ADMINISTRATIVE REPORT **DATE: December 10, 1996**
PUBLIC HEALTH SERVICE/CDC/NIOSH/DSR
FACE-96-21

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

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

SUBJECT: **Temporary Employee Falls Through Coliseum Roof--Virginia**

SUMMARY

On June 27, 1996, a 27-year-old laborer (the victim) was fatally injured when he fell through an unguarded roof opening while repairing the rubber roof membrane of a college sports coliseum. The victim and his foreman were repairing the membrane after it had been sliced open to provide access to the underlying roof structure. The victim had been cleaning the existing membrane while his foreman, working behind him, was completing the patch. The victim had progressed to the peak of the arched roof, out of sight of the foreman, and had disconnected his fall protection lanyard from the lifelines. For an unknown reason, the victim stepped on an exposed ceiling tile which gave way, allowing the victim to fall 90 feet to the gym floor. Workers inside the gym saw the victim fall and hit the floor. One of the workers, an EMT, immediately went to the victim and began CPR while another worker notified 911. The campus emergency medical squad (EMS) responded within 8 minutes and transported the victim to a local emergency room, where he was pronounced dead.

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

- *ensure that appropriate fall protection equipment is available and correctly used when working from elevations where there is a danger of falling*

- *consider alternative methods of providing fall protection, such as overhead life line tie-off points.*

INTRODUCTION

On June 27, 1996, a 27-year-old laborer for a roofing company died of injuries sustained when he fell through the roof of a sports coliseum. On July 2, 1996, officials of the Virginia Occupational Safety and Health Administration (VAOSHA) notified the Division of Safety Research (DSR) of the incident and requested technical assistance. On July 30, 1996, a DSR safety

engineer and a DSR general engineer reviewed the incident with the VAOSHA compliance officer. On July 31, 1996, the engineers visited the incident site and interviewed the prime contractor's safety director and the roofing contractor's foreman. Photographs of the incident site were taken.

The prime contractor had been in business for about 40 years, employing 75 to 100 employees depending on industry demand. The victim's employer was a roofing company which had been subcontracted to perform roof maintenance and repair related to the structural modification of the existing coliseum structure. Roof repair work on this job-site required a crew of two, a foreman and a laborer. The foreman had 11 years experience in the roofing trades. The victim, a temporary employee, had started work the day before the incident. Site safety was controlled by the general contractor who employed a full-time safety coordinator. The general contractor had a written safety policy and written site-specific procedures. These procedures were comprehensive and included fall protection standards. Weekly safety meetings were conducted on site for all workers on the project.

INVESTIGATION

The incident occurred on a college campus where a project was underway to strengthen the roof structure of an arch-shaped sports coliseum 262 feet long, 241 feet wide, and 91 feet high. A construction contractor had been hired by the school to install additional steel purlins to the roof structure. As originally constructed, purlins had been installed on roughly 8-foot centers. The contractor was adding steel purlins between the existing purlins, essentially reducing the spacing to 4-foot centers. The structure had a "built-up" roof consisting of ceiling tile roughly 2 inches thick, plywood sheets, asbestos insulation, and a rubber membrane. To install the additional purlins, it was necessary to open access holes at each arch location where the purlins were to be secured. Preparatory to this, the rubber membrane was sliced from the eaves of the roof to the peak, and folded back, exposing the built-up roof structure underneath. Just before lowering a purlin through the roof, the ceiling tile was removed. Once this was done, the purlin was lifted by crane, and placed end wise into the structure and lowered to either the floor or bleachers depending on the location. A lifting beam with an air tugger at each end was then attached to the crane's load line. The winch lines from each air tugger were fed through the roof access holes, and the tuggers were used to lift and hold the purlin while it was clamped in place. Once this was done, the roof was replaced, with the final step being the repair of the rubber membrane by gluing a strip of rubber over the slice. The access holes were temporarily covered by sheets of plywood and marked by orange paint on the surface of the roof. Protection was required to be

worn by all workers on the roof. All workers on the roof were required to wear full-body harnesses with shock absorbing lanyards and rope grabs. Tie-off points were provided by 3/8 inch wire ropes, strung lengthwise along the surface of the roof, at 40 and 80 feet from the eaves. A third rope was secured around the perimeter of the air-handler ducts mounted at the peak of the roof. Nylon life lines, size-matched to the lanyard's rope grabs, were dropped at various locations for the workers to tie off from.

On the day of the incident, the victim and the roofing foreman had spent the morning patching slices. After lunch, they were preparing to repair another slice. They were working together at the bottom of the slice. The victim was using a roller and solvent to clean the membrane while the foreman was readying the membrane patch and beginning to apply the adhesive. The victim, wearing fall protection, worked his way towards the peak of the roof while the foreman's work kept him occupied near the bottom of the slice. Shortly before 1:30 p.m., the victim had progressed to the peak, between 80 and 90 feet from the eaves, and was out of sight of the foreman. The victim disconnected his lanyard from the lifeline and his harness. At 1:30 p.m., workers inside the coliseum heard a noise near the ceiling, and observed the victim fall and hit the floor. One worker who was a trained EMT immediately went to the victim and began CPR while another worker contacted 911. The campus EMS responded to the scene in 8 minutes and transported the victim to the local emergency room where he was pronounced dead.

CAUSE OF DEATH

The medical examiner's report established the cause of death as head trauma with probable aortic rupture.

RECOMMENDATIONS

Recommendation #1: Employers should ensure that appropriate fall protection equipment is available and correctly used when working from elevations where there is danger of falling.

Discussion: The victim had been provided with appropriate fall protection equipment, a new harness and shock absorbing lanyard with rope grab. Additionally, the prime contractor had provided sufficient life lines to tie off to and the victim had been properly instructed in the use of the equipment. However, once the victim had made his way to the peak of the roof he disconnected from the life line and removed the lanyard from his harness. It could not be determined why he did this. The roof was essentially flat in the area of the incident, he was not near the edge of the roof, and the openings were marked. Although he had received instruction the day before, he may have not fully comprehended the necessity to use fall protection at

all times when on the roof. The proper use of fall protection equipment must be continually emphasized.

Recommendation #2: Employers should consider alternative methods of providing fall protection, such as overhead life line tie-off points.

Discussion: It could not be determined why the victim disconnected his lanyard from the lifeline or why he disconnected the lanyard from the harness. It is possible that once he reached the peak of the roof, he did not feel the need for fall protection, since the peak was essentially level so he disconnected from the lifeline. Also, during discussions with the foreman, it was learned that it was not unusual for employees to disconnect from lifelines after reaching the top of the roof, since the lifelines were rigged on the surface of the roof, and the lanyards dragging around the workers were cumbersome and made it difficult to work. After disconnecting he would have had to carry the lanyard with rope grab attached. To do this, he may have pulled the lanyard through the straps of the harness, allowing the slack to hang down from his waist. Walking with the lanyard in this manner, would have allowed the rope grab to bang against his leg. This may have been enough of an annoyance that he disconnected the lanyard from the harness and laid it on the air handler duct. It may be possible to alleviate the annoyance of dragging lanyards by suspending them from overhead lifelines.

Paul H. Moore
Safety Engineer
Trauma Investigations Section
Surveillance and Field
Investigations Branch
Division of Safety Research

Rebecca J. Gibrcelli, Ph.D.
General Engineer
Safety Controls Section
Surveillance and Field
Investigations Branch
Division of Safety Research

Virgil J. Casini
Project Officer
Trauma Investigations Section
Surveillance and Field
Investigations Branch
Division of Safety Research

Ted A. Pettit, M.S., R.E.H.S.
Chief
Trauma Investigations Section
Surveillance and Field
Investigations Branch
Division of Safety Research

Nancy A. Stout, Ed.D.
Acting Deputy Director
Division of Safety Research

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 a participating State reports an occupational fatality and requests technical assistance. 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, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia.

Additional information regarding this report is available from:

Division of Safety Research
National Institute for Occupational
Safety and Health (NIOSH)
1095 Willowdale Road
Morgantown, West Virginia 26505-2888
Phone: (304) 285-5916
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