The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research NIOSH

Confined Space Incident Kills One Worker and Injures Another

FACE-8512

Introduction:

The National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR), is currently conducting the Fatal Accident Circumstances and Epidemiology (FACE) project, which Is focusing primarily upon selective electrically related fatal injuries and confined space fatalities. By scientifically collecting data from a sample of fatal accidents, the FACE will identify and rank factors which increase the risk of fatal injuries for selected employees.

On March 13, 1985, one elevator mechanic and one temporary mechanic were atop an elevator car on the sixth floor attaching a permanent cable. During the connection process the elevator car broke loose and fell to the pit killing one worker and injuring a second.

Contacts/Activities:

The Division of Safety Research received an invitation from the Department of Army, Corps of Engineers, to include this confined space incident in the FACE project. A research team consisting of a safety specialist and a consulting mechanical engineer visited the construction site in St. Louis, Missouri. Pictures (35 mm and video tapes) of the accident site were taken. Multiple interviews were hold, survey instruments were completed, and next-of-kin interviews were done.

Synopsis of Events:

On March 13th a certified elevator mechanic and three temporary mechanics were assigned the task of wiring an elevator and installing the permanent cables. Up until the time of the accident, a temporary hoist was used to move the elevator up and down the hoistway to provide a working platform for the various jobs required within the hoistway. originally a small hoist was installed in the pit but proved too small to handle the elevator cab; therefore, a larger 4 ton rated hoist was placed in the doorway of the sixth floor.

At the time the elevator fell uncontrolled to the pit, the foreman and his helper were working on the first floor position indicator. The two injured workers had spent the morning making electrical connections from. atop the elevator. By early afternoon the requirement for removing the temporary hoisting cable became necessary to permit the installation of the permanent main cables. The elevator car was raised as high as possible with the temporary hoisting cable. The elevator car was still approximately 3 feet short of the required height to make the proper permanent cable connection. The fatal worker had set up a six foot ladder atop the elevator for the purpose of attaching the “come-along” to the overhead beam and the

crosshead above him. The non-fatal worker was attaching metal covers over a vertical channel designed to enclose electrical wires. Immediately upon ascending to the upper elevation in the hoistway, the survivor said the safeties were manually set' and the dogs on the governor were set.

At approximately 3 o'clock p.m. the elevator fell approximately 75 feet before crashing into the pit. Within 10 seconds the elevator foreman and his helper had opened the elevator door from the first floor. They found both workers atop the elevator car. The survivor was lying down on the rear of the elevator car and perpendicular to the elevator door. The survivor's injuries were less severe because he was in constant contact with the elevator car top and, upon impact, the roof of the elevator was flexible and, as a result, absorbed much of the energy. The fatal worker was found draped across the crosshead which is attached to the roof of the elevator car. It is believed that the fatal worker followed the elevator down and freefell until he struck the crosshead. The crosshead, constructed of rigid steel, was unable to absorb sufficient energy to cushion the fall. The fatal worker received severe multiple injuries including a severed spine and a broken neck. Within five minutes, three registered nurses from the facility dispensary arrived on the accident site. One nurse was lowered onto the elevator where she applied mouth-to-mouth resuscitation to the seriously injured worker. A second nurse treated the other worker for shock. By 3:30 both victims were transported to a local hospital where the fatal worker was pronounced dead at 4 o'clock p.m. and the second injured worker was admitted for treatment.

Conclusions:

The injuries to the workers occurred due to an elevator cab descending to the pit in an uncontrolled manner. The safeties had been set in accordance with an approved method performed by skilled craftsmen. Analyzing the system, it is virtually impossible for the safeties to disengage without first lifting the cab to unseat the safety shoes. Secondly, assuming the governor was not manually tripped, the instant the cab started to descend, the trip speed of 280 feet per minute or 4.667 feet per second would occur quickly and immediately set the governor jaw clamp which through the governor cable would apply the safety shoe to the guide rails. If the governor was set when the cab was located between floors 5 and 6, examination of the governor cable may reveal jaw "pull through" marks over the length of the cable equal to the length of the descent of the cab. These same marks observed at some shorter distance near the bottom would indicate at what approximate point the governor actually tripped. Due to the possibility of the safety shoes not being properly adjusted, there may have been a sufficient retarding frictional force applied to the guiderails to limit the velocities slightly below the rated tripping speed and thus the governor, if not previously tripped, would not activate the clamp jaw thus permitting the cab to descend uncontrolled. Another consideration is the governor itself. Was it properly adjusted and functional as per certification?

Recommendations:

1. Examine the governor control cable to reconstruct the-.point of application of the mechanical safety system.

2. Confirm the governor operating parameters by an independent testing facility.

3. Verify the two safety jaw compression spring locations and deter-mine if they were in conformity with the recommended settings established in the attached company procedures for setting the safeties.

4. Inspect the safety system of elevator number 1 as it is dismantled for any other oddities that may have caused a safety system failure. A complete inspection is impossible until the elevator is dismantled.

5. In future installations do not let the elevator safety system become the primary holding device. Install a redundant holding system before removing the temporary hoist rigging.

6. Develop a written certification document, for the spring settings and adjustments on the safety arms, to be signed by the installer and approved by a supervisor before operation.

7. Critical elements of elevator installation/repair should be identified and certified as correctly performed via a signature from a certified mechanic.

Return to In-house FACE reports

Last Reviewed: November 18, 2015