MO FACE Investigation: 98MO064

Subject: PVC Blender-operator Crushed by Blinding Machine

Summary:

A 33-year-old blender-operator (victim) suffered a crushing injury when he entered part of the blending machine he was operating. The victim worked at a poly-vinyl-chloride (PVC) pipe manufacturing facility. His responsibility was to blend additives to the PVC product for certain types of pipe products. While operating the blending machine he noticed a problem with one of the thermocouples that monitor batch temperatures. He and another co-worker decided to replace the thermocouple with a new one. While the co-worker was working on replacing the thermocouple, the victim proceeded to another part of the blender unit, possibly to check another thermocouple. While the victim was partially inside this part of the blender, the unit activated. The victim was caught by the machinery and pulled into the unit. The victim helped extricate himself from the machinery. He was transported to a local hospital and life-flighted to trauma center where he received treatment, but he died the same night.

The MO FACE Investigator concluded that, in order to prevent similar occurrences, ALL employers should incorporate the following recommendations into their safety and health plans:

- ensure that written lock-out/tag-out procedures are developed, implemented and enforced to protect workers from hazardous energy;

- develop, implement, and enforce a comprehensive safety program which includes, but is not limited to, training of employees in hazard recognition and avoidance, and safe work policies including task-specific procedures;

- routinely inspect and test safety lock-out devices and switches on machinery. These devices should not be relied upon to replace a properly initiated lockout/tagout procedure.

Introduction:

On July 6, 1995, a 33-year-old blender-operator (victim) was fatally crushed when he entered a section of the blending machine he was operating. On July 7, 1995, the medical examiner's office and the area OSHA office notified the MO FACE Program. The MO FACE investigator traveled to the incident site and met with company officials and the OSHA investigator the same day. The MO FACE investigator returned on July 10, 1995, and completed interviews with company officials and interviewed witnesses, and viewed a reenactment of the incident. Photographs were taken of the incident site and the blender blades that caused the injuries to the victim.

The employer produces poly-vinyl-chloride (PVC)-type tubing used in plumbing and for electrical conduit. The company has been in business since 1954, and has been operating at this facility since 1973. The company has a safety coordinator, a safety and health committee, a joint labor/management safety and health committee, and a written safety and health plan. At the time of the incident, this facility employed 92 workers and employed 5 workers with the same job title as the victim. The victim received safety and health training and was trained and certified to operate the equipment. The victim had been with the company for 10 months and had worked as a blender operator for 7 months.

Investigation:

The employer is a poly-vinyl-chloride (PVC) pipe producer. They operate 7 days a week and run 12-hour shifts. On the day of the incident, the victim arrived for his scheduled shift and relieved the blender operator from the first shift. According to the employer and equipment log sheets, the equipment was operating normally.

The company takes bulk PVC product in bead form, blends in special additives and color for particular applications, then stores this blended product in storage silos located outside the production building. These silos feed the lines that produce the different sizes and types of tubular products. The blending is a multi-step process and involves several different pieces of machinery. The first step brings in the bulk PVC product into a compounder machine and measured amounts of the

additives are added to the product. This machine rapidly moves the product in a circular motion using convection to increase the product's temperature allowing it to bind with the additives. When the product reaches the given temperature it is released into a cooler unit. This unit uses blades to stir and cool the product before releasing it into the *take-a-way* process. Both of these machines and processes are time and temperature dependent.

The victim was operating the blending unit and was about to be relieved for a break by a co-worker. The victim noticed the temperature gauge for the compounding machine was not operating correctly. The victim stated to the co-worker that a bad thermocouple wire needed to be replaced. The co-worker then went to maintenance and retrieved new a thermocouple. The victim went to the control panel for the machine and put the machine into *batch stop mode*. This allows the machine to finish each step of the current batch and then shut down that process. When the co-worker returned, the victim was standing at the control panel. The new thermocouple did not have a plug end attached. The co-worker unplugged the faulty thermocouple and removed the plug end and placed it onto the new thermocouple. The supervisor states he then heard the belts of the cooler unit start to squeal.

For reasons unknown, the victim left the control panel and went to the cooler unit. He opened one of the cooler doors and with a flashlight may have peered inside the unit. The opening to the unit measured 17.5 inches by 15.5 inches. It consisted of a single door hinged at the top and secured at the bottom with two lever-type handles. The door was equipped with a lock-out safety switch. While the victim was looking inside, the machine activated, caught his arm and drug him in where another blade came down across his back.

The co-worker went to investigate the squealing belts and to see where the victim went. He did not initially see the victim while looking across the plant, but then turned around and saw the victim trapped in the cooler. He went to the cooler and saw the blade across the victim's back. He then went to the control panel and shut down all the stop buttons and shut the breaker off that supplied power to the control panel. The co-worker then ran to get help. He returned with the production supervisor who then checked the victim. The victim was breathing and the supervisor said he was going to go call 911. The co-worker stayed with the

victim and another worker came to help. They continually talked to the victim telling him not to move. The victim started moaning and moving and worked himself out from under the blade and out of the cooler. Emergency personnel started arriving and prepared the victim for transportation to the hospital. He was taken to the local hospital and then life-flighted to a trauma center where he was pronounced dead.

Re-Enactment:

In order to determine the exact chain of events leading up to this fatality, the company initiated an internal investigation into incident. They went to the blender unit and set the machine up just as it was on the day of the incident. While the machine was running in normal mode, they pressed the *batch stop button*. The componder then finished its cycle and released the product into the cooler, the componder door shut, and the compounder motor shut off automatically. The cooler then completed its cycle and released the product to the *take-a-way* unit, and it shut down automatically. The *take-a-way* unit also completed its cycle and it shut down automatically.

The thermocouple for the componder was then unplugged and the temperature gauge started to decrease to zero. When the temperature indicator read zero it started increasing. When it reached 240 degrees, the compounder door opened and the cooler activated.

The doors of the cooler, which allow access to the blades or plows, are equipped with lockout safety micro switches. These switches are on a threaded plunger. To open the doors to the cooler the plunger must be completely backed out and released. When the plunger is backed out, the microswitch opens, and the power to the machines motor is interrupted. This is what occurred during the re-enactment.

This same test was repeated on a second blending unit. In this instance the microswitch failed and the machine continued running.

It is believed that the micro-switch controlling the door that the victim was in failed, allowing the cooler to activate and the blades to start turning, crushing the victim.

Cause of Death:

Bunt Abdominal Trauma

Recommendation/Discussion:

The following recommendations are intended to educate all employers and employees on how similar occurrences, as the one discribed above, can be avoided.

Recommendation #1: Employers should ensure that written lock-out/tag-out procedures are developed and implemented to protect workers from hazardous energy. All workers should be trained in the procedure and document that they received this training. The lockout/tagout procedure should be followed each and every time maintenance is performed on any piece of equipment.

Discussion: The employer did have a written lockout/tagout procedure in place for this blender unit. It was discovered that the operators were under the impression that shutting off power to the control panel renders the machine inoperable. During the company's reenactment they found this not to be the case.

When the thermocouple was unplugged the temperature indicator started falling to zero, but after reaching zero it began climbing. When it reached 240 degrees it triggered an emergency over-heat cycle. This cycle bypasses all other switches on the control panel. The compounder door opened and the cooler motor started up, turning the blades that caught the victim.

Recommendation #2: Employers should develop, implement, and enforce a comprehensive safety program which includes, but is not limited to, training of employees in hazard recognition and avoidance, and safe work policies including task specific procedures.

Discussion: The employer did have written safety rules and policies including directions to lock out equipment when maintenance is to be performed. The workers may not fully understand what a lockout/tagout procedure is, does, or why it is important. The main power interrupt or breaker for this machinery is located in an electrical room a short distance away. It is important that each worker knows where the power interrupt is for the equipment they are operating, as well as, the importance of locking and tagging out equipment every time maintenance is performed.

Recommendation #3: Employers should routinely inspect and test safety lock-out devices and switches on machinery. These devices should not be relied upon to replace a properly initiated lockout/tagout procedure.

Discussion: In this incident it was found during the reenactment that some of the micro switches that interrupt the power supply to the cooler motor were not operable. If such devices are found to be inoperable, the machine should not be started until the appropriate personnel are contacted and necessary repairs made. This type of switch may have a tendency to stick when the plunger is backed out, remaining closed. Employers should follow manufacturer's guidelines for proper installation and maintenance of lockout safety devices.

The Missouri Department of Health, in co-operation with the National Institute for Occupational Safety and Health (NIOSH), is conducting this research project on work-related fatalities in Missouri. The goal of this project, known as the Missouri Occupational Fatality Assessment and Control Evaluation (MO FACE), is to show a measurable reduction in traumatic occupational fatalities in the State of Missouri. This goal is being met by identifying causal and risk factors that contribute to work-related fatalities. Identifying these factors will enable more effective intervention strategies to be developed and implemented by employers and employees. This project does not determine fault or legal liability associated with a fatal incident or with current regulations. All MO FACE data will be reported to NIOSH for trend analysis on a national basis. This will help NIOSH provide employers with effective recommendations for injury prevention. All personal/company identifiers are removed from all reports to protect the confidentiality of those who voluntarily participate with the program.

SIGNATURES:

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MO FACE Dissemination List

NIOSH
Alaska Department of Health and Social Services AK FACE Program
California Public Health Foundation CA FACE Program
University of Iowa IA FACE Program
Kentucky Injury Prevention and Research Center KY FACE Program
Massachusetts Department of Public Health MA FACE Program
Maryland Division of Labor & Industry MD FACE Program
Minnesota Department of Health MN FACE Program
Nebraska Department of Labor NE FACE Program
State of New Jersey Department of Health NJ FACE Program
Ohio Department of Health OH FACE Program
Oklahoma State Department of Health OK FACE Program
Texas Worker's Compensation Commission TX FACE Program
Washington Department of Labor & Industries WA FACE Program
Wisconsin Division of Health WI FACE Program
WVU School of Medicine WV FACE Program
Wyoming Department of Health
Missouri Southern State College
Missouri Department of Public Safety
Cuivre River Electric Company
University of Missouri
OSHA Kansas City Area Office
MIRMA
OSHA St. Louis Area Office
St. Joseph Safety Council
Missouri Safety Council
St. Louis County Department of Community Health
41st Judicial Circuit of Missouri
Cape Girardeau County Community Traffic Safety
St. Louis County Medical Examiner Office
AMEC
Missouri Police Chiefs Association
Children's Mercy Hospital
St. Louis City Medical Examiner Office
St. Charles Police Department
Grundy Electric Company
Jackson County, Office of the Medical Examiner
Shelter Insurance Companies
Missouri Hospital Association
Safety Council of Greater St. Louis
MO Department of Elementary & Secondary Education
Missouri Farm Bureau
Missouri State Labor Council
Empire District Electric Company
Department of Social Services
Mine Safety and Health Administration
Safety Council of the Ozarks
Stephens College

Missouri Department of Mental Health
Missouri Department of Labor and Industrial Relations
North Central Missouri Safety Council
Missouri Sheriff's Association
Missouri Attorney General's Office
Missouri Department of Agriculture
Safety and Health Council of Western Missouri & Kansas