

# The Case of the Shipyard Electrocution

## Journeyman electrician is killed while performing maintenance on high-voltage transformer

*From the forensic files of the National Institute for Occupational Safety and Health's (NIOSH) Fatality Assessment and Control Evaluation (FACE) Project*



It seemed like a typical night at a ship repair yard one rainy evening. Operating for more than 15 years — 13 of which had been at this particular location in California — the shipyard was home to around 1,300 employees working round-the-clock shifts. For a particular 35-year-old journeyman electrician, one of approximately 60 employed by the company, this shift would sadly be his last.

Working from 4 p.m. until midnight, the man was sent out by his supervisor to perform electrical maintenance on a high-voltage transformer, which provided power to numerous essential areas and systems, including shipboard activities, confined spaces, lighting systems, and power hand tools. The assignment took him to the south power transformer, located outside in the southern portion of the shipyard, where the task at

hand would expose him to high-voltage equipment (12,000kV and 600A) — a condition that would ultimately lead to his death.

**The accident.** According to his coworkers and supervisor, the man's electrical experience had been primarily working with low-voltage equipment; however, he had worked with high-voltage on occasion. Instructed by his supervisor

to inspect the transformers throughout the shipyard, this process involved ensuring the high-voltage conductors in the transformers were properly insulated — a job a local electrical company had performed on several occasions earlier that month. (It's important to note that around 9 p.m., while inspecting these transformers, he accidentally turned off power to a dry dock somehow, leaving a large number of employees without power until it was restored.)

The plans changed, however. With a shift change came a new set of instructions from a new supervisor. This time, the worker was told to stop what he was doing and proceed with two new tasks. First, he was to troubleshoot and repair a ground fault in the center yard. Next, perform maintenance service on the high-voltage transformers.

At approximately 10:20 p.m., while working alone performing maintenance work on the south transformer, the victim was discovered lying unconscious and unresponsive face down on a wet surface by a coworker. Emergency crews were called to the scene. Cardiopulmonary resuscitation (CPR) was initiated by coworkers and continued until arrival of paramedics at approximately 10:26 p.m.

At this time, the victim did not have a pulse, was absent of blood pressure and respiration, and was asystolic on the cardiac monitor. An esophageal obturator airway (EOA) was placed, and he was administered intravenous normal saline, epinephrine, and atropine. No clinical response was noted, and he was transported to the local hospital. Upon arrival at the hospital emergency room at 10:54 p.m., the victim was unconscious and unresponsive with CPR in progress. Despite aggressive resuscitative efforts, including six defibrillation attempts, no clinical response was noted, and death was pronounced. Cause of death? High-voltage electrocution.

**The investigation.** Informed of the incident the next day by a Cal/OSHA safety engineer, a California Fatality and Control Assessment Evaluation (FACE) investigator arrived on the scene. Aided by a copy of the Cal/OSHA Report and the medical examiner's autopsy report,

the forensic investigator began to gather evidence. This process would uncover several findings.

First, he established that environmental conditions at the site were very poor that night due to a recent rain and inadequate lighting. The victim was also not wearing any personal protective equipment (PPE), and there was no ground provided for the transformer at this location. A pair of protective gloves were found on the north side of the transformer by the victim's supervisor along with several tools (crescent wrench on top of the transformer and small hand tools in the victim's tool belt) as well as a can of all-purpose degreaser found inside the transformer where the victim had been working.

## The man's electrical experience had been primarily working with low-voltage equipment; however, he had worked with high-voltage on occasion.

Neither coworkers nor the victim's supervisor could explain what the aerosol was being used for, although some speculated it may have been used to detect cracks in the wire insulation.

The investigator also found that the panels in the power supply room were not labeled, nor was there a label or warning sign at the incident site. The panel that provided electrical current to the south transformer was found in the "Open" position — a position that de-energizes the unit — when observed by company officials after the incident.

Although the conductors in the transformer had been de-energized by the victim, there may still have been backfeed or stored energy remaining in the conductors. There was no

testing equipment located in the immediate area, making it appear that no tests had been made by the victim to ensure that all the cables were de-energized before he began his work that evening. As noted earlier, there was also no ground in place at the south transformer. The victim did not try to install a ground to the transformer, possibly because grounding the unit prior to beginning his work could have exposed him to an increased electrical hazard.

When interviewed for this case, coworkers hinted at the fact that the victim may have been reprimanded after the initial power outage around 9 p.m., thus causing him to act hastily with regard to his other tasks later on that evening. The next power outage occurred at approximately 10:10 p.m., allegedly at the time of the accident.

**The lesson.** On the surface, it appeared that safety was a priority at the shipyard. For example, safety meetings were conducted on a regular basis, according to management. Employees were also given several types of safety training, including on-the-job, classroom, manuals, videos, and guest speakers. This was complemented by weekly safety meetings, called "gangbox meetings." Nevertheless, there were no written safety rules available for the California FACE investigator to review during the time of his site investigation.

After conducting his analysis, the investigator formed the following conclusions, offering these recommendations to prevent similar tragedies from happening in the future.

*Recommendation #1 — Employers should have an Injury and Illness Prevention Plan (IIPP) that addresses specific electrical safety training for supervisors and employees working with electrical equipment.*

According to the investigator, this incident could have been prevented if such a plan had been developed and implemented. In addition, a communication system should also be in place, offering employees the opportunity to express concerns regarding electrical hazards in the workplace.

In fact, under Title 8 of the California Code of Regulations (CCRs) Section

3203(3), employers should include a system for communicating with employees in a form readily understandable by all affected employees on matters relating to occupational safety and health, including provisions designed to encourage them to inform the employer of hazards at the worksite without fear of reprisal. Per Section 3203(7)(f), employers should provide a plan that states supervisors should familiarize themselves with the safety and health hazards to which employees under their immediate direction and control may be exposed.

*Recommendation #2 — Employers should have a standard operating procedure (SOP) stating that all high-voltage work be performed by a licensed electrician.*

In this case, the victim was not yet a licensed electrician.

*Recommendation #3 — Employers should have a proper ground in place for all electrical transformers and equipment.*

In this particular case, the incident could have been prevented if a ground had been in place at the south transformer. Excess electrical energy in the cables at the transformer that evening may have contributed to the electrocution.

Under Title 8 of the CCRs Section 2943 (f), suitable grounding devices shall be used — first connected to a ground before being brought into contact with any de-energized conductors or equipment to be grounded. The other end shall be attached and removed by means of insulated tools or other suitable devices. When removed, they shall be removed from all conductors or equipment before being disconnected from the ground.

*Recommendation #4 — Employers should have an SOP that clearly outlines guidelines for a lockout/tagout system.*

If a lockout/tagout system had been in place, this accident may not have occurred. Employers should instruct supervisors and employees in the operation of such a system. The individual doing the electrical work should de-energize and lock the power panel before beginning to do any electrical work. A single key to the lock should be kept by this individual until all electrical work is completed.

Under Title 8 of the CCRs Section 4413, employees shall be instructed to retain possession of the key(s) to the

lock(s) and personally remove the lock(s) or, if used, blocking means upon completion of work.

*Recommendation #5 — Employers should have all power panels and transformers labeled so that it is evident where electricity is provided and from which panels.*

In this specific location, the power panels and transformers were not labeled. Proper labeling may have acted as a visual reminder to the victim with regard to which panels control which equipment. A warning label on the transformer may have also reminded the victim to take safety precautions when working with high-voltage electricity. Under Title 8 of the CCRs Section 2811, permanent and conspicuous warning signs shall be posted on all doors or gates that provide access to enclosures containing exposed energized parts and conductors. Such signs shall be legible at 12 feet and shall read substantially as follows: "WARNING - HIGH VOLTAGE - KEEP OUT."

## The victim was not wearing any personal protective equipment (PPE), and there was no ground provided for the transformer at this location.

*Recommendation #6 — Employers should have an SOP addressing the necessary environmental conditions for certain types of work activities, such as electrical maintenance work done in the outdoors.*

The victim in this incident was working under wet conditions and with poor lighting. This incident may have been prevented if there had been an SOP stating that no electrical work was to be done outdoors in adverse weather or without sufficient illumination when working at night.

*Recommendation #7 — Employers should train employees in the proper use of personal protective equipment (PPE).*

Unfortunately, the victim in this case

was not wearing gloves or any other type of PPE. Employers should have adequate personal protective equipment at the workplace and provide training for employees on the proper use of such equipment.

*Recommendation #8 — Employers should have an SOP stating that two employees should work together when working with high-voltage electrical equipment.*

Contrary to this recommendation, the victim in this incident was working alone. A coworker may have reminded the victim to wear PPE or may have suggested that the victim not continue to work under the poor environmental conditions in existence that evening. Under Title 8 of the CCRs Section 2940(c), only qualified electrical workers shall work on energized high-voltage system.

Except for replacing fuses, operating switches, or other operations that do not require the employee to contact energized high-voltage conductors or energized parts of equipment, clearing "trouble" or in emergencies involving hazard to life or property, no such employee shall be assigned to work alone. Employees in training, who are qualified by experience and training, shall be permitted to work on energized conductors or equipment connected to high-voltage systems while under the supervision or instruction of a qualified electrical worker.

Although hindsight is 20/20, there is a considerable possibility that if the employer had followed even a few of the recommendations above, the tragedy may not have occurred.

**Editor's Note:** This article was excerpted from a FACE report with permission from NIOSH. All FACE reports involving electrical injury and fatalities can be accessed on the Web at [www.cdc.gov/niosh/face/default.html](http://www.cdc.gov/niosh/face/default.html).

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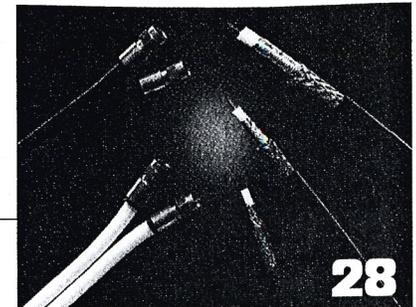
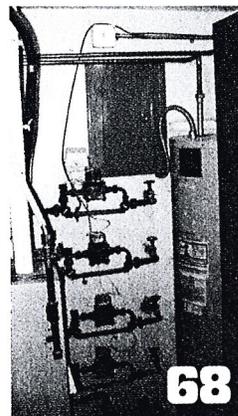
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