

FATALITY ASSESSMENT AND CONTROL EVALUATION

Metal Recycling Worker Run Over by a Front-End Loader at a Scrap Yard (Case # 17NY023)

INCIDENT HIGHLIGHTS

-  **DATE:**
June 23, 2017

-  **TIME:**
2:30 p.m.

-  **VICTIM:**
49-year-old yard worker at a metal recycling company

-  **INDUSTRY/NAICS CODE:**
Recyclable Material Merchant Wholesalers/423930

-  **EMPLOYER:**
Metal recycling company

-  **SAFETY & TRAINING:**
Pre-employment training & biweekly toolbox talks

-  **SCENE:**
Metal recycling company scrap yard

-  **LOCATION:**
New York

-  **EVENT TYPE:**
Struck by a front-end loader



SUMMARY

On June 23, 2017, a 49-year-old yard worker at a metal recycling company was fatally struck by a front-end loader at the company’s scrap yard. On the day of the incident, the yard worker was in the ferrous yard cutting scrap with a torch and a shear. An equipment operator was operating the front-end loader (WA-470 Komatsu) in the car reclamation area which was to the southeast of the ferrous yard... [Read the report](#) (p.2)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- The scrap car carried by the front-end loader blocked the operator’s view.
- Front-end loader had to travel in the same area where workers were walking due to equipment maintenance.
- Walking paths for ground workers were not demarcated and protected.
[Learn more](#) (p.6)

RECOMMENDATIONS

NY FACE investigators concluded that, to help prevent similar occurrences, employers should:

- Establish a standard procedure for equipment operators to follow when they have to operate front-end loaders with an obstructed view.
- Consider using additional technologies, such as proximity sensors, to help mitigate heavy equipment-pedestrian interaction hazards and prevent serious worker injuries.
- Should implement a heavy mobile equipment safety program to protect metal recycling workers from suffering serious struck-by and caught-between injuries. [Learn more](#) (p.6)

SUMMARY

On June 23, 2017, a 49-year-old yard worker at a metal recycling company was fatally struck by a front-end loader at the company's scrap yard. On the day of the incident, the yard worker was in the ferrous yard cutting scrap with a torch and a shear. An equipment operator was operating the front-end loader (WA-470 Komatsu) in the car reclamation area which was to the southeast of the ferrous yard. At approximately 2:30 p.m., the yard worker was seen on the company surveillance video walking towards the office building where the employee breakroom and restrooms were located. At the same time, the front-end loader was traveling forward carrying a scrap car on its forks that had tinted windows in the same area and direction as the yard worker was walking. The equipment operator, whose view was blocked by the scrap car, stated that he did not see the yard worker. While driving forward, the operator saw a yellow hard hat roll off to the left front of his loader. He immediately stopped and exited the loader and saw the yard worker on the ground. The customer who brought in the scrap car called 911. EMTs arrived at the site within minutes, but the yard worker was pronounced dead at the scene. From the position and condition of the body, along with markings observed on the loader and the car, OSHA postulated that the yard worker was first struck and knocked to the ground before being run over by the left rear tire of the loader.

INTRODUCTION

On June 23, 2017, a 49-year-old yard worker of a metal recycling company was struck and killed by a front-end loader at the company's scrap yard. New York State Fatality Assessment and Control Evaluation (NY FACE) staff learned of the incident from news media reports and initiated an investigation. A NY FACE investigator visited the incident site, met with the employer representative, observed scrap yard operations, and conducted an employee interview. The Occupational Safety and Health Administration (OSHA) also investigated the case. The NY FACE investigator discussed the case information with the OSHA compliance officer, and reviewed the OSHA report, the front-end loader operation and maintenance manual, and the death certificate. This report summarizes the findings of the NY FACE investigation.

EMPLOYER

The metal recycling company, a family-owned-and-operated business since 1938, employs approximately 400 employees working in 17 recycling centers in both New York and Pennsylvania. These recycling centers, being open to both commercial customers and the public, receive and process scrap materials ranging from cans, insulated wire, automobiles, appliances, and machines, to scrap generated from industrial manufacturing processes. The scrap materials are sorted and processed before being shipped to the company's main shredder stations where they are shredded and packaged. The recovered metals are sold to steel mills and iron foundries. The company processes approximately one million tons of ferrous and 125,000 tons of nonferrous metals annually. The employer is a member of the Institute of Scrap Recycling Industries, Inc. (ISRI), a trade association representing scrap recycling businesses nationwide.

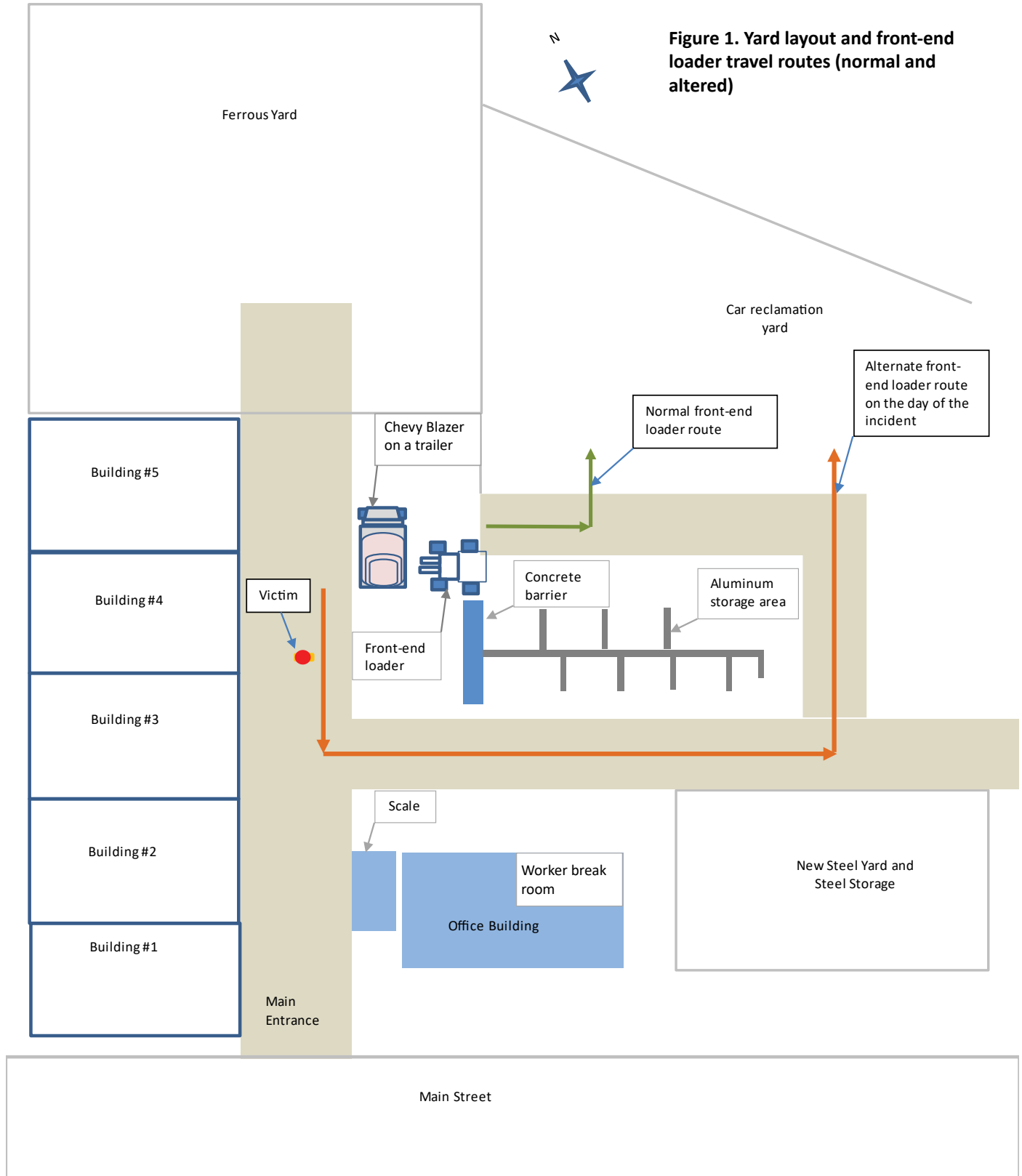
The recycling center where the incident occurred had approximately 20 employees working in the yard, warehouse, metal shop, baling station, and office. The recycling center was open on weekdays from 7 a.m. to 6:30 p.m. Saturdays from 7 a.m. to 4 p.m., and on Sundays from 7 a.m. to 2 p.m. Mobile equipment such as magnets, shears, grapples, forklifts, and front-end loaders were used to handle scrap metals.

Figure 1 shows the layout of the recycling center (not to scale) at the time of the incident. The buildings on the west side housed the indoor operations including the metal shops, warehouse, and baling station. Drivers of visiting vehicles entered the facility through the main street entrance, completed paperwork, and weighed their loads at the scale house by the office building before driving to different yard areas to unload. The aluminum scrap storage station was in the middle of the yard with a concrete barrier demarcating the area. The new steel yard and steel storage area was in the southeast side of the facility bordering Main Street. The ferrous yard was at the northwest corner and the car reclamation yard was at the northeast side of the yard. The recycled cars were drained of fluids using an Enviro Rack in the car reclamation yard.

The worker breakroom, including bathrooms, was inside the office building. Yard workers, equipment operators, and the workers in the shop buildings had to walk across the main traffic routes to get to the breakroom. There were no designated routes or marked paths for workers to travel in the yard.

WRITTEN SAFETY PROGRAMS AND TRAINING

Workers received pre-employment training conducted by the Human Resource Department (HR). The topics covered by the pre-employment training ranged from personal protective equipment, forklift safety, and heat stress, to electrical and ladder safety. HR also provided workers with annual re-fresher training. The company used training materials developed by ISRI. Biweekly toolbox talks for yard workers were conducted by the company's safety officer. All yard workers wore yellow hard hats and high visibility vests. They had two-way radios to communicate with the scale house, the office, and other yard staff through a dedicated channel.



WORKER INFORMATION

The yard worker had worked for the metal recycling company intermittently for approximately 10 years. He operated a scrap shear and used a torch to cut metals in the ferrous yard. He received pre-employment training and refresher training and attended the toolbox talks.

The front-end loader operator involved in the incident was considered to be an experienced equipment operator. He worked for the company off and on for 17 years including working full-time for the last six years prior to the incident. He had also worked for another metal recycling company in Maryland. He operated the grapple, front-end loader, shear, and magnet machines. He had completed the OSHA 10-hour construction safety training and provided training for equipment operators at other recycling centers.

MACHINERY INVOLVED IN THE INCIDENT

The front-end loader was a Komatsu (model WA 470-6). The loader, powered by a 6-cylinder turbo-charged diesel engine of 273 HP, was approximately 29 feet long, 10 feet wide, and 11 feet high and weighed over 50,000 pounds.

The loader had a backup alarm and three mirrors: two exterior side mirrors and a rearview mirror inside the cab. If the mirrors were adjusted correctly according to the manufacturer's instructions, the operator should be able to see an object that was 1.5 meters (4.9 ft) or higher at the rear left or right of the loader outside the loader's blind spot. The manufacturer defined the loader blind spot boundary as 1 meter (3.3 ft) from the loader perimeter in rear, front left, and front right. The FACE investigator tested the blind spot with a person who was 5 ft tall and found that the left rear and right rear blind areas extended to 3.4 meters or (11 ft 2 in) from the machine. There was no blind spot observed in front of the loader if the loader was not carrying any object.

The loader was equipped with an adjustable seat, and the adjustment was done by compressed air. By maneuvering the levers under the seat, the positions and angles of the seat, backrest, headrest, lumbar support, and armrest could be adjusted. The range of adjustment for seat position was 7.1 inches (backward or forward) and 2.6 inches (up or down) for seat height. The seat angle could be tilted back or forward a maximum of 24 degrees. The manufacturer emphasized that to ensure a good visibility for the operator, the seat had to be properly adjusted.

INVESTIGATION

Two workers were in the yard on the day of the incident: the victim and the equipment operator. The victim worked in the ferrous yard cutting scrap metals with a torch and a shear while the equipment operator operated the front-end loader to unload scrap cars and bring them to the car reclamation yard to drain fluids before loading them onto the trucks for the shredder yard. The recycling center received an average of 10 to 15 scrap cars daily. The loader may handle up to 40 scrap cars on a busy day. Usually, the loader stayed inside the car reclamation area, where it would move forward to pick up a junk car and back into the car reclamation yard to unload (See the green arrows as the front-end loader normal travel route on Figure 1).

A contractor started maintenance and repair work on a grapple in the car reclamation yard the day before the incident. The car reclamation yard was closed to traffic for the duration of the grapple maintenance. Consequently, the equipment operator had to alter his normal travel route: The loader had to go around the concrete barrier towards the office building before turning left and traveling between the aluminum storage station and the new steel yard to reach the car reclamation yard (See the orange arrows for the front-end loader alternate travel route on Figure 1).

OSHA established the incident timeline based on a yard surveillance video (the video was not available to NY FACE). At approximately 2:25 p.m., the equipment operator was unloading a dark green Chevy Blazer with tinted windows from a trailer. The vehicle was brought in by a customer to be scrapped. The trailer was parked outside the car reclamation yard adjacent to the concrete barrier. The loader picked up the Blazer with its forks approximately three feet above the ground. It then backed away from the trailer before turning left and moving forward to go around the concrete barrier to reach the car reclamation yard through the alternate route.

At 2:27:41 p.m., the victim was seen on the video walking towards the office building. The victim reportedly took his break every day at around 2:30 p.m. At the same time, the loader was travelling forward along the concrete barrier carrying the Chevy Blazer. The video did not catch the instant when the victim was struck. One metal

shop worker who happened to be outside Building #3 saw the loader carrying the Blazer moving forward. He then looked over his shoulder while walking back to the building and saw the victim lying on the ground.

The equipment operator stated that he did not see the victim. His view was blocked by the Blazer that had tinted windows. While driving forward he saw a yellow hard hat roll off to the left front of his loader, and he thought that he may have felt a bump. He immediately stopped and exited the loader and saw the victim on the ground. The equipment operator immediately called the office. The owner of the scrap Blazer walked over and saw the incident scene and called 911. The EMTs responded and arrived at the site within minutes, but the victim was pronounced dead at the scene.

Post-incident examination of the front-end loader determined that the loader mirrors and glass were relatively clean and properly adjusted. The horn and back up alarm were operational. One of the OSHA photos showed that the front-end loader's windshield had a crack.

The seat air compressor broke several months before the incident, and the seatbelt was not operable either. The equipment operator informed management about the broken seat and the seatbelt months before the incident, but no repairs were done. The operator found a cook pot three months prior to the incident and had used it as a



Photo 2. The loader operator's adjustable seat was broken, and the operator used a cooking pot as a booster seat (Photo courtesy of OSHA).



Photo 3. The front-end loader operator's view was blocked by the scrap car that had the tinted windows. There was a crack across the loader's windshield (Photo courtesy of OSHA).

booster seat (Photo 2). The operator was sitting on the pot while driving the loader during the incident.

The OSHA compliance officer was able to recreate the operator's view at the time of the incident with the loader carrying the Blazer three feet above the ground (Photo 3). A large area of obstructed view was observed in the front of the loader from the operator seat. The obstructed view area was created by the Blazer with tinted windows. OSHA measured the Blazer dimensions as 172" L X 73" W X 61" H.

Based on the video and the witness' account, OSHA concluded that the loader was travelling at a "prudent speed". OSHA observed that there were two areas that appeared to be brushed clean: one on the bottom of the scrap car and the other on the bottom of the backrest of the forks on the left side. There were also dust smear marks on the left rear tire of the front-end loader. From the position and condition of the victim's body, along with markings observed on the loader and the scrap car, OSHA postulated that the yard worker was first struck and knocked to the ground before being run over by the left rear tire of the loader.

CAUSE OF DEATH

According to the death certificate, the cause of death was severe blunt trauma.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. The NY FACE investigation identified the following key contributing factors in this incident:

- The scrap car carried by the front-end loader blocked the operator’s view.
- The front-end loader had to travel in the same area where workers were walking due to equipment maintenance.
- Walking paths for ground workers were not demarcated and protected.
- Workers were exposed to yard traffic daily.
- Changes in scrap yard operations that affected traffic patterns were not communicated to workers.
- No standard communication procedure between ground workers and equipment operators was established.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should establish a standard procedure for equipment operators to follow when they have to operate front-end loaders with an obstructed view.

Discussion: Equipment operators have blind spots around heavy mobile equipment where they cannot see by direct line of sight or by using rear or side mirrors due to the size and configuration of the equipment. Front-end loaders, such as the one in this case, carry loads of varied sizes and shapes which can further obstruct the equipment operators’ view. Employers should establish a standard procedure for equipment operators to follow when they have to operate heavy mobile equipment with an obstructed view.

To effectively protect workers on foot, a signal person or a spotter can be assigned to monitor the blind spots around heavy equipment or vehicles. However, without a clearly established communication procedure and proper training, spotters themselves can be at risk for serious injuries or even deaths. Employers should ensure that spotters and equipment operators agree on hand signals before equipment or vehicles start moving and maintain visual contact at all times until the equipment or vehicles stop. Equipment operators should stop the equipment immediately if they lose sight of the spotter. Spotters should wear high-visibility clothing. They should not have additional duties while they are acting as spotters. Nor should they use personal mobile phones, headphones, or other devices which could pose a distraction to spotting duties.

Recommendation #2: Employers should consider using additional technologies, such as proximity sensors, to help mitigate heavy equipment-pedestrian interaction hazards and prevent serious worker injuries.

Discussion: Metal recycling workers are exposed to high ambient noise in scrap yards where heavy equipment sort, crush, compact, and move scrap metal. Traditional alerting devices such as auditory alarms may fail to alert workers who might be desensitized and suffer “safety alarm fatigue”. This desensitization often causes workers to take longer time to react or completely fail to react when in an imminent danger situation. The victim, who did not wear ear plugs in this case, did not hear the front-end loader approaching from behind and was fatally struck.

Employers should consider using additional technologies, such as proximity sensors, to protect workers on-foot from being struck by heavy equipment. Proximity sensing technology uses infrared, radio frequencies, Bluetooth, and specialized lasers to detect the presence of an object, machinery, or person within preset proximity boundaries. Sensors can be mounted on heavy equipment and worn by workers so that equipment operators can be alerted immediately once a worker enters a hazardous area. Additionally, these sensors can be connected or attached to part of a machine which can automatically cut off energy sources to reduce risk of contact injuries.

A centralized proximity sensing system, which can monitor different scrap yard operations and send signals to a central platform, can alert management as soon as a hazard situation occurs. Employers should review the layout of yard operations, map out traffic areas, design and designate safe travel routes for pedestrians and workers on foot, and identify proximity boundaries for high hazard areas. All the information should be considered and incorporated into designing the centralized sensing system to ensure a quick detection and rapid response so that serious worker injuries associated with heavy equipment hazards can be prevented.

Recommendation #3: Employers should implement a heavy mobile equipment safety program to protect metal recycling workers from suffering serious struck-by and caught-between injuries.

Discussion: Workers at this recycling center were exposed to both mobile equipment and delivery traffic hazards daily. A mobile equipment safety program should be developed and implemented to prevent mobile equipment or vehicle related incidents. Employers may incorporate the following control measures in the

program:

- Designate the mobile equipment and vehicle travelling routes and pedestrian paths based on the traffic hazard evaluation.
- Use devices such as concrete barriers or longitudinal channeling devices, to keep the mobile equipment, delivery vehicles, and workers within the demarcated routes or areas. Use of such devices can positively prohibit workers from accidentally or purposely entering and across the traffic area.
- Survey the yard to identify blind spots created by piles of scrap materials, stationary equipment, or buildings and install traffic mirrors and warning signs at these blind spots.
- Provide additional restrooms and breakrooms adjacent to work areas so that workers do not have to walk across the yard traffic to use these facilities.
- Reduce traffic hazards through coordinating breaks for different departments and warn operators of the pedestrian traffic during breaks.
- Establish a standard communication procedure between a pedestrian worker and an equipment operator.
- Alert both workers-on-foot and equipment operators when normal work areas or traffic routes are disrupted, closed, or relocated, determine how pedestrian traffic might be affected, and establish a contingency plan for workers to travel safely in the yard.
- Perform routine inspection and maintenance on traffic-control devices to ensure that all devices are in working condition.

Recommendation #4: Employers should provide training to both ground workers and equipment operators to ensure that all workers strictly follow the mobile equipment safety program.

Discussion: Mobile equipment used in scrap yards, such as front-end loaders, shears, scrap handling grapples and magnets, all have blind spots around them that cannot be directly observed by equipment operators. The view of the equipment operator in this case was further obstructed by the scrap car carried by the loader. Employers should provide training to both ground workers and equipment operators so that they are aware of equipment blind spots and familiar with the key elements of the mobile equipment safety program.

Ground workers play a key role in preventing injuries and deaths caused by mobile equipment. Employers should ensure that the ground workers strictly follow the following safety precautions:

- Never use mobile devices while walking across a yard, or near mobile equipment. Take the time to look around and scan surroundings to avoid unexpected incidents.
- Always stay on designated walk paths within the boundaries. Never take hazardous shortcuts and always follow safety protocols.
- Never distract equipment operators and keep a safe distance near active equipment.
- Never assume that equipment operators can see you until you receive direct positive communication signals from them.

Both equipment operators and workers on foot should strictly follow the communication protocols when encountering mobile equipment: Operators should sound a horn before starting the equipment, and ground workers should establish direct communication with equipment operators either through electronic communication devices, by hand signals, or through verbal speech, if possible. If an operator loses sight of a ground worker, the operator should stop the equipment immediately until visual contact is resumed. Ground workers should not approach mobile equipment without communicating and receiving positive feedback from the operator.

Recommendation #5: Employers should develop and implement an equipment inspection program to ensure that front-end loaders are inspected daily and needed repairs and maintenance are done in a timely manner.

Discussion: The front-end loader in this case had a broken seat and cracked windshield; both affected the equipment operator's ability to see. If a piece of equipment becomes damaged or malfunctions, it should be removed from service immediately. Employers should ensure that all equipment operates without missing or broken parts.

Employers should develop an equipment inspection program to ensure that front-end loaders are inspected at

the beginning of each shift or on a daily basis. An inspection checklist should be developed, and a system of recording and reporting for identified issues and needed repairs should be established. Equipment with broken or missing parts should be taken out of service immediately. The equipment should not be returned to service unless the repairs are completed.

Recommendation #6: Employers should establish a safety and health management system (SHMS) to effectively control and reduce workplace hazards, risks, and injuries.

Discussion: Employers cannot successfully implement individual safety and health programs successfully without the backing of a SHMS. Although the metal recycling company in this case had developed OSHA-required safety and health programs at the corporate level, the program implementation was not consistent across recycling centers.

Without a SHMS, the approach to injury prevention tends to be reactive. Problems are addressed only after a worker is injured or becomes sick, a new standard or regulation is published, or an outside inspection finds a problem that must be fixed. Finding and fixing hazards before they cause injury or illness is a far more effective approach, which can only be achieved through implementing a SHMS. In addition to better worker protection, an effective SHMS also improves productivity, product quality, workplace morale, recruitment and retention, and company image and reputation among customers and in the community.

Guidelines for setting up a SHMS are recommended by OSHA and are outlined in several major consensus standards such as ANSI Z10 and ISO 45001. Employers should incorporate key elements such as management leadership, employee participation, worker participation, hazard identification and assessment, hazard prevention and control, education and training, and program evaluation and improvement into their SHMS.

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INVESTIGATOR INFORMATION

This investigation was conducted by NY FACE, Bureau of Occupational Health and Injury Prevention, Center for Environmental Health, New York State Department of Health.

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