ADMINISTRATIVE REPORT **DATE: February 17, 2000**
PUBLIC HEALTH SERVICE/CDC/NIOSH/DSR
FACE 99-03

TO: **Director, National Institute for Occupational Safety and Health**

FROM: **Division of Safety Research, NIOSH**

SUBJECT: **Female Construction Worker Dies in a Compactor Tip Over at a Highway Construction Site – South Carolina**

On April 19, 1999, a 38-year-old female highway construction worker (the victim) died after the compactor she was operating slipped off the edge of the road surface while backing up, tipped on its side and pinned her underneath. The victim had been working for a company that was subcontracted, as part of a major highway expansion project, to construct a highway off ramp that would eventually lead to an overpass bridge. The victim's job at this site was to compact the dirt ramp in preparation for hard surfacing. Two days prior to the incident, the company had delivered to the site a new compactor equipped with a rollover protective structure (ROPS), but no seatbelts. The victim was operating the compactor, with the enclosed cab door open, back and forth over a built up road bed when she backed up near the edge and the earth under the rear tires gave way. When the compactor tipped over the embankment, the unrestrained victim was partially thrown from the open door of the cab and pinned under the ROPS. Emergency rescue personnel were immediately called and arrived at the site within 15 minutes. The victim was pronounced dead at the site.

NIOSH investigators concluded that, in order to help prevent similar incidents, equipment manufacturers/dealers, and employers should:

- ensure that all ROPS-equipped vehicles are also equipped with functioning seatbelts.

Additionally, employers should:

- ensure that all operators are trained on the need to wear seatbelts when operating machinery equipped with ROPS

- ensure that employees comply with company rules, as well as ensuring that the company complies with state and federal rules and regulations pertaining to occupational safety and health.

INTRODUCTION

On April 17, 1999, a 38-year-old female equipment operator (the victim) died when she was partially thrown from the compactor she was operating when it tipped over an embankment and pinned her beneath the ROPS. On April 22, 1999, officials from the South Carolina Department of Labor, Licensing and Regulation, Office of Occupational Safety and Health (SCDOSH) notified the Division of Safety Research (DSR) of the incident and requested technical assistance. On September 14, 1999, two Occupational Safety and Health specialists from DSR met with the SCDOSH assigned compliance officer to discuss the case and to review information collected during the course of his investigation.

The employer, a construction company primarily engaged in highway projects, was subcontracted to construct a single-lane-highway exit ramp that would connect to a two-lane bridge overpass. At the time of the incident, the employer had approximately 23 employees working at the exit ramp site. The typical work schedule for this crew was day shift, 6 days a week, at 10.5 hours per day. Weekly toolbox safety meetings were held with all site workers and the topics for the meetings were generally chosen by the employer. The meetings were conducted by the on-site safety person, who in this case was also the victim in the incident. Although the company had been working for over 16 months at other sites on this particular highway expansion project, they had only been working 3 days at the exit ramp site.

INVESTIGATION

The employer had been subcontracted to construct a highway off ramp that would eventually lead to an overpass bridge. The employer had been involved for over 16 months with other construction activities on this particular highway expansion project, but had only been on the exit ramp project for 3 days. On the first day of the exit ramp job, the company had delivered to the site a new compactor (similar to the one shown in figure 1a) equipped with an enclosed cab (figure 1b) that incorporated the rollover protective structure (ROPS). Although the new compactor had ROPS, no seatbelts were installed. Unlike the old compactor with its front and rear rollers that the victim had operated for over a year, the new compactor had a single roller in the front and pneumatic tires in the rear. The new compactor was just over 18 feet long and nearly 8 feet wide, with a wheelbase of 10 feet. The height of the machine, including ROPS, was just over 10 feet. The front drum diameter was 5 feet and the rear tires were 23.1 by 26 inches in diameter. The new compactor was operated at the site by the supervisor 2 to 3 hours after it was delivered, to ensure proper operation. Other construction equipment being used at this site were scrapers, loaders, graders and a number of haulage trucks.

At the time of the incident the victim was operating the compactor in a back-and-forth motion on a built up road bed. The roller impressions left in the soil by the compactor, as well as witness statements, indicated that the victim was running the machine somewhat non-parallel to the road layout. The cab door on the compactor was latched opened (similar to figure 1c) while she operated the machine. It is uncertain why the cab door was latched open, but it may have been for comfort

or visual needs. At approximately 1:15 p.m., as she backed the compactor to the road edge, the dirt underneath the rear tire gave way and the compactor tipped over on its side and slid down the embankment. The embankment had an approximate 45 degree slope, and after the compactor slid down the hill on its side it came to rest some 25 feet from the top. When the compactor tipped, the unrestrained victim was partially thrown through the open door, and was pinned underneath the ROPS. Emergency rescue personnel were immediately called and arrived at the site within 15 minutes. The victim was pronounced dead at the site.

It was reported during the investigation that one of the company's safety policies required all operators to wear seatbelts while operating equipment. The compactor was equipped with ROPS, but was not equipped with seatbelts. Mounting holes for the installation of seatbelts were present, but the seatbelts had not been installed by either the manufacturer, dealer, or the company prior to placing it in operation.

CAUSE OF DEATH

The cause of death was determined by the coroner to be trauma to the trunk of the body as a result of being struck by the ROPS.

RECOMMENDATIONS

Recommendation #1: Equipment manufacturers/dealers and employers should ensure that all ROPS-equipped vehicles are also equipped with functioning seatbelts.

Discussion: According to the manufacturer's specifications for this particular compactor, ROPS and seatbelts are standard items on new machines sold in North America. This compactor had the mounting holes for the installation of the seatbelts, but they had not been installed by the manufacturer or the dealer prior to delivering the new machine to the work site. In addition, the employer should have inspected the new compactor to ensure all safety devices were available and in proper working order before accepting or placing the equipment in operation.

Recommendation #2: Employers should ensure that all operators are trained on the need to wear seatbelts when operating machinery equipped with ROPS.

Discussion: A Rollover Protective Structure (ROPS) is only effective when used in conjunction with a seatbelt. Seat belts are incorporated into the design of the ROPS to restrain the operator in the operator's seat and within the confines of the protective structure in the event of a sudden stop or rollover of the equipment. Failure to use seat belts in conjunction with ROPS has proven to be hazardous to equipment operators during a rollover. Employers should train workers to wear the seat belt and not to jump from the equipment in the event of a rollover. Operators who try to jump away may be crushed by the ROPS designed to protect them. The training should teach the operator not to jump, to keep the seat belt on, to keep the knees and elbows close to the body, and to hold on firmly and lean away from the impact. If seatbelts had been installed and used in conjunction with

the ROPS, the victim in this incident would have most likely survived the tip over. The day after this incident, seatbelts were installed in the compactor. Because the machine sustained only minor damage; it was placed back in operation.

Recommendation #3: Employers should ensure that employees comply with company rules, as well as ensuring that the company complies with state and federal rules and regulations pertaining to occupational safety and health.

In this incident, both the site supervisor and the victim (who was the employee safety representative) knew that the new compactor was not equipped with seatbelts but still operated the machine even though it was in violation of company safety policies. The site supervisor operated the new compactor for 2 to 3 hours after it was delivered to the work site. At the time of the incident, the compactor had logged 22 hours of operation.

Finally, the construction industry has long recognized the hazard of rollovers and tipovers with respect to compactors. The Society of Automotive Engineers (SAE) adopted performance criteria for ROPS when used on a variety of different machines, including compactors.[1,2] If a manufacturer or owner installs ROPS on a compactor, it must meet a specific SAE minimum level of performance. OSHA does not have a specific regulation for requiring ROPS or seatbelts on compactors. It is OSHA's position that the hazard of equipment rollover is a "recognized" hazard within the meaning of the General Duty Clause (Section 5(a)(1) of the Occupational Safety and Health Act), and that ROPS and seatbelts are feasible in many situations to reduce this hazard for compactors.[3]

REFERENCES

1. Society of Automotive Engineers: ISO6683 - Earth Moving Machinery - Seatbelt and Seatbelt Anchorages. April 1994.

2. Society of Automotive Engineers: J386 - Operator Restraint System for Off-Road Work Machines. November 1997.

3. US Department of Labor, Occupational Safety and Health Administration (OSHA): OSHA Standards Interpretation and Compliance Letters - ROPS/Seatbelts for Roller Compactors. Letter to Mr. Brian McQuade, Executive Director, Laborer's Health and Safety Fund. March 1998.

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Fatality Assessment and Control Evaluation (FACE) Project

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), performs Fatality Assessment and Control Evaluation (FACE) investigations when technical assistance is requested from participating States or the Wage and Hour Division of the Department of Labor. 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.
States participating in this study: North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia.

Additional information regarding this report is available from:
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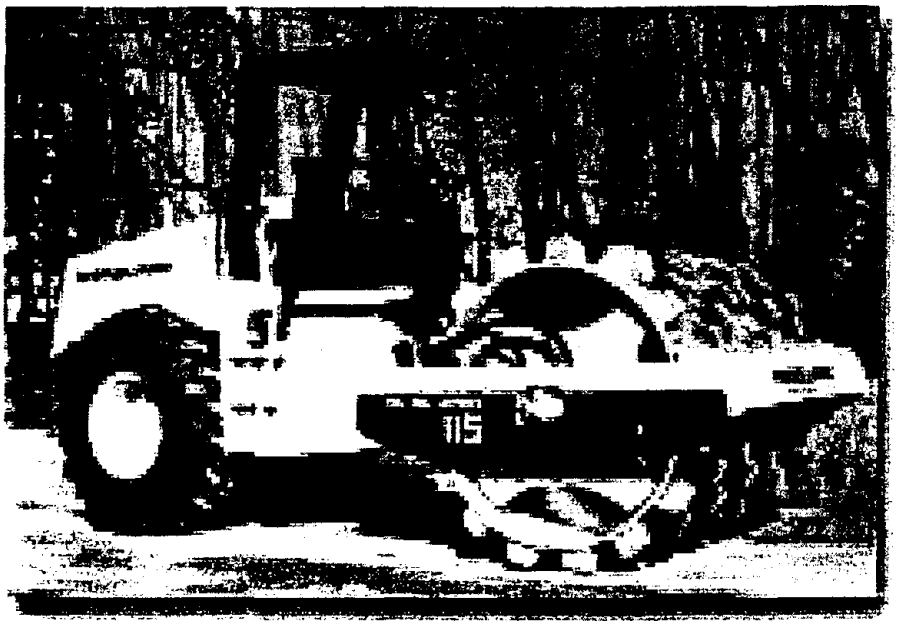
FACE 99-03

Figure 1a. Ingersoll-Rand Pro-Pac Series 100 Compactor



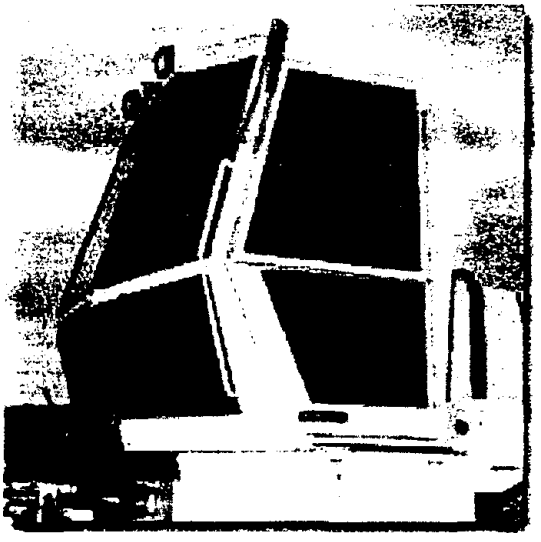


Figure 1b. Enclosed Cab Option

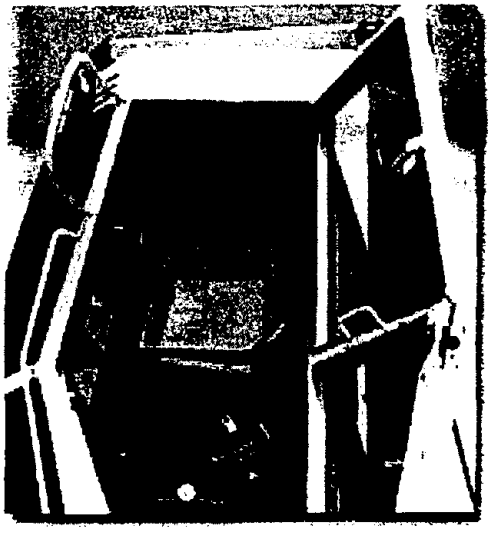


Figure 1c. Cab Door Open