FACE AK-92-16

TO: **CDR Louis Smith, NIOSH, Division of Safety Research**

FROM: **Gary Bledsoe, AKFACE**

SUBJECT: **Police Officer Dies in 41-Foot Fall from Roof of Fire Training Tower - Alaska**

SUMMARY;

On May 3, 1992, a 39-year-old, male police officer (the victim) sustained severe head injuries as a result of a fall of 41 feet from the roof of a four-story fire training tower. He died as a result of these injuries on May 4, 1992. The victim was participating in a mountain rescue training exercise called a "vertical lower" This maneuver involved the lowering of a mock casualty in a rescue litter and a medical attendant from the roof to simulate the rescue of an injured person in mountainous terrain. As the victim assisted three other participants move the litter off the retaining wall ledge of the training tower, the 400-pound litter fell. The victim was pulled from the roof as he either attempted to prevent the litter from falling or could not let go of the litter. He struck his head on the asphalt pavement below. The mock casualty and medical attendant also fell, suffering serious but nonfatal injuries. The only personal protective equipment used was a fire helmet worn by the mock casualty. The victim was examined in the local hospital emergency room and evacuated by air transport to a major trauma care facility in another state. He died the following morning.

The FACE investigator concluded that, in order to prevent similar occurrences, employers should:

ensure that hazardous training exercises have an assigned safety officer and a sufficient number of instructors to enable adequate monitoring of participant activities

ensure that a secondary means of fall protection is in place for all participants on training towers

ensure that the load line is completely reset in the brake system immediately after each "vertical lower" exercise

ensure that protective helmets are worn by all participants during training exercises

ensure that live loads (individuals rather than substitute weights or dummies) are not used in rescue litters during training exercises

ensure that training course participants understand how all system components interact in complex load line/braking mechanisms.

INTRODUCTION

On May 4, 1992, a 29-year-old police officer died from severe head injuries sustained after falling 41 feet, 3 inches from the roof of a practice tower at a fire training center; the incident had occurred the previous day. The Alaska Division of Public Health, Section of Epidemiology was notified by a staff member familiar with this incident. The incident was also reported extensively in the television and news media. A full-scale investigation involving an Injury Prevention Specialist from the Alaska Department of Health and Social Services, Division of Public Health, Section of Epidemiology ensued on May 4, 1992 and a fatality site investigation was conducted on May 7, 1992. The incident was reviewed with the State Occupational Safety and Health (AKOSH) Compliance Officer, course participants and witnesses, fire-rescue personnel, and the training course instructor. The incident site was visited, measurements were made, new photographs of the fatality site were taken, and fire/rescue agency photographs were obtained. Appropriate documents (police reports, AKOSH Accident Reports, etc) were obtained during the investigation.

The employer was a municipal police department which had been in operation since 1914. The department had a written safety policy, however the policy did not have rules and procedures specific to prevent the type of fatality that occurred. It should be noted that the training session was conducted by a private individual, not the police department. This training is also highly specific. and is unlikely to be a normal component of most police officer training programs. The course instructor was known to be a local expert in the field of mountain rescue, and he had organized this training course to increase the available pool of trained mountain rescuers.

Mountain rescue is a largely voluntary, highly needed skill in this area of extensive mountainous terrain. The training session was conducted at a fire training tower in order to simulate heights commonly encountered in mountain rescues. This one-day course and a similar 4-day version had been conducted on several other occasions at the fire training center without incident. Safety issues were discussed during the morning lecture phase of the course. These issues were discussed within the context of techniques of the "vertical lower" maneuver rather than as a separate topic. A manual on practical mountain rescue was provided to each course participant; this book provided similar information related to safety. The lecture phase of the training was followed by participation in actual "vertical lowers" at the fire training center's tower in which course participants rotated through different key positions (casualty, medical attendant, brakeman, "lower" chief, observer). Two successful maneuvers had been completed before the fatality occurred.

INVESTIGATION

On May 3, 1992, a training course on practical mountain rescue was conducted to increase the number of available mountain rescuers in the community. Participants included volunteer mountain rescuers, volunteer fire fighters, and a police officer. The sole instructor was a well experienced mountaineering and mountain rescue expert. The training course began at 8:00 A.M. at a local volunteer fire department. After 3-4 hours of classroom instruction (described above) the class reconvened at noon at an area fire training center. During this phase of the course, "vertical lower" exercises were conducted. The "vertical lower" is sometimes called a "hasty

lower", and refers to the method in which the litter is lowered feet first and led by a litter attendant (used when the casualty can tolerate a bumpy, but faster ride).

The descent was controlled through use of a load line and brake bar rack (see the "Break Bar Rack" attachment). This apparatus is a friction device consisting of five metal bars through which a climbing rope is woven. A varying number of brake bars are swung into place to increase the amount of desired friction. The bars rotate freely (360 degrees in either direction) on the aluminum frame. Typically, three to four bars are used to control a load line

Six trainees rotated through the various positions required for this maneuver. These included the mock casualty, medical attendant, brakeman. "vertical lower" chief, and observer. Two "vertical lowers" had been successfully completed prior to 2:00 P.M.

Weather conditions during the practical exercise phase of the training were as follows: moderate to heavy rainfall with winds gusting up to 25 miles per hour. The air temperature was approximately 45 degrees Fahrenheit. Since such weather is commonly encountered in this geographic area, it is not practical to schedule fair weather training only. Also, these conditions might be expected to occur in real rescue situations. The roof surface of the training center tower was constructed from wooden planks, and was surrounded by a 4-foot high retaining wall which was about one foot wide. The roof was slippery due to rain, and the relatively small area was congested by the presence of the seven participants (instructor and six trainees), litter, the open stairwell cover, and associated climbing equipment.

At 2:00 P M. a third "vertical lower" was attempted. The position of the course participants, load line, brake bar rack, anchoring system, and key reference points at the time of this attempt are shown in the attached diagram. The litter was placed on the retaining wall ledge as indicated in the diagram. Four participants (instructor, victim, two other trainees) moved the litter into position to be lowered. The victim, acting as the "vertical lower" chief, gave the command "on belay." This command was part of the routine procedure to insure that the rope system was functional and prepared to handle the load. After the brakeman gave the response, "belay on", the litter was moved to the edge of the ledge. The instructor backed away, and the victim and one other trainee continued guiding the litter into the descent position as the litter (which weighed approximately 400 pounds when loaded with the mock casualty and attached attendant) was moved beyond its center of gravity on the retaining wall, it began to fall. One trainee was unable to keep his handhold on the litter and let go. The victim was either unable to release his handhold in time, or was attempting to keep the litter (loaded weight: approximately 400 pounds) from falling. He had previously moved slightly up and forward in his effort to guide the litter, and his center of gravity changed accordingly. Witnesses state that his "feet flew into the air" and he fell (41 feet, 3 inches) along with the litter attendant and mock casualty onto the asphalt pavement below. The mock casualty and litter attendant fell feet first, sustaining severe foot, ankle, and leg injuries. The victim struck his head on the asphalt and sustained severe head injuries. Course participants called emergency responders immediately, and the EMT team arrived at 2:06 P.M. Two course participants were trained EMT's and had started medical intervention prior to the arrival of the EMT team. They noticed the victim was cyanotic and tilted his head back which cleared his airway. The victim then began breathing on his own, CPR was not required. The EMT team found the victim unresponsive to neural stimuli, and transported him to the local

hospital emergency room. He was evaluated along with the other two injured participants by ER staff, and it was decided to evacuate all three to a major trauma care center The victim was transported and died the following morning. The two remaining injured workers were recovering, and out of immediate danger. Whether they will fully recover from their injuries is unknown at this time.

An analysis of the fatality scene revealed the most likely cause to be a failure of the rope braking system procedure. Investigators believe the load line was not pulled completely through the brake bar rack The rope was probably coiled in front of the brake rather than behind the brake as would be necessary for proper operation (see the "TOP VIEW - Fire Training Center" attachment). This would allow the litter to free-fall when it was moved over the edge of the retaining wall because the brake bar rack could not be engaged.

CAUSE OF DEATH

The autopsy report attributed the victim's death to "blunt impact injuries to the head".

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that hazardous training exercises have an assigned safety officer and a sufficient number of instructors to enable adequate monitoring of participant activities.

Discussion: The training course was conducted without a specifically assigned safety officer, and only one instructor for six trainees This omission may have led to multiple failures in systems safety (described below). This situation made it very difficult to monitor the activities of all participants. In addition, the single instructor was required to monitor all equipment rigging, the physical condition of all ropes, carabiners (snap-links), bridles, slings, harnesses, and other associated equipment, and evaluate the job comprehension and performance of course participants. These activities and conditions had to be monitored while working in a relatively small area crowded with spare ropes, rigging, tools, other associated climbing equipment, as well as the seven participants (trainees and instructor). The instructor also had to remain constantly aware of changing winds, precipitation, temperature, and other physical factors to make proper judgments about safe training conditions. This was a formidable task for one individual to manage. The addition of a safety officer would have enabled one individual to concentrate solely on safety issues.

Finally, consideration should be given to less risky training environments. Could this type of training be conducted in-doors, or at lower heights? As an example, the first phase of training might be conducted inside a gymnasium. This would eliminate adverse weather conditions and allow for greater engineering and environmental controls (height limits, fall protection, space and lighting considerations, etc.). Additional "real-life" training could be designed for a second phase of training.

Recommendation #2: The employer should ensure that a secondary means of fall protection is in place for all participants on training towers.

Discussion: No means of secondary fall protection was employed during this training exercise This was not used because it is considered to be impractical in actual mountain rescues. However, this incident occurred in a training exercise at a building site where such protective measures could have been employed. Eyebolts were available along each side of the inner retaining wall. These could have been used as anchor points for secondary fall protective devices. Safety considerations should outweigh "absolute realism" in training exercises. Although specific AKOSH regulations regarding fall protection do not exist for this type of training, use of secondary fall protection, such as catch platforms and secondary restraints, is appropriate in these circumstances. In addition, the medical attendant could have used a separate fall protection system (harness/lanyard on an anchored line) rather than being dependent on his attachment to the load line.

Recommendation #3: Employers should ensure that the load line is completely reset in the brake system immediately after each "vertical lower" exercise.

Discussion: In crowded conditions as described in recommendation #1 above, positions of ropes and proper rigging might be more difficult to monitor. Requiring that the brake bar rack be rewoven and that the entire length of the load line be threaded through the rack immediately after each descent would ensure that proper attention is given to this critical braking system component. Consideration should be given to adding a standard command, such as "check brake" or "brake engaged", to the "vertical lower" (as well as other lowering methods which involve load lines and braking systems) command and acknowledgement routine.

Recommendation #4: The employer should ensure that protective helmets are worn by all

participants during training exercises.

Discussion: Only one course participant was wearing a helmet at the time of this incident. The medical attendant was wearing a standard fire helmet which was severely damaged (the helmet liner was torn out its of normal position) during the fall. From this evidence fire rescue officials believe the attendant avoided serious head injury, and possibly death by his use of a helmet. Although this recommendation is not likely to prevent severe injuries resulting from direct falls at significant heights, injuries from "glancing" blows on structural projections (e.g., concrete window sills, etc.) may be prevented or lessened by reducing the magnitude of impact forces.

Recommendation #5: The employer should ensure that live loads (individuals rather than substitute weights or dummies) are not used in rescue litters during training exercises.

Discussion: The instructor used a live load in the litter rather than a weighted dummy which was available at the training site. The fire training center had two dummies available at all times for practice exercises. Although the fatality would not have been prevented by use of a dummy in the litter, serious injuries to the mock casualty would have been avoided. No significant increase in training effectiveness was gained by using a live patient in the litter because emergency medical procedures were not a component of this training course.

Recommendation #6: The employer should ensure that training course participants understand how all system components interact in complex load line braking mechanisms.

Discussion: Some course participants indicated that they were very concerned about their comprehension of how the braking system functioned. Trainees had concentrated on learning about individual components of the system (knot tying, weaving the brake, the anchor system), but were unsure of how the individual components created a working load line braking system This uncertainty could lead to misunderstandings and failure to recognize obvious hazards (e g., an improperly woven load line) All hazardous training should include information on component integration, or viewing the system as a whole. Schematic diagrams, models, photographs, slides, or drawings may assist trainees in understanding at the "systems safety" level. An appropriate amount of classroom time should be devoted to this critical area.

REFERENCES

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