The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces through safety and health research NIOSH

Journeyman Wireman Electrocuted After Contacting Energized Switchgear Components at Power Plant–West Virginia

FACE 94-10

SUMMARY

On March 14, 1994 a 53-year-old male journeyman wireman (the victim) was electrocuted when he contacted two energized 6.9 kV buss terminals at a power plant. The victim and two co-workers had been engaged in final installation of electrical components associated with a sulfur dioxide emissions control system. These components were being installed in a 14-compartment switchhouse. The circuit breaker protecting the switchhouse's internal buss had been isolated according to the power plant tagout procedures. The victim and co-workers were wiping down the individual compartments in preparation for a pre-startup inspection by power plant personnel. Without the knowledge of the victim and co-workers, the switchhouse's internal buss had been energized by power plant personnel; when the victim attempted to wipe down one of the compartments at the south end of the switchhouse, he contacted the A phase buss terminal with his right hand and the C phase buss terminal with his left hand. This completed a path between phases for 6.9 kV and he was electrocuted. One co-worker was walking past the victim when the incident occurred; he was blown backward from the resulting explosion, and received first degree flash burns on the face and neck. The second co-worker, at the north end of the switchhouse, heard the explosion and came to render assistance. The contractor's safety coordinator was notified by radio and EMS assistance was requested. The EMS responded in approximately 15 minutes and transported the victim to a local hospital emergency room where he was pronounced dead.

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

- **develop and implement procedures to control hazardous electrical energy which include both lockout and tagout provisions**
- **provide employees with voltage sensors and implement their use prior to and during workers' entrance into enclosures containing electrical components.**

In addition, power plant owners and supervisory personnel should:

- **consider installing hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization**
- **ensure that employees follow all safety procedures established for control of hazardous electrical energy.**

INTRODUCTION

On March 14, 1994, a 53-year-old male journeyman wireman (the victim) was electrocuted when he contacted the 2 phases (A and C) of an energized buss inside a swithchhouse at a power plant. The following day the Division of Safety Research (DSR), National Institute of Occupational Safety and Health, learned of the incident through a newspaper article and contacted the employer to offer technical assistance. A DSR safety engineer investigated the incident at the site on March 25, 1994. The DSR representative interviewed a vice president of the electrical contracting company and the company's on-site safety coordinator, took measurements of the site and requested the medical examiner's report.

The employer had been in business for 76 years and employed 10,000 workers nationwide, about half of whom were journeymen wiremen. The employer was one of two contractors installing a sulfur dioxide emissions control system for the utility company which owned the power plant and had been on site for 1 year. The company maintained a full-time corporate safety director and an on-site safety coordinator. The company normally adhered to a company-wide lockout and tagout procedure; however, for this particular job, the company had adopted the utility company's procedure, a tagout-only policy. Employees of the contractor received on-the-job training in addition to safety-manual and new-hire orientation. Weekly safety meetings were held at the jobsite and safety talks were given each time a job task was changed.

INVESTIGATION

The incident occurred on the third floor of the power plant electrical equipment building where workers were in the final stages of installing electrical components inside a 14-compartment switchhouse. The switchhouse and associated switchgear were part of a newly installed sulfur dioxide emissions control system for the power plant and had never been energized.

On March 14, 1994, employees of the contractor began work at 7 a.m. The victim and two co-workers went to the third floor of the electrical equipment building where they had been installing electrical components inside the switchhouse. The workers were completing the installation which included making the final connections to the ground circuit, checking electrical connections for proper tightness, and cleaning the inside of the switchhouse compartments prior to pre-startup inspection by power plant personnel. They were engaged in this activity during the morning and most of the afternoon. The switchgear had been isolated according to the tagout procedure in effect at the power plant but was not physically locked against energization. All of the circuit breakers inside the switchhouse had been isolated by placing the panel-mounted circuit breaker operating handles in the remote position and tagging out (red tag). The circuit breakers can be opened in two ways remotely or manually depending on which mode of operation is selected at the switch handle on the front panel of each compartment. In the remote position, the breakers can be operated from outside the electrical equipment room. When manual operation is selected, the circuit breakers can only be closed from the front panel. Power (6.9 kV) is supplied to the north end of the switchhouse by insulated conductors which are connected to an internal buss running the length of the switchhouse. Power is then distributed from the enclosure to various areas of the facility.

At about 3:30 p.m. without the knowledge of the workers, the red tag posted on the circuit breaker protecting the internal buss was replaced by a green tag and the breaker was closed by power plant personnel. This energized the internal buss of the switchhouse. The workers continued working, unaware that the switchhouse buss was energized. At about 4:40 p.m. the victim reached inside the upper part of the second compartment from the south end of the switchhouse to wipe it down. This compartment contained three buss terminals, A, B, and C phases, where a jumper had been connected to carry power to an adjacent switchhouse. As he reached inside the compartment, he contacted the A phase terminal with his right hand and the C phase terminal with his left hand and was electrocuted. One of the co-workers had been walking past the victim at the time of contact, was knocked down to the floor by the blast and suffered first degree burns on his neck and face. A second co-worker, at the north end of the switchhouse, heard the explosion and went to render assistance to the victim, who had fallen to the floor and whose clothes were on fire. The second co-worker suffered burns to his hands when he tried to beat out the flames. The contrac- tor's safety coordinator was notified by the operator of a cherry picker, who had witnessed the flash of the explosion from outside the building. The safety coordinator notified plant security to request emergency medical services (EMS) and then went to the third floor. He checked the victim for a pulse and finding none, started CPR. In approximately 15 minutes, the EMS arrived and transported the victim to a local hospital emergency room where he was pronounced dead.

CAUSE OF DEATH

The cause of death was established by the deputy medical examiner as electrocution.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should develop and implement procedures to control hazardous electrical energy which include both lockout and tagout provisions.

Discussion: The tagout procedure established by the power plant did not include physically locking out the switchgear. The procedure allowed the switchgear to be placed in the remote position and a red tag (known as a "release" tag) placed on the panel-mounted breaker control handle on the front panel of the compartment and a corresponding red tag placed on the appropriate controls located in the power plant control room. It was intended by the procedure that this tag had the same effect as physically locking out the switchgear compartment. However, because the handle was placed in the remote position, it was possible to operate and energize the compartment remotely from outside the equipment room. While lockout procedures are not fail-safe, physically isolating electrical components with locks whose keys are controlled by the workers performing the work in the compartment would provide an additional level of protection.

Recommendation #2: Employers should provide employees with voltage sensors and implement their use prior to and during workers' entrance into enclosures containing electrical components.

Discussion: Voltage-sensing instruments are available which when used, can detect the presence of energized electrical components. These hand-held instruments could be provided to anyone prior to entry into enclosures such as switchhouses containing electrical components and could be used to provide a final check and warning of the presence of hazardous electrical energy. Use of these detectors should not be considered a first-line defense against exposure to energized electrical components; however, their use could offer a back-up to a lockout/tagout isolation policy.

Recommendation #3: Owners of power plants should consider in- stalling hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization.

Discussion: Additional protection against contact with ener- gized components could be provided by installing warning lights inside compartments which contain electrical equipment not under the direct control of the workers. Such a light could be connected to the control circuit for the switchgear to indicate that the equipment is energized. Multicompartment switchouses should have a separate light mounted inside each compartment where it is readily visible to workers.

Recommendation #4: In addition, power plant supervisory personnel should ensure that employees follow all safety procedures established for control of hazardous electrical energy.

Discussion: The tagout procedure in effect at the power plant required that prior to energizing electrical equipment which had been isolated by red tagging, an inspection of the equipment and area should be performed by qualified persons; the switchhouse doors and access panels should be closed; and the area cleared of all persons. The person authorized to red tag the equipment then removes the tag and places a green tag on the equipment, indicating that the equipment is to be operated for test purposes only. The equipment can then be energized. On the day of the incident, this procedure was bypassed when the red tag isolating the circuit breaker protecting the internal buss was replaced with a green tag while work was being performed inside the open switchhouse compartments.

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