



# The National Institute for Occupational Safety and Health (NIOSH)



## Warehouseman Crushed While Unloading Pipe from a Trailer

Alaska FACE Investigation 99AK014

October 5, 1999

### SUMMARY

On May 19, 1999 a 31-year old male warehouseman was crushed while unloading a bundle of pipe from a 20-foot platform trailer. The warehouseman (the victim), working alone, was standing on the ground next to the side of the trailer. He had cut several bands securing the separate layers or tiers of pipe to the trailer when a single bundle either-1) shifted and fell off the trailer or 2) was pushed off when the top bundle collapsed between the bundles underneath it. The bundle struck the victim as it fell, knocking the victim to the ground. A customer exiting the company building heard the load crash to the ground and crossed the parking lot to the trailer's location. The victim was lying on the ground beneath the pipes. The customer went back into the store to notify workers and call medical emergency services (EMS). Coworkers lifted the pipes off the victim and began CPR. The victim was transported to a nearby medical center, and he died shortly thereafter from his injuries.

Based on the findings of the investigation, to prevent similar occurrences, employers should:

- Ensure a competent person inspects all incoming freight before accepting the shipment;
- Ensure workers are capable of recognizing and avoiding hazardous situations and develop and implement a warehouse training program that includes, but is not limited to, loading/unloading procedures;
- Ensure that warehousemen follow prescribed work practices for loading and unloading shipments and enforce a comprehensive safety program;
- Follow a standardized practice for securing stacked or tiered materials to pallets or skids.

### INTRODUCTION

At 1:30 p.m. May 19, 1999 a 31-year-old male warehouseman was fatally injured when a bundle of metal pipe fell from a trailer. On May 19, 1999 Alaska Department of Labor (AK-DOL) notified the Alaska Division of Public Health, Section of Epidemiology. An investigation involving an injury prevention specialist for the Alaska Department of Health and Social Services, Section of Epidemiology ensued on May 20, 1999. The incident was reviewed with AK-DOL officials. Police department, Medical Examiner and AK-DOL records were requested.

A national electrical distributor purchased the wholesale electrical supply company in this incident in 1996. The company employed approximately 40 workers in Alaska of which 12 employees worked at the incident site. At the time of the incident, the victim was one of two full-time warehousemen at the site and had been employed for 8 months. The victim had nearly 5 years experience as a warehouseman.

The company had a written safety program. All employees were required to attend an orientation and training sessions at the time of their initial hire. Safety training included a review of all safety rules and procedures, use of company equipment and motor vehicles, hazard communication, emergency preparedness, and personal protective equipment. Training in warehousing safety was conducted on the job by the senior warehouseman. This training addressed precautions to be used when loading and unloading trailers, work practices in and around the yard, and loader/forklift training. Safety meetings were held monthly until 1997 and then were conducted on an "as needed" basis.

## INVESTIGATION

The incident occurred in a parking lot immediately in front of a storage yard next to the store. This area was used to unload materials from flatbed trailers and then move them into the storage yard. The parking lot consisted of packed soil and gravel. The surface appeared level and even. Weather was sunny and was not considered a factor in this incident.

The pipe bundles were originally loaded onto a mega-pallet or skid in Seattle prior to shipment by barge, rail, and truck to the electrical distributor in Alaska. The load consisted of 21 bundles of rigid galvanized steel conduit pipe. The pipe was of a standard length, 10 feet, with diameters that varied from ½ inch to 4 inches. The pipe was sorted into bundles and bound with ½-inch wide metal straps or bands located 1 to 2 feet from each bundle end. The ends of the pipe were color coded to help identify the pipe diameter. The individual bundles weighed approximately 2,000 – 2,150 pounds. The total weight of the load was 41,620 pounds, which was within the legal road limit for ground freight transported by tractor-trailer.

The pipe bundles were arranged in two piles on the skid. On the front half of the skid, a pile consisted of 11 bundles; on the back half of the skid, a pile consisted of 10 bundles (Figure 1a). For each pile, the bundles were stacked in layers or tiers, separated by lengths of 4-inch x 4-inch wood or dunnage (Figure 1a). Dunnage was also placed between the bottom tiers and the skid. Workers loading the skid tried to arrange the bundles to provide a surface as close to level as possible for the dunnage supporting the next tier. Since all bundles weighed approximately the same, their shape and size was of greater importance than weight when loading and balancing the piles. (Bundles of the same pipe diameter had similar shape and size.) The bundles in the front pile were arranged symmetrically (Figure 1b).

Figure 1a. (insert image here)

Figure 1b. (insert image here)

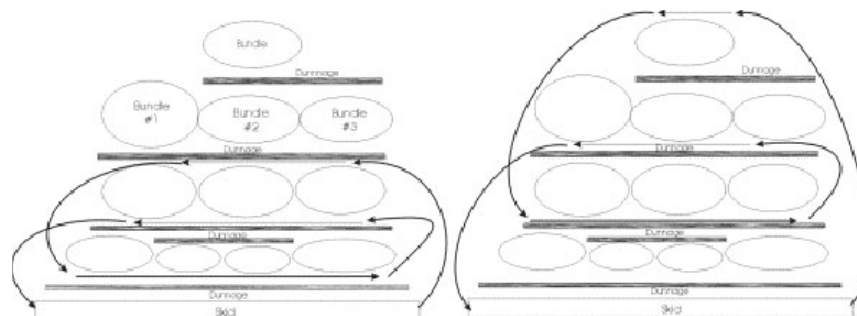
**Figure 1a. Arrangement of pipe bundles after the incident, as viewed from the rear right of trailer.**

**Figure 1b. Arrangement of pipe bundles after the incident, as viewed from the front of trailer.**

Note the extra dunnage on top of the middle bundles on the bottom tier to fill the gap under the support dunnage. (Figure 2 illustrates the bundle arrangement of the front pile before the incident.)

It was unknown how the dunnage for the single bundle on the fourth (highest) tier of the front pile was positioned before the incident. However, because bundle #1 on the third tier was larger than bundle #2 and #3 (Figure 2), it was surmised that dunnage was placed across bundle #2 and bundle #3. When bundles could not be matched to form a level surface, the dunnage would rest on top of the bundles at an angle. The bundles were then arranged in a manner that allowed the dunnage supporting an upper tier to compensate for the angle of the dunnage supporting a lower tier (Figure 3).

a. Straps securing the 1<sup>st</sup> and 2<sup>nd</sup> tiers b. Straps securing 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> tiers



**Figure 2. Diagrams of straps used to secure front pile to the skid, viewed from the front of the trailer.**

Note: Straps as shown in Figure 2a. and 2b. were placed near each end of the piles.

When securing the load to the skid, tiers were normally tied down in pairs. In this case, the first and second tiers of the front pile were strapped as a single unit to the skid (Figure 2). Starting 1 to 2 feet from one end of the pile, the tiedown strap was looped over the second tier, under the first tier, and then back between the tiers. This process was repeated with a second strap placed 1 to 2 feet from the other end of the pile and then with two bands for the second and third tiers. Since the fourth tier consisted of a single bundle, it was included with the tier below it. The straps were  $\frac{1}{3}$ -inch wide metal bands. The entire load was then covered with a blue tarp that was attached to the front and back corners of the skid. Two metal bands were placed over the tarp to secure it.

insert image here

**Figure 3. Tiered bundles, as viewed from the rear of trailer.**

Note: If not secured tightly, materials may shift due to stresses (vibration and motion) during transportation. For example, side to side motion during rail transportation may cause lateral shifting.

Normally, unloading would begin by examining the load. If a tarp was present, bands holding the tarp would be cut, and the tarp would be removed from the load. The load would be examined for any indication of shifting or twisting of bundles. (Twisting, which could cause the bundles to roll, can occur during loading or when bands are tightened.) If the load looked unstable, the warehouseman would obtain assistance. Company warehousing procedure for unloading conduit bundles also required at least one forklift be used as a safeguard while cutting bands. The forklift tines or forks would be raised and placed under the bundles of the highest unsecured tier(s). If the load shifted, the bundles would be supported or caught by the forks and mast of the forklift. Once properly safeguarded, the bands holding the highest tier(s) to the skid would be cut. All unsecured bundles would be unloaded prior to proceeding to the next secured tier. This process was repeated for each tier, working down through the piles. It was also common practice by company warehousemen to position a second forklift on the opposite side of the trailer to prevent bundles from falling from either side.

On the day of the incident, the victim entered the parking lot to unload the trailer and move the pipe bundles into the storage yard. He parked a single forklift **parallel** to the rear left side of the trailer before starting the unloading process (Figure 4). He was standing on the ground along the side of the trailer as he began cutting the metal bands holding the piles to the skid. The band holding the rear half of the tarp, all the bands securing the rear pile to the skid, and all four corner tiedowns of the tarp were cut. The victim, however, did not cut the front band securing the tarp, preventing its removal.

insert image here

**Figure 4. View of trailer and forklift.**

At the time of delivery, the ends of the dunnage supporting the highest tier of each pile were protruding through the blue tarp. However it was unknown if dunnage at the front of the trailer was projecting upward at a sharp angle prior to the incident (Figure 4). Neither the freight subcontractor nor the company employees noticed the angle of the dunnage poking through the tarp. A shift of the dunnage supporting the top bundle or the bundles under it could have occurred during transport.

The victim proceeded to cut bands securing the upper tiers of the front pile to the skid (leaving only the bands securing the lower tiers to the skid and the tarp in the center of the front bundles). Bundle #3 (Figure 2) from the third tier either-1) shifted and slid off the dunnage or 2) was pushed off when the top bundle collapsed between bundles #1 and #2 on the third tier. The front end of the bundle slid down as the front band was cut. It then slid out from under the band securing the tarp and fell approximately 10 feet to the ground. The victim was struck-by the bundle as it fell, trapping him under the pipes.

A customer exiting the company store heard the pipes crash to the ground. He called to the victim. When he did not receive a response, he went to the trailer. The customer found the victim pinned under the fallen pipe. He ran back into the building to notify workers of the incident. Emergency medical services were called. The customer and the victim's coworkers went back to the trailer and began to move the pipes off the victim. CPR was initiated, and emergency medical personnel transported the victim to a nearby medical center. He was later pronounced dead from his injuries.

Following the event, an AKDOL official examined the trailer. There was evidence that some of the bundles were twisted. In addition, the bundles at the rear of the trailer had shifted toward the side that the victim was working. The outside bundle on the third tier extended approximately 6 to 8 inches past the dunnage (Figure 3). At the front of the trailer, the bundle on the highest tier had collapsed between two bundles on the third tier, possibly due to the same shift of the load. It could not be determined if:

- The fallen bundle (#3) shifted off the dunnage under the third tier,
- The fallen bundle was twisted giving it a greater tendency to roll,
- The uppermost bundle had shifted off its dunnage causing the bundle from the third tier to become dislodged.

However, once the bands were cut, the bundle fell.

## CAUSE OF DEATH

The medical examiner's report listed the cause of death as massive crush injuries

## RECOMMENDATION/DISCUSSION

**Recommendation #1: Employers should ensure that a competent person inspects all incoming freight before accepting the shipment.**

Discussion: In this incident, the load on the trailer had shifted, causing the upper bundles to be less stable. This was indicated by their position over the dunnage. A competent person should inspect incoming freight. The competent person should be:

- Capable of identifying existing and predictable hazards in the work area or work conditions that are hazardous or dangerous; and
- Authorized to make prompt corrections and actions if shipments have been apparently damaged or if loads were shifted and are a hazard to employees.

**Recommendation #2: Employer should ensure workers are capable of recognizing and avoiding hazardous situations and should develop and implement a warehouse training program that includes, but is not limited to, loading/unloading procedures.**

Discussion: While precautions are taken to secure freight during transport, warehousemen should always inspect cargo pallets and other materials stored in tiers or stacks for slippage and collapse prior to cutting straps and unloading the materials. The tarp should **always** be completely removed; it should never be used to control “whipping”, which can occur when bands that are under tension are cut. Warehouse and other employees involved in freight unloading and loading should receive specialized training in freight and warehousing safety. Training should include, but not be limited to:

- Assessing stability of the trailer and freighted materials prior to unloading
- Proper use of equipment to safeguard against personal injury
- Common forklift problems and solutions
- Lift truck capacity and center of gravity
- Safety procedures for picking up, dropping, moving, and stacking loads

Training should be documented in the employee record and include training dates, completion verification, and course content (checklist).

**Recommendation #3: Employer should ensure that warehousemen follow all prescribed work practices for loading and unloading shipments and enforce a comprehensive safety program.**

Discussion: In this incident the victim did not follow prescribed work practices that required the tarp to be removed and a forklift to be positioned perpendicular to the trailer with its tines raised and under the tiered materials before the bands securing the load were cut. Warehouse workers should be supervised until they have safety competency for to their assigned tasks. Workers who are unable to attain and retain their ability to accomplish tasks in a safe manner should be reassigned to another work area. Employers should consider conducting random work site safety inspections and supervisor observations to evaluate compliance with and understanding of established safety standards and practices. While employees have the right to question the safety of any task, they are responsible for following the practices outlined by their employers safety program. In addition to specific safe practices, steps should be outlined and discussed with employees for noncompliance with an established safety program.

**Recommendation #4: Employers should follow a standardized practice for securing stacked or tiered materials to pallets or skids.**

Discussion: It is inevitable that cargo will be exposed to vibration and motion that may cause it to settle or shift. In addition, some types of transport may produce greater stress (such as the side to side motion in rail transportation) than others. Industry practices for freight and cargo shipping mandate that materials stacked or stored in tiers must be strapped securely to prevent shifting or slipping during transportation. While regulations address the number and spacing of tiedowns, the technique of securing the load is up to the loader. In this case, the single bundle making up the highest tier was included with a lower tier, leaving two unsecured tiers when the bands were cut. A standardized method of securing stacked or tiered materials either in single units or redundantly-paired units (first and second tiers, second and third, third and fourth, etc.) may reduce the risk of load shifting and slippage during transport **and** unloading.

## References

Alaska Dept. of Public Safety, Division of Motor Vehicles. Commercial Driver License Manual. Anchorage. Nov. 1997.

Canadian Centre for Occupational Health and Safety. Warehouse Workers Safety Guide. Hamilton, Ontario, Canada: CCOHS, 1998.

National Safety Council. Accident Prevention Manual for Business & Industry: Administration & Programs. Tenth Edition. Chicago, IL; 1992.

Office of the Federal Register: Code of Federal Regulations, Labor 29 Parts 1917 and 1926. Washington, DC: GPO, 1996.

Safe Equipment Transport. International Union of Operating Engineers. Videocassette. Video Information System Training Association, Inc. 1995.

### **Fatality Assessment and Control Evaluation (FACE) Project**

The Alaska Division of Public Health, Section of Epidemiology performs Fatality Assessment and Control Evaluation (FACE) investigations through a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR). The goal of these evaluations is to prevent fatal work injuries in the future by studying the working 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.

To contact [Alaska State FACE program personnel](#) regarding State-based FACE reports, please use information listed on the Contact Sheet on the NIOSH FACE web site Please contact [In-house FACE program personnel](#) regarding In-house FACE reports and to gain assistance when State-FACE program personnel cannot be reached.

[Back to Alaska FACE reports](#)

[Back to NIOSH FACE Web](#)

Page last reviewed: November 18, 2015  
Content source: [National Institute for Occupational Safety and Health](#)