the walkway boundaries; however, there is no physical constraint. Signage, lights, policies and training are other examples of administrative controls to reduce the exposure to risk. Using stop signs for mobile equipment or pedestrians, or even both, when the paths interact, presents an opportunity to avoid a collision.
- Personal Protective Equipment — High-Visibility Clothing: While regarded as the "last line of defense" and the lowest of the controls, bright-colored clothing, preferably orange, with high-visibility striping should not be underestimated, especially in low-light areas or in hours of darkness. This clothing needs to be kept clean to be at its optimum. The application of reflective tape to hard hats should be included for additional visibility. Now LED lights are becoming available for personal protection equipment (PPE).

Technology around mobile equipment and pedestrian interface is becoming more popular, especially in the steel industry. There are many technological operator assistance systems and products available for use in PPE. These products range and vary in protective properties, control levels (engineering vs. administrative), advantages and disadvantages. There are a few examples of the technologies on the market today listed in this section.

- Radio Frequency Identification (RFID): RFID is a proximity technology that uses radio frequency waves to establish the distance between a sensor and an ID tag and usually corresponds to an audio alarm for the operators. The ID tag can be placed on fixed objects, other mobile equipment or pedestrians. Some systems offer anti-collision properties between vehicle to vehicle or vehicle to pedestrian. This allows the equipment to physically stop if it enters a danger zone that generally equates to a close proximity to a pedestrian or another piece of mobile equipment. Another offering to this technology is the ability to track and collect near-miss occurrences. When the system detects an ID tag in the danger zone, the data is stored as a near miss. This allows management to identify high-risk areas with increased mobile equipment and pedestrian interface.

- Sonar/Radar/Lidar: These technologies use sound waves, radio waves or light pulses to discover and identify the area surrounding them. They can be used on their own or together depending on the solution required.
- Blind Spot Cameras: A blind spot camera is a system that shows areas directly behind or 360° around a piece of mobile equipment prior to a directional movement. These should not be confused with the functionality of backup cameras.
- Backup Cameras and Alarms: Backup cameras and alarms utilize visual and/or sound to provide a field of view and a method of depth perception for operators when reversing the equipment.
- Laser Lights: Laser lights can be used to project down the front, back and/or sides of the equipment in operation. This technology can be useful to mark a piece of equipment's operating safe zone. Commonly found fitted to forklifts in a distribution or manufacturing environment.
- Blue Projection Spots: Blue projection spotlights give great advanced warning of the equipment's approach indoors and at night or in poor light conditions. The projection spotlights need to be correctly adjusted and installed on the equipment in order to function properly. LED lights are proving to be more reliable than traditional lamps.

Conclusion

Does technology solve the problem of mobile equipment and pedestrian interface? These technology solutions, while possibly solving one set of problems, come with some significant trade-offs. For example, if more technology is added on to mobile equipment, more distractions are being introduced to the operator. The added screens, alarms, lights, etc., all distract the operator from the task at hand, creating a new set of risks. More systems installed in the cab for the operator to look at may result in the operator spending less time looking at where he or she is going. These technologies may also cause an employee to operate at a slower pace, creating inefficiencies in production.

Technology systems can create additional fatigue due to bombarding the operators with too much information via lights, alarms, sensors, screens and cameras. Other potentially negative trade-offs could be the perception that the piece of mobile equipment is so safe that it's not possible to hurt anyone, thus breeding complacency. False alarms from improperly set up, calibrated or poorly maintained systems can also present a weakness that ends up being an expensive waste of time, money and perceived safety.

Ultimately, there is not a conclusive solution to this problem. However, the solutions evaluated offer some useful options for an organization to explore when assessing the hazards surrounding mobile equipment and pedestrian interfaces. There are many potential ways to assess the workflow of equipment and employees in a facility. Depending on the work and environment, some of the methods or applications discussed in this article may be worth assessing for use. The higher up the Hierarchy of Controls the solutions can remain, the more reliable they are likely to be and therefore offer the best return on investment, regardless of whether it was time, capital or effort.

References

1. "Fatality Inspection Data: Work-Related Fatalities for Cases Inspected by Federal or State OSHA," Occupational Safety and Health Administration, https://www.osha.gov/dep/fatcat/dep_fatcat.html.
2. "History of Workplace Safety in the United States, 1880–1970," Economic History Association, https://eh.net/encyclopedia/history-of-workplace-safety-in-the-united-states-1880-1970-2.
3. Jonathan D. Karmel, *Dying to Work: Death and Injury in the American Workplace*, Cornell University Press, 2017.
4. "National Census Of Fatal Occupational Injuries in 2017," U.S. Bureau of Labor Statistics, U.S. Department of Labor, https://www.bls.gov/news.release/pdf/cfoi.pdf.
5. "Work Injury Costs," National Safety Council, https://injuryfacts.nsc.org/work/costs/work-injury-costs. ✦