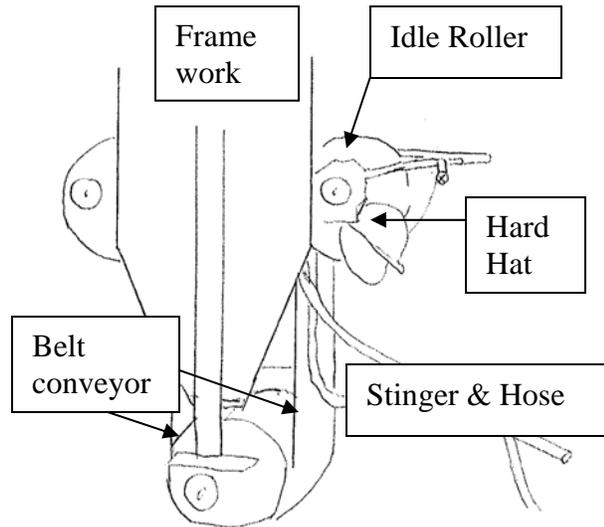


MIFACE INVESTIGATION REPORT: #08MI003

SUBJECT: Steel Mill Supervisor Pulled From Catwalk by Contact with Belt Conveyor

Summary:

On January 11, 2008, a 39-year-old male steel industry supervisor died when he was pulled from a catwalk, struck against a conveyor system support structure and fell to the floor below. The decedent was pulled from a catwalk located approximately 11 feet above the floor when the air hose to the 10-foot long metal pipe (stinger) he was using to blow debris from a nearby non-operational conveyor table and rollers located parallel to the catwalk caught between a belt conveyor and an idle roller. He struck the framework at the mounting point of the belt conveyor tension roller and fell to the floor below (Drawing 1). The unguarded belt conveyor was located 72 inches above the catwalk and then turned downward from above the catwalk 25 inches away from the 42-inch standard rail of the catwalk (Figure 2). Facing the non-operational conveyor, with the stinger/air line placed over his shoulder, he passed under the belt conveyor and its idle roller, which was located behind him. It appeared that the stinger/air hose became entangled in the belt conveyor's idle roller, drawing the decedent over the catwalk handrail where he struck against the framework supporting the belt conveyor and its tension roller. The decedent then fell to the floor. The air hose and stinger, his hard hat and his respirator were found jammed between the framework and the tension roller. One of the crewmembers standing in another area of the building looked in and saw him lying on the floor. Another crewmember used the decedent's radio to call for help. Because of the excessive noise in the building, it was necessary for this coworker to exit the building to summon help. Another crewmember ran for help. The company's emergency response personnel were the first to arrive and began emergency treatment. The city fire department rescue squad was the next to arrive. After the fire department called in the decedent's condition to a local hospital, he was declared dead at the scene.



Drawing 1. Belt conveyor drawing illustrating resting point of decedent's hard hat and location of stinger/air hose

RECOMMENDATIONS

- Employers should provide guards on conveyor belts at all in-running nip points where employees may be at risk of contacting moving/rotating parts.

- Company safety management should develop a risk assessment protocol for prioritizing work orders that concern safety issues.
- Employers should ensure all workers are trained to recognize and avoid hazards in the workplace.
- Employers should determine if there are feasible alternative methods to using compressed air to clean conveyor systems.
- Employers and workers should work towards developing a “positive” safety culture for their workplace.
- Employers should ensure that personal protection program policies are followed.

INTRODUCTION

On January 11, 2008, a 39-year-old male steel industry supervisor died when he was pulled from a catwalk, struck against a conveyor system support structure and fell to the floor below. On the same day as the incident, MIFACE investigators were informed of this work-related fatality by the Michigan Occupational Safety and Health Administration (MIOSHA) personnel, who had received a report on their 24-hour-a-day hotline. On January 14, 2008, MIFACE interviewed one of the company’s safety engineers and union’s health and safety representative at the company headquarters. The safety engineer and union representative escorted the MIFACE researcher to incident site. The safety engineer permitted MIFACE to take pictures of the incident scene. During the course of writing this report, the police report and pictures, death certificate, medical examiner report, and the MIOSHA file and citations were reviewed. Figures 1, 2, and 3 were taken by the MIFACE researcher at the time of the site visit. MIFACE made several attempts to obtain permission to incorporate into this report pictures taken at the scene by company personnel and responding police. Permission was denied by both entities. As a result, the MIFACE researcher developed a drawing to illustrate the resting location of the decedent’s hard hat and stinger with hose (Drawing 1).

The company for whom the decedent worked was an integrated steel mill. The company employed approximately 2,100 people throughout the facility. The department in which the decedent worked had approximately 330 individuals. The safety engineer indicated that there were 10 employees with the same job classification, as the decedent: supervisor. The decedent was a full-time salaried employee. He had worked at the company for approximately 17 years. He was a union employee for six years, and then transferred to supervision. His eight-hour, third-shift workday began at 12:00 a.m.

All work shifts at the mill had a safety engineer(s) assigned to provide services. All safety engineers reported to the safety director. Each building on site had a joint health and safety committee, composed of the upper level management (such as the building supervisor) and the union. The joint health and safety meetings were held on a weekly basis. The firm had individuals assigned to production areas to identify safety issues. Once identified, work orders were generated to correct the identified problems, and given a priority level by the safety department. Once the work order was placed and prioritized, the maintenance manager and a planning group ordered parts, materials and determined

man-hours to correct the issues. The planning group followed the requisitions to completion. The safety department reviewed the priority list weekly.

Crew supervisors conducted daily safety meetings with employees prior to handing out job assignments. Company safety policy assigned safety responsibilities on the floor to crew supervisors. The decedent had received training prior to the job assignment and was considered adequately trained for the job by MIOSHA. MIOSHA determined that the company's health and safety program and policies were partially implemented.

The decedent was wearing the required protective clothing: hearing protection, eye protection, leather gloves, steel-toed/metatarsal boots, respiratory protection, hard hat, and fire retardant clothing. In addition, he was wearing a winter cap liner under his hard hat.

At the conclusion of its investigation, MIOSHA General Industry Safety and Health Division issued the following Serious citations citing General Industry Safety Standard, Part 14, Conveyors:

- Rule 1442(2): No guard, nip point at tension pulley, belt conveyor.
- Rule 1421(7): Belt conveyor passing over catwalk did not have pan or screen type guard with built up side.

INVESTIGATION

The decedent and his crew began their 8-hour shift at 12:00 a.m. Due to a prior incident that kept them from their normal job duties they were given odd jobs so that they would not be laid off. The five-person crew was waiting in a break room for a job assignment. The incident site was a building supplying raw iron ore materials to the blast furnace via a network of conveyor belts and hoppers spanning several stories. The charger room in the building needed cleaning. At approximately 1:30 a.m., the building supervisor assigned the decedent and his crew to clean the charger room including blowing fines and other debris from a conveyor table and rollers. At this time, he informed the crew that respirators would be necessary.

The charger room was poorly lit. The conveyor table and rollers that required cleaning was approximately 150 inches

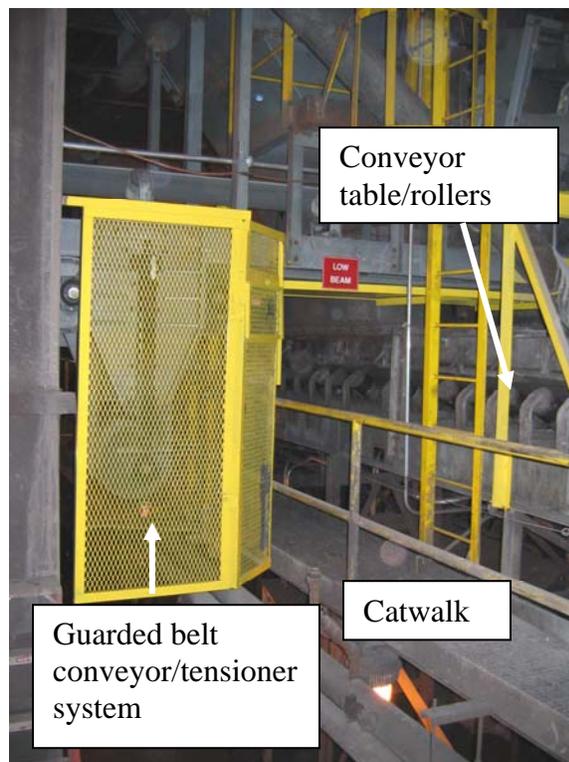


Figure 1. Overview of work area

above the charger room floor. Access to this conveyor was provided by stairs leading to a catwalk that ran parallel to the conveyor table/rollers. The catwalk was approximately 132 inches above the floor. The catwalk had a standard 42-inch barrier (Figure 1). The belt conveyor into which the decedent was pulled was 22 inches wide. This conveyor first traveled parallel to the catwalk and then turned and traveled in a perpendicular direction above the catwalk. At the location where the catwalk passed under the belt conveyor, a warning sign identified a low beam approximately 66 inches above the catwalk. At the low beam area, the tensioner for the belt conveyor turned downward from above the catwalk. The tensioner system was 25 inches from the catwalk rail (Figure 2). At the time of the incident, the belt conveyor and tensioner system was unguarded.

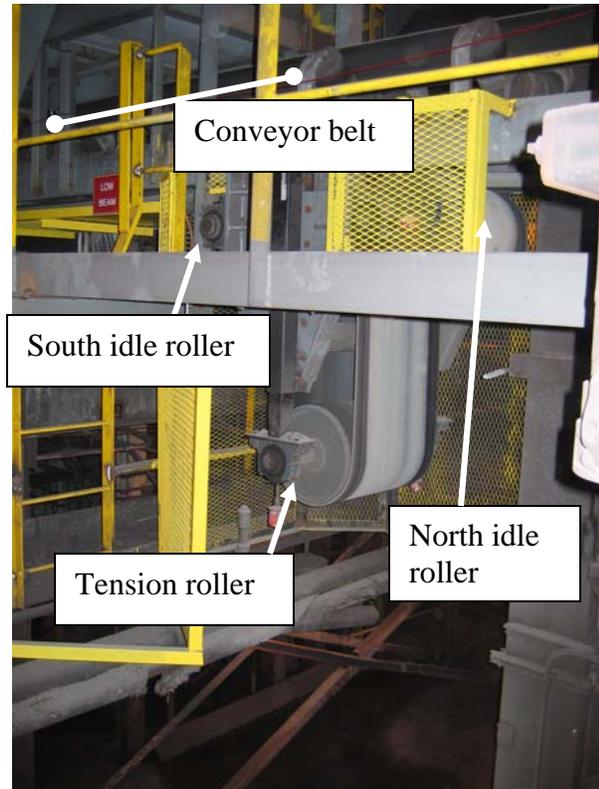


Figure 2. Conveyor belt tensioner system and catwalk work area

There were two idle rollers above and on each side of the tension roller. The north idle roller was involved in the incident. The tension roller was located at the bottom point between the two idle rollers. The tension roller was adjustable for the amount of slack created when the conveyor belt stretched.

Upon arrival on the charger room floor, the building supervisor gave additional instructions to the decedent concerning the work to be performed. According to documents in the MIOSHA file, the building supervisor indicated that the belt conveyor could be turned off, but doing so would shut down the entire system. The decedent indicated that



Figure 3. Tornado heater with example of stinger resting on top

it would not be necessary to turn off the belt conveyor because the crew would not be near the tensioner. The building supervisor accompanied the crew to the area where the conveyor and catwalk were to be cleaned of coke rocks and debris. The building supervisor then shut off the conveyor table to be cleaned but left the belt conveyor operational. Because of the time of year, the tornado heaters being used to heat the building were contributing to the noise level in the building (Figure 3).

The decedent and his crew had used stingers in the past as a part of their normal job duties, but had not used stingers in the past to perform cleaning operations. A stinger was a 10-foot long pipe with a valve attached to a one-inch diameter compressed air line. The decedent was first to use the stinger to blow debris from the conveyor table/rollers. He started the cleaning process at the west side of this conveyor. He cleaned approximately 10 to 15 feet of the conveyor creating excessive amounts of dust. He left the area to procure a respirator.

The crew took turns, each lasting approximately 15 minutes, blowing off the conveyor table/rollers, from one end to the other. The cleaning procedure most likely was performed by moving the stinger in a back and forth motion. While the conveyor table/rollers were being cleared of debris, two crew members picked up the coke rocks/debris on the catwalk. During this time, the decedent returned with his respirator. They continued blowing off debris from the conveyor causing a large cloud of dust that limited visibility. After the task was about half finished, the two crewmembers who were not using the stinger exited the charger room to stand on the other side of a doorway. One crewmember left for a nearby break room due to the level of airborne dust. The fourth crewmember had taken over the stinger and was working with the decedent on the catwalk. As they approached the area of the belt conveyor/tensioner system, they could not clean any further because the air hose would not reach any further. The crewmember handed the stinger to the decedent and descended the stairs to shut off the air. The decedent disconnected the air hose and dropped the end down to him to reconnect to a different air supply point. The worker who turned on the air went back up to the catwalk. The decedent signaled to him that he was going to continue to clean the conveyor table for a while. The fourth crewmember left the area.

The incident was unwitnessed. It appeared that as the decedent passed under the low beam and conveyor belt with the stinger/air hose unit on his shoulder, the air supply hose and/or stinger were caught in the conveyor belt/tensioner north idle roller. The movement of the belt caused the hose and stinger to be pulled between the conveyor belt and idle roller. Unable to react quickly enough, the decedent was also pulled from the catwalk and struck the structural support of the tensioner system. The decedent struck the support with sufficient force to wedge his hardhat between the tension roller and support framework before his body dropped over the railing to the floor below.

After an unknown period of time, one of the crew who had been standing on the other side of the door looked through the door window and saw a pile of "greens" on the floor. The crewmember entered the charger room and looked up to the catwalk to locate the decedent but did not see him. Upon looking back down to the floor, he saw that the

decedent had fallen and was lying face down. The air hose and stinger was found between the conveyor belt and the tension roller at the topside of the tension roller. The stinger was bent around the roller and several feet of hose was looped under the conveyor belt north of the roller. The air hose shut-off valve was bent. The decedent's hardhat was caught between the east edge of the idle roller and support frame with his helmet liner and respirator hanging from the hard hat.

One of the crewmembers used the decedent's radio to call for help. Because of excessive noise in the building, he had to exit the building to summon help. Another crewmember ran for help. The company's emergency response personnel were the first to arrive and began emergency treatment. The city fire department rescue squad was the next to arrive. After the fire department called in the decedent's condition to a local hospital, he was declared dead at the scene.

CAUSE OF DEATH

The cause of death as listed on the death certificate was multiple injuries. The toxicology report was negative for alcohol and screened drugs.

RECOMMENDATIONS/DISCUSSION

- Employers should provide guards on conveyor belts at all in-running nip points where employees may be at risk of coming into contact with moving/rotating parts.

Although not required to be shut down and locked out, the fatal incident could have been prevented if the unguarded conveyor/tensioner system had been shut down and locked out prior to beginning the cleaning operation. Because of the ever-present danger of entanglement when working near unguarded moving machinery components, employers should continually strive to protect employees by providing machine guarding in the areas where work is actually performed. The decedent, while cleaning the conveyor table/rollers with the 10-foot stinger apparently contacted the adjacent belt conveyor, which had no guarding to prevent contact with the conveyor's belt/tensioner system. The in-running nip point formed by the belt tensioner system was just 25 inches away from the catwalk that was designed to provide access to both Conveyor A and Conveyor B. As the stinger/air hose became entangled, he was unable to release the stinger before he was pulled into the conveyor system. A guard that prevented inadvertent contact with the moving conveyor belt would have prevented the decedent from coming into direct contact with the adjacent conveyor's belt. An interlock to interrupt power to the conveyor when the guard is disabled would provide additional safety.

Machine guarding is required by MIOSHA General Industry Safety and Health Safety Standard, Part 14, Conveyors, Rule 1442 (2): *A nip point at a pulley shall be guarded by an enclosure or barrier constructed to prevent access by an employee's body members or loose clothing.* After the incident, the employer had installed a fixed metal guard to shield the area and prevent employee contact with the conveyor belt/tensioner system (Figures 1

and 2). The guard was designed and installed so an employee could not reach behind it and get caught in the in-running nip point.

- Company safety management should develop a risk assessment protocol for prioritizing work orders that concern safety issues.

In this incident, according to persons interviewed by the MIFACE researcher, the lack of guarding on the adjacent conveyor had been previously brought to management's attention. The safety engineer indicated that the company did not have a formal prioritization metric to address identified risks posed by identified safety concerns. A formal risk assessment procedure would address this issue.

In addition, the metric should include a report back to the safety department that the control measure(s) have been implemented for identified safety concern(s).

No company has the resources to address and institute control measures for every safety issue and its associated risk simultaneously. Because of this limitation, ranking or prioritizing hazards is one way to help determine which hazard is the most serious and thus which hazard to control first. Although newly identified safety concerns may change the priority of control action(s), companies should ensure that previously identified safety concerns are addressed and controlled in a timely fashion, not continually moved lower on the list of priorities.

- Employers should ensure all workers are trained to recognize and avoid hazards in the workplace.

The building where the incident occurred was not the decedent's normal work area. The task the decedent was performing was not his usual task. Due to the decedent's unfamiliarity with both the building and the task, he may not have recognized the hazard posed by the unguarded operational belt conveyor/tensioner system. According to the MIOSHA file, the operational conveyor location was pointed out to him by the building supervisor. Due to his unfamiliarity with the building and task, the decedent may not have wanted to interfere with production or may have been under the impression that the distance between the tensioner system and the catwalk platform was adequate for the crew to safely perform the conveyor table/roller cleaning process without fear of becoming entangled in the belt of the adjacent conveyor.

MIOSHA determined that the decedent (a supervisor) had been adequately trained in lockout/tagout. The lockout/tagout (LOTO) program at this company did not cover the decedent and his work crew's operation, because they were not performing maintenance, inspection, cleaning, adjustment, or servicing of the belt conveyor/tensioner system into which he was pulled.

Employers should continually stress the importance of hazard recognition, avoidance, and control. The company health and safety program should contain a section regarding conducting a job hazard analysis for existing and new work procedures, and for providing

employee job hazard analysis training. A job hazard analysis is a procedure used to review each job, identify potential hazards, and design actions and procedures to eliminate or control the hazards. Of primary importance is the recognition that hazards exist. Company policies and training should be implemented based upon the findings of the job hazard analysis.

- Employers should determine if there are feasible alternative methods to using compressed air to clean conveyor systems.

The work process entailed using compressed air to blow the debris off of the conveyor system. This operation generated high levels of airborne dust, as noted in the interview statements of the decedent's coworkers. The operation also required the use of a respirator, as specified by the building supervisor. The levels of airborne dust created at least two hazards for the work crew: the need for respiratory protection and decreased visibility. Decreased visibility, in conjunction with a poorly lit building may have been a factor in this incident. The decedent may not have known where he was positioned in relation to the unguarded belt conveyor.

An alternative method for capturing the coke debris from the conveyor and catwalk would have been to vacuum the debris. Vacuuming would reduce the airborne dust level, potentially eliminating the requirement for respiratory protection, as well as providing an opportunity to recycle the coke debris. There are several manufacturers with portable or chassis-mounted mobile industrial vacuum systems with holding capacities ranging from 3 cubic yards to 18 cubic yards.

- Employers and workers should work towards developing a "positive" safety culture for their workplace.

During the MIFACE site visit, union representation was present with management, and it was apparent that there was not a good working relationship between the union and management personnel. The MIFACE observation was confirmed when the police report was reviewed. The coworker interview statements in the police report indicated that there was not a good rapport between management and union workers.

The adversarial relationship appeared to inhibit effective communication between safety management and the union. The union representative indicated that the belt conveyor/tensioner system had been previously identified as requiring a guard. The firm's management and union must work cooperatively to address safety concerns. When promoting safety, it is important to not just "talk the talk" of safety. Management and union together must "walk the walk," for example, implement appropriate safety programs, act on identified safety concerns, and appropriately train individuals to identify hazards. When working together to "walk the walk," the actions taken can help to establish the credibility of the commitment to safety, laying a foundation for a more positive relationship with all employees.

- Employers should ensure that personal protection program policies are followed.

The decedent was wearing a tight-fitting half-mask negative pressure respirator. Although the decedent was clean-shaven, the MIOSHA file indicated that other crewmembers had beards. MIOSHA Occupational Health Standard, Part 451, Respiratory Protection adopted by reference the federal Respiratory Protection standard, §1910.134. §1910.134(g) requires employers to establish and implement procedures for the proper use of respirators. These requirements include prohibiting conditions that may result in face piece seal leakage. §1910.134(g) states that employers shall not permit respirators with tight-fitting face pieces to be worn by employees who have:

- Facial hair that comes between the sealing surface of the face piece and the face or that interferes with valve function.
- Any condition that interferes with the face-to-face piece seal or valve function.

REFERENCES

MIOSHA standards cited in this report may be found at and downloaded from the MIOSHA, Michigan Department of Energy, Labor & Economic Growth (DELEG) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Energy, Labor & Economic Growth, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

- MIOSHA General Industry Safety Standard, Conveyors, Part 14.
- MIOSHA Occupational Health Standard, Respiratory Protection, Part 451.
- MIOSHA General Industry Safety, Lockout/Tagout, Part 85.
- Carrillo, R.A. *Breaking the Cycle of Mistrust to Build a Positive Safety Culture*. Occupational Hazards, July 29, 2004. Internet Address: http://www.occupationalhazards.com/Issue/Article/37126/Breaking_the_Cycle_of_Mistrust_to_Build_a_Positive_Safety_Culture.aspx
- Machine Operator Crushed in Conveyor Belt in California. California FACE Report #92CA004. Internet Address: <http://www.cdc.gov/niosh/face/stateface/ca/92ca004.html>
- Rewinder Operator's Assistant Crushed in Paper Rewinder Machine—Maryland. Maryland FACE 94MD057. Internet Address: <http://www.cdc.gov/niosh/face/stateface/md/94md057.html>
- Utilities Worker Dies After Being Pinned in a Pulpwood Belt Conveyor at a Paper Company. Wisconsin FACE 97WI097. Internet Address: <http://www.cdc.gov/niosh/face/stateface/wi/97wi097.html>

Key Words: Manufacturing, Machine, Belt Conveyor, Entanglement

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