NIOSH

FACE

Fatality Assessment and Control Evaluation Program

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Hispanic Youth Dies in Densifier at a Plastics Recycling Plant - Tennessee

Revised September 6, 2006 to correct the name of a web site.

SUMMARY

On March 9, 2005, a fourteen-year-old male Hispanic laborer (the victim) died from injuries sustained after coming in contact with the blade inside a Densifier. A Densifier is a machine used to shred and grind plastic bags into a recyclable product. During the night shift, while the seven other crew members, all Hispanic, were out of the immediate vicinity of the Densifier, the victim entered the machine. When the coworkers returned to the area, they were unable to locate the victim on the plant floor. A coworker looked into the machine and saw the victim inside. He called 911 and then called the plant manager at his home. Emergency Medical Service (EMS) personnel responded to the scene within 7 minutes. When the plant manager arrived, he turned off and locked out the external power source to the Densifier. EMS personnel, who entered the machine through a side access hatch by removing the fixed bolts, removed the remains of the victim. A coroner in attendance pronounced the victim dead at the scene.

Rotor blade located inside and at the bottom of the Densifier. [Photograph courtesy of TDLWD]

Fatality Assessment and Control Evaluation (FACE) Program

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), performs Fatality Assessment and Control Evaluation (FACE) investigations when notified by participating states (North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia); by the Wage and Hour Division, Department of Labor; or when a request for technical assistance is received from NIOSH-funded state-level FACE programs in Alaska, California, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Nebraska, New Jersey, New York, Oklahoma, Oregon, Washington, West Virginia, and Wisconsin. The goal of FACE is to prevent fatal work injuries by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact. FACE investigators evaluate information from multiple sources that may include interviews of employers, workers and other investigators; examination and measurement of the fatality site, and related equipment; and review of records such as OSHA, police, medical examiner reports, and employer safety procedures and training records. The FACE program does not seek to determine fault or place blame on companies or individual workers. Findings are summarized in narrative reports that include recommendations for preventing similar events in the future. For further information visit the FACE website www.cdc.gov/niosh/face or call toll free 1-800-35-NIOSH.

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

- ***establish a lockout/tagout program that, at a minimum, meets requirements established by the Occupational Safety and Health Administration (OSHA)***
- ***ensure that equipment is inspected daily and all defective equipment is removed from service until needed repairs have been made***
- ***develop, implement, and enforce a comprehensive written safety and health training program for all workers, including requirements for work in permit-required confined spaces, such as Densifiers***
- ***train workers in hazard recognition and safe work practices for all tasks to which they are assigned or allowed to perform, including those pertaining to work requiring lockout/tagout and work in a permit-required confined space. The use of the workers' primary language(s) and careful consideration of literacy levels will maximize worker comprehension of these subjects.***
- ***post warning signs in a language(s) that all workers can understand at entrances to each permit-required confined space, such as the top opening and the side hatch of the Densifier, warning of immediate danger and safety requirements for entry***
- ***consider retrofitting the Densifier with a barrier or guardrail to prevent workers from entering or falling into the top opening, installing appropriate guardrails around the operator platform, and placing standard railings on access stairways***
- ***establish work policies that comply with employment standards for 14-and 15-year-olds in nonagricultural employment. These requirements are published in Subpart C of Part 570 of Title 29 of the Code of Federal Regulations, Child Labor Regulation No. 3. Employers should communicate these work policies to all employees.***

INTRODUCTION

On March 9, 2005, a fourteen-year-old male Hispanic laborer (the victim) died from injuries sustained after coming in contact with the blade inside a Densifier (Photo 1). On March 16, 2005, the U.S. Department of Labor, Wage and Hour Division, notified the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR) of the incident. On March 23-24, 2005, a DSR Safety and Occupational Health investigative team met with a compliance officer and an Assistant Director of the U.S. Department of Labor, Wage and Hour Division, Southeast Region; and with a compliance officer of the Tennessee Department of Labor and Workforce Development (TDLWD), Division of Occupational Safety and Health. Findings from the compliance officers' investigations were reviewed, along with the police report of the incident and the assistant coroner's report. On March 23, 2005, the DSR team made a site visit to the plant and discussed the incident with the plant manager and the employer's workers' compensation specialist. None of the coworkers who were working during the incident were available for interview. The DSR team

Photo 1. This photo illustrates the Densifier in which fatality occured. The rotor blade is located inside the Densifier and its approximate location is marked with an X. [Photograph courtesy of TDLWD].

was allowed to view the incident scene at a distance, but was not permitted to take measurements or photograph the area. Photographs and measurements taken by TDLWD were used in this report.

The employer began operations at the plastics recycling plant on December 2, 2003. The company employed 31 people at the time of the incident. Twenty-nine were Hispanic and spoke primarily Spanish. Two employees, the plant manager and the mechanic, spoke only English. No one working at the plant at the time of the investigation was bilingual. According to the plant manager, the company had employed an office worker who was bilingual, but she left the company two weeks before the incident.

According to the TDLWD compliance officer, the company's general safety program was deficient in several areas. There was no permit-required confined space safety program, and the hazardous energy program (lockout/tagout) in place at the time of the incident was not machine specific for this facility.

The bilingual office worker had conducted the company safety training. This training involved translating the safety pamphlets on general lockout/tagout procedures, work place safety, and forklift operations. The instructor had reportedly not received any formal training in these areas herself. There was no documentation of training.

The victim, who was hired five days prior to the incident, received no training. He presented a social security card and an alien registration card attesting that he was 19 years old. Following the incident it was discovered, through the police investigation of the incident, that the victim's reported social security card number corresponded to the number from an individual who died in 1987, and the victim's alien registration card was attributed to an individual from Honduras. The victim's correct age was 14. This was confirmed by his birth certificate obtained after his death from a family member. This was the employer's first workplace fatality.

INVESTIGATION

The incident took place at a plastics recycling plant that produced 50 million pounds of high density polyethylene annually. The main process at the plant consisted of converting discarded plastic bags into plastic pellets, which were then sold to various industries. The conversion occurred when the plastic bags were introduced into the Densifier via a conveyor belt powered by a 1 horsepower

motor. The conveyor belt was approximately 24 inches wide with an angled metal guard on either side to prevent the plastic bags from falling off the belt. When the plastic bags reached the end of the conveyor belt, they fell through the top opening of the Densifier. The combination of the sheering action of the blade and the heat produced from the motion converted the plastic bags into pellets that were discharged through a side chute. The pellets were moved through pneumatic conveyors to a collection point where they were bagged and stored on pallets.

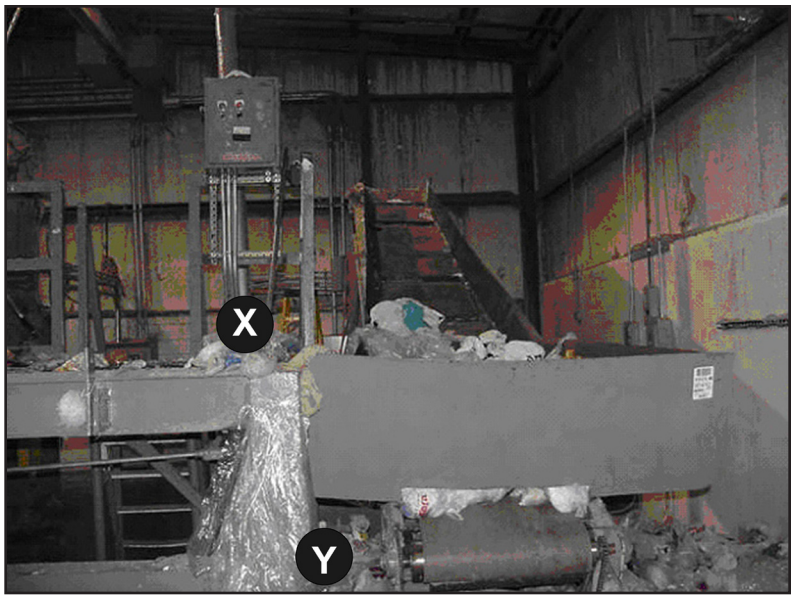


Photo 2. This photo illustrates the operator platform for the Densifier and the conveyor over which plastic bags traveled to enter through the top opening of the Densifier. The Densifier is not visible because it is positioned behind and under the top of the conveyor. An X indicates the platform on which the machine operator stands while operating the machine and monitoring the flow of plastic bags over the conveyor. A Y indicates the usual location of the worker loading the conveyor (victim's usual location). [Photograph courtesy of TDLWD].

The Densifier was reportedly manufactured 30 years ago. The employer did not have an operator's manual for the machine. It consisted of a large steel drum with an 18 by 26 inch opening in the top of the Densifier. The Densifier body was approximately 5 feet in height and approximately 3.5 feet in diameter. The distance from the top of the Densifier opening to the plant floor was approximately 8.5 feet. A 3 foot diameter direct drive rotor blade which traveled at 1750 rotations per minute revolved at the base inside the Densifier and was powered by a 250 horsepower motor. There was a hinged hood over the top opening that could be retracted to gain access to the interior of the Densifier from above. The hood was not used as a guarding method for the opening. It was used to keep the plastic bags from being thrown upward during plastic bag shredding operations. According to the TDLWD compliance officer, the conveyor belt was wide enough for a single worker to walk on to reach the top of the Densifier. The controls for the conveyor belt and Densifier's spinning internal rotor blade were located to the side of the machine and were accessed by an operator who stood on an elevated platform. The platform was approximately 56 inches wide at the front of the platform and 4.5 feet above the plant floor. There were no standard guardrails at the front of the platform (Photo 2). The control panel for the Densifier consisted of push start/stop buttons and an emergency shutoff button for the blade. There was an on/off switch mounted on a pole near the operator station which controlled power to the conveyor belt. A sign was observed on the Densifier's control panel that read in English, "Only Authorized Personnel Can Operate this Machine." There was no Spanish translation provided. Power to the Densifier ran through a fuse box mounted on the wall adjacent to the machine (Photo

3). The machine was designed to be operated by two people. One worker (the loader) stood at the base of the conveyor belt and threw the plastic bags over a guard onto the conveyor belt. The role of the second person (the operator) was to turn the conveyor belt on and off, to push the start and stop buttons that control movement of the blade, and to ensure smooth flow of raw materials into the Densifier. The victim was employed as a loader.

Photo 3. This photo illustrates the energy source to the Densifier which was de-energized and locked out before EMS personnel entered the Densifier to remove the victim's remains [Photograph courtesy of TDLWD].

There was a side access hatch leading to the interior of the Densifier that was covered and secured with bolts (Photo 4). There were no signs or placards observed on the Densifier warning that it was a permit-required confined space and that special operating procedures were required for authorized entrance. According to the company's mechanic, this side opening was designed as a sole entrance into the Densifier for its

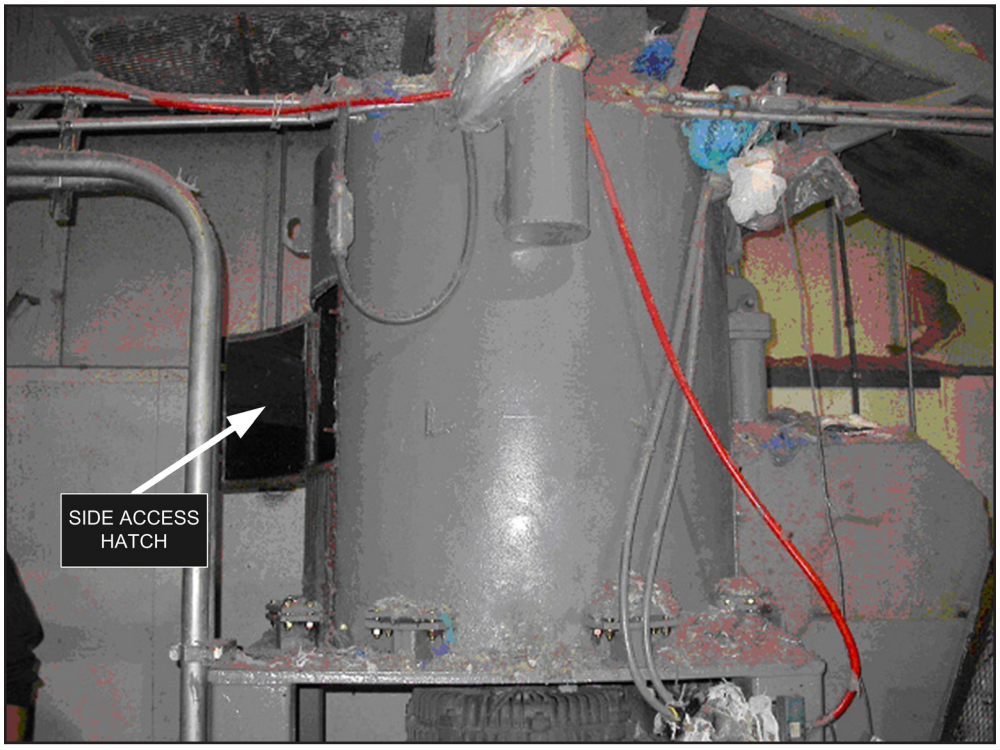


Photo 4. This photo illustrates the side access hatch that should have been used by appropriately trained workers to gain access to the interior of the Densifier to perform maintenance and repair. [Photograph courtesy of TDLWD].

maintenance, but it was frequently entered from the top when the rotor blade jammed. According to the TDLWD compliance officer, there was a 4 riser stairway at the rear of the Densifier leading to this hatch. Standard railings were not installed on the stairway.

The incident was unwitnessed. It occurred at approximately 4:45 a.m. on March 9, 2005, when the plant was being operated by a workforce of eight Hispanic workers. The Spanish speaking police officer who investigated the scene on the morning of the incident was reportedly told by the Hispanic coworkers that they had not seen or heard anything. One coworker said he saw the victim's body at the bottom of the Densifier and called 911. No one remembered turning the controls for the Densifier and the conveyor belt off, but they were off when EMS personnel arrived. All of these coworkers failed to report to work after the incident and were not available for interview by DSR investigators.

Interviews with other plant workers familiar with the procedures and operation of the machine in question, as well as the physical parameters of the incident site, prompted investigators to postulate that the victim, for unknown reasons, was operating the machine alone, loading plastic bags onto the belt with both the conveyor belt and the Densifier running. At some point, it is presumed that the rotor blade inside the Densifier jammed. Several workers familiar with the process reported that this occurred frequently when the rotor blade became dull and no longer cut the plastic bags efficiently. The plastic bags would melt and congeal around the rotor blade. When there was a sufficient amount of plastic accumulated around the blade, it would jam. The victim presumably went to the controls and shut off the conveyor belt and the Densifier rotor blade from the operator's platform, but he failed to shut down and lockout the power to the machine at its source (Photo 3). From the location of the operator's platform, which was located about four feet from the top opening to the Densifier, it was unlikely that the victim could have stepped over to the Densifier's top opening. He presumably walked up the conveyor belt and entered the Densifier from above, most likely with the intent to unjam the blade at its base. It is also possible that the victim fell into the Densifier, but given that there was a history of routine entry into the machine from the top to clear jams, this was determined by investigators to be less likely. While inside the Densifier and bent over, the victim would not have been visible to anyone in the plant. It is presumed that a second worker, unaware of the victim being inside the Densifier and noticing that the machine was not running, went to the controls and started the Densifier. The victim may have made a sound prompting a coworker to stop the machine or coworkers may have noted that the victim was not at his post and began looking for him.

A coworker looked in the Densifier and saw the victim's body. He called 911 and then called the plant manager at his home. Emergency Medical Service (EMS) personnel responded to the scene within 7 minutes. When the plant manager arrived, he turned off and locked out the external power source to the Densifier. EMS personnel entered the Densifier through the side access hatch after removing the fixed bolts which secured the hatch. They recovered the remains of the victim. A coroner in attendance pronounced the victim dead at the scene.

CAUSE OF DEATH

The assistant coroner's report listed the cause of death as partial decapitation of the head with multiple open/crushing injuries.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should establish a lockout/tagout program that, at a minimum, meets requirements established by the Occupational Safety and Health Administration (OSHA).

Discussion: All sources of hazardous energy should be locked out before any repairs, blade replacement, or procedures to remove jams are begun. Regulations regarding the control of hazardous energy (lockout/tagout) must be followed and are covered under OSHA standards. OSHA standards for General Industry have specific requirements for lockout/tagout procedures for control of hazardous energy located in subpart J.[1] 29 CFR 1910.147(a)(1)(i) states that "*This standard covers the servicing and maintenance of machines and equipment in which the* ***unexpected*** *energization or start up of the machine or equipment, or release of stored energy could cause injury to employees.*" 29 CFR 1910.147(a)(2)(ii) states that " *Normal production operations are not covered by this standard. Servicing and/or maintenance which takes place during normal production operations is covered by this standard only if [A] An employee is required to remove or bypass a guard or other safety device; or [B] An employee is required to place any part of his or her body into an area on a machine or piece of equipment where work is actually performed upon the material being processed (point of operation) or where an associated danger zone exists during a machine operating cycle.*"

Specific recommendations are outlined in the NIOSH Alert titled *Preventing Worker Deaths from Uncontrolled Release of Electrical, Mechanical, and other types of Hazardous Energy.* Salient points that need to be covered should be machine specific and include the following:

- Identify and label all hazardous energy sources.
- De-energize, isolate, block, and/or dissipate all forms of hazardous energy before work begins.
- Establish lockout/tagout programs that
  - —require workers to secure energy control devices with their own individually assigned locks and keys—*only one key for each lock the worker controls*;
  - —require that each lock used to secure an energy control device is clearly labeled with durable tags to identify the worker assigned to the lock;
  - —require that the worker who installs a lock is the one who removes it after all work has been completed; and
  - —require that if work is not completed when the shift changes, workers arriving on shift apply their locks before departing workers remove their locks.
- Verify by test and/or observation that all energy sources are de-energized before work begins.
- Inspect repair work before reactivating the equipment.
- Make sure that all workers are clear of danger points before re-energizing the system.

- Train *all* workers in the basic concepts of hazardous energy control.
- Include a hazardous energy control program with any confined-space entry program.[2]

Only trained and qualified personnel should perform repair work or work that entails removing jams from machinery. The company should identify personnel who are qualified and trained to conduct this work and document their hazardous energy related training.

Recommendation #2: Employers should ensure that equipment is inspected daily and all defective equipment is removed from service until needed repairs have been made.

Discussion: Employers should designate a supervisor to be responsible for daily preshift equipment checks and for verifying that any problems identified are corrected. Although the equipment may also be inspected by other workers, for example, the Densifier operator, the supervisor must be responsible for ensuring that inspections are performed daily, that necessary repairs are made, and that records of all inspections are documented and maintained. Since the company has no operator's manual for the Densifier, the company should establish a timetable for routine inspection of the rotor blade and should have trained persons inspect the blade. If the Densifier is not operating properly, for instance if it jams, it should be removed from service until the problem is corrected by personnel who are qualified and trained in lockout/tagout safety procedures.

Recommendation #3: Employers should develop, implement, and enforce a comprehensive written safety and health training program for all workers, including requirements for work in permit-required confined spaces, such as Densifiers.

Discussion: Although employees had received some on-the-job training, they had not received adequate training based on OSHA requirements for a permit-required confined space program, including training in control of hazardous energy. The OSHA standards define a permit-required confined space as a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material with the potential to engulf someone who enters the space;
- Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward or tapers to a small cross section; and /or
- Contains any other recognized serious safety or health hazard.[3]

Since the Densifier falls within this definition, a permit-required confined space program is essential. Such a program has several requirements which include but are not limited to:

- implement necessary measures to prevent unauthorized entry;
- identify and evaluate permit space hazards (e.g. atmospheric, mechanical, electrical, or other injury hazards) before allowing employee entry;

- establish and implement the means, procedures, and practices to eliminate or control hazards necessary for safe permit space entry operations;
- ensure that at least one attendant is stationed outside the permit space for the duration of entry operations;
- implement appropriate procedures for summoning rescue and emergency services, and preventing unauthorized personnel from attempting rescue;
- establish, in writing, and implement a system for the preparation, issue, use and cancellation of entry permits;
- review established entry operations annually and revise the permit space entry program as necessary.[3]

For a complete list of requirements for written permit-required confined space programs, see 29 CFR 1910.146.[4]

Additional recommendations regarding safe work practices in confined spaces can be found in the NIOSH Publication No. 80-106, *Criteria for a Recommended Standard: Working in Confined Spaces*;[5] NIOSH Alert Publication 86-110, *Request for Assistance in Preventing Occupational Fatalities in Confined Spaces;*[6] NIOSH Publication No. 87-113, *A Guide to Safety in Confined Spaces;*[7] and NIOSH Publication No. 94-103, *Worker Deaths in Confined Spaces: A Summary of NIOSH Surveillance and Investigative Findings.*[8] These publications may be useful in developing confined space safety programs and in training workers to identify hazards found in confined spaces. Specific information provided in these publications includes recommendations for control of hazardous energy, communication procedures, entry and rescue procedures, posted warning signs, and required safety equipment and clothing. NIOSH publications are available through the NIOSH website at http://www.cdc.gov/niosh or by calling 1-800-356-4674.

Recommendation #4: Employers should train workers in hazard recognition and safe work practices for all tasks to which they are assigned or allowed to perform, including those pertaining to work requiring lockout/tagout and work in a permit-required confined space. The use of the workers' primary language(s) and careful consideration of literacy levels will maximize worker comprehension of these subjects.

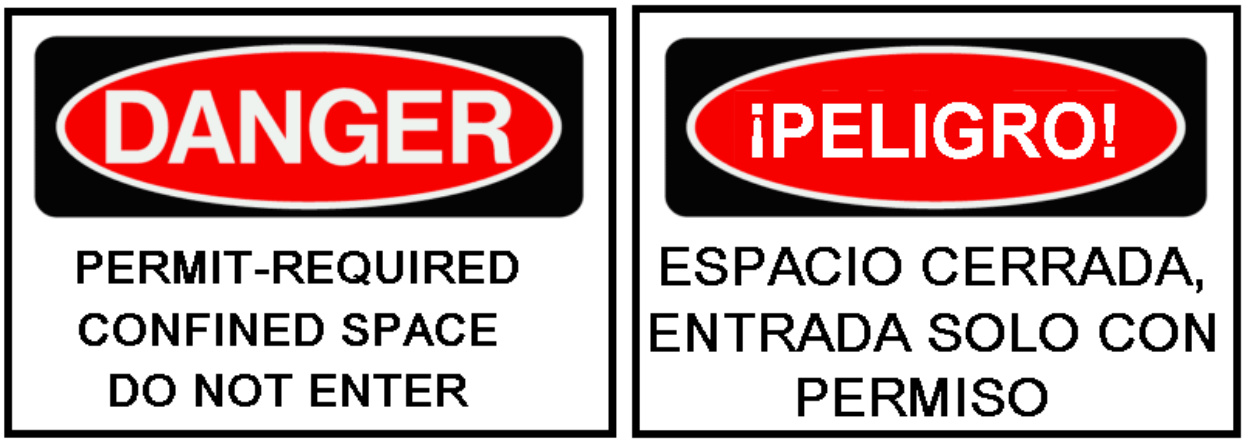
Discussion: Employers should evaluate tasks performed by workers, identify all potential hazards, and then develop, implement, and enforce a safety program that meets applicable OSHA standards[9] addressing these issues. The safety program should include, at a minimum, worker training in hazard identification, and the avoidance and abatement of these hazards. In situations where process machines, such as Densifiers, are used, company policy and training for operators should include that machines are never to be left without a trained operator in attendance when the machines are operating. Companies that employ workers who do not understand English should identify the languages spoken by their employees and design, implement, and enforce a multi-lingual safety program. To the extent feasible, the safety program should be developed at a literacy level that corresponds with the literacy level of the company's workforce. Companies may

need to consider providing special safety training for workers with low literacy to meet their safety responsibilities. The program, in addition to being multi-lingual, should include a competent interpreter to explain worker rights to protection in the workplace, safe work practices workers are expected to adhere to, specific safety protection for all tasks performed, ways to identify and avoid hazards, and who they should contact when safety and health issues arise. All training should be documented, identify who provided the training and their qualifications, the content of the training, workers who were trained, and any assessments of workers' comprehension of the training.

Recently, OSHA developed the Compliance Assistance: Hispanic Employers and Workers web page to assist employers with a Spanish-speaking workforce in learning more about workplace rights and responsibilities, identifying Spanish-language outreach and training resources, and learning how to work cooperatively with OSHA. In addition, the Compliance Assistance: Hispanic Employers and Workers web page provides a list of OSHA's Hispanic/English-as-a-second-language coordinators. These materials are available at http://www.osha.gov/dcsp/compliance_assistance/index_hispanic.html[10] or can be obtained by contacting an area OSHA office. Information provided can be used by employers who are developing or improving safety and training programs for their Spanish speaking employees.

Recommendation #5: Employers should post warning signs in a language(s) that all workers can understand at entrances to each permit-required confined space, such as the top opening and the side hatch of the Densifier, warning of immediate danger and safety requirements for entry.

Discussion: Employers should post warning signs in the primary language(s) used by their employees at sites that represent a fixed hazard. This would include posting signs at the top and side access to the Densifier noting: (1) Requirement for atmospheric testing; (2) A mechanical hazard exists; (3) The need to properly shut down and secure with locks all power sources prior to entry; and (4) Entry limited to authorized personnel only. Reference is made to American National Standards Institute standards Z53.1[11] and Z535.2[12], and OSHA standards 29 CFR Subpart J 1910.145[13] for further clarification. These signs do not take the place of a safety training program; they should be used to enhance it. The meaning of these signs and their location should be incorporated into the facility's general safety training program. The following examples are warning signs printed in both English and Spanish:



Recommendation #6: Employers should consider retrofitting the Densifier with a barrier or guardrail to prevent workers from entering or falling into the top opening, installing appropriate guardrails around the operator platform, and placing standard railings on access stairways.

Discussion: Engineering controls are the cornerstone of any safety program. These controls include construction of physical barriers to isolate a hazard, installation of guardrails to mitigate against a fall hazard, and construction of access routes free of obstructions and hazards for safe operation in and around the plant while providing safe accessibility to the work area. This is in keeping with OSHA's General Duty Clause which requires employers to furnish a place of employment which is free of recognized hazards that are causing or likely to cause death or serious physical harm to employees.[14] Areas to consider retrofitting include placing a guard over the opening at the top of the Densifier to prohibit an employee from entering the Densifier from above. Also, consideration should be given to installing guardrails for fall protection around the operator platform and installing standard railings along the stairway leading to the Densifier's side access hatch.

Recommendation #7: Employers should establish work policies that comply with employment standards for 14-and 15-year-olds in nonagricultural employment. These requirements are published in Subpart C of Part 570 of Title 29 of the Code of Federal Regulations, Child Labor Regulation No. 3. Employers should communicate these work policies to all employees.

Discussion: Given the victim's authentic-appearing social security and alien residence cards, both of which were forged, it may have been very difficult for the employer to ascertain the victim's correct age. However, employers should make every effort to ensure they are aware of a worker's true age and that 14-and 15-year old workers are not assigned to perform prohibited work. Employers who have a multi-lingual/multi-cultural work force should use interpreters when necessary to inform all employees about age-appropriate work assignments. If employers do not fully understand the types of work prohibited for young workers, they should contact the U.S. Department of Labor (DOL), Employment Standards Administration (ESA), Wage and Hour Division. This Division enforces child labor laws under the Fair Labor Standards Act (FLSA).

Under FLSA standards for 14-and 15-year-olds in nonagricultural employment, employment of 14-and 15-year-olds is limited to certain occupations and under certain conditions that do not interfere with their schooling, health or well-being. For example, employment in any manufacturing occupation [such as the manufacture of plastic pellets in this incident] and operating or tending of any hoisting apparatus or any power-driven machinery [such as the Densifer tended by the victim in this incident] is prohibited. Under FLSA Hours standards, 14-and 15-year-olds are prohibited from working before 7 a.m. or after 7 p.m. This incident occurred at 4:45 a.m., during a time expressly prohibited for employment of 14-and 15-year-olds. Information regarding FLSA can be obtained by visiting the DOL ESA website at www.dol.gov/esa. FLSA employment standards for nonagricultural occupations are listed and explained in Child Labor Bulletin 101[15] and summarized in DOL Fact Sheet No. 43.[16] Child labor information can also be obtained by calling or visiting offices of Federal and State child labor departments, located by using the telephone directory government pages.

Employers should meet with their workforce to communicate the company's policies regarding appropriate work assignments for young workers. They should explain that young workers are at an increased risk for injury at work and reinforce the importance of assigning youths to appropriate work tasks. They should provide all staff with a description of youth work assignments, identify the person(s) responsible for supervision of young workers, inform all staff about assigned supervisors, and direct staff to notify supervisors immediately if they see young workers performing hazardous work or working outside their assigned tasks.

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INVESTIGATOR INFORMATION

This investigation was conducted by Joseph F. Chesky MD, MPH, Occupational Medicine Resident at West Virginia University School of Medicine assigned to NIOSH, Division of Safety Research, Special Studies Team and Doloris N. Higgins, Safety and Occupational Health Specialist, Fatality Investigation Team, Surveillance and Field Investigations Branch, Division of Safety Research.