



Electrical wiring mistakes have resulted in electrical shocks and near misses.

Events

Site/Facility: **Hanford Waste Treatment Plant Construction Project**

Wiring Error Results in Electrical Shock -- Reference: **ORPS Report** [RP--BNRP-RPPWTP-2003-0006](#)

On December 3, 2003, a worker received an electrical shock when he grasped the leg of a 480-volt portable electrical heater with his right hand, while touching a metal tabletop with his left hand. The 3-phase, 4-wire, grounded plug on the heater had just been re-wired by an electrician, such that the ground wire was attached to a power prong and a hot wire was attached to the ground prong, energizing the heater housing with 277 volts.

Important Points:	<ul style="list-style-type: none"> • The journeyman electrician did not perform a visual inspection or circuit check of the re-wired electrical plug before releasing it for use.
Contributors:	<ul style="list-style-type: none"> • It was not standard practice at the time of the incident for journeymen electricians to conduct circuit testing after wiring end caps. • Management did not have an assured grounding program or a program in place that required circuit testing following work on electrical equipment.

Site/Facility: **Idaho National Engineering Laboratory - Test Reactor Area**

Near Miss - Improperly Wired Extension Cord -- Reference: **ORPS Report** [ID--BBWI-TRA-2003-0008](#)

On September 9, 2003, electricians discovered a miswired extension cord while troubleshooting a loss of power to a HEPA filter unit when a fuse blew. The extension cord had one of the phase wires connected to the plug case, resulting in a short to ground.

Important Points:	<ul style="list-style-type: none"> • The electrician who fabricated the extension cord had never wired this type of connector before.
Contributors:	<ul style="list-style-type: none"> • The electrician failed to inform his supervisor of his inexperience and therefore, received no specific direction or oversight on how to wire the cord correctly.

Site/Facility: **Los Alamos National Laboratory - Data Storage Project**

Miswired Welding Plug Results in Electrical Shock -- Reference: **ORPS Report** [ALO-LA-LANL-NUCSAFGRDS-2003-0002](#)

On May 27, 2003, a machinist received an electrical shock when he simultaneously touched a welding cart and another piece of equipment. A 480-volt plug on the cart was incorrectly wired (power lead and ground reversed) energizing the body of the cart. A journeyman electrician had installed the pin and sleeve plug as part of a modification to the welding cart.

Important Points:	<ul style="list-style-type: none"> • The journeyman electrician, who installed the welder pin and sleeve cap, did not verify that the wiring was correct.
Contributors:	<ul style="list-style-type: none"> • Management's expectations of, and standards for, self-checks were not communicated to the electrician during the pre-job briefing, leaving an ambiguous process as to what was acceptable in verifying that work was performed correctly and left in a safe condition. • The task of verifying work was considered "skill of craft."

Site/Facility: **Oak Ridge Spallation Neutron Source Construction Site**

Electrical Shock from Incorrectly Wired Receptacle -- Reference: **ORPS Report** [ORO--ORNL-X10SNS-2003-0002](#)

On May 27, 2003, an electrician received an electrical shock when he touched a metal component while working on a locked-out circuit. An incorrectly wired 120-volt receptacle in a communications cabinet had a ground wire connected to a power terminal and a hot wire connected to the ground terminal. In addition, a transformer had been rewired by a subcontractor electrician who failed to properly bond the neutral wire to ground allowing current to float between circuits. The floating current was carried through the improperly wired receptacle. .

Important Points:	<ul style="list-style-type: none">• The cabinet vendor had improperly wired the electrical outlet and an electrician incorrectly wired a transformer that together, created an unknown electrical hazard.
Contributors:	<ul style="list-style-type: none">• The Quality Program failed to detect the improperly wired transformer because no inspection had been performed after the rewiring.• The communication cabinet was provided to the construction manager for installation without undergoing an acceptance inspection and approval.

Site/Facility: **Lawrence Livermore National Laboratory - NIF Construction Site**

Improperly Wired Power Cord Results in Electrical Shock -- Reference: **ORPS Report** [OAK--LLNL-LLNL-2002-0002](#)

On January 15, 2002, an electrician received an electrical shock while plugging a supply cord into a short pigtail connected to a 208-volt power panel. Two experienced electricians had shortened the pigtail and accidentally switched the ground and a hot conductor in the connector at the end of the pigtail.

Important Points:	<ul style="list-style-type: none">• The wiring modification required a visual inspection for proper wiring and the electricians did not perform one.• The modification also required an assured grounding inspection on each pigtail using a voltage/continuity test instrument. Instead of testing each individual conductor for proper voltage, the electricians used an A/C Sensor Wand passed over the insulation of the pigtail, verifying only that it was energized and not correctly wired.
Contributors:	<ul style="list-style-type: none">• The electricians were unaware of the requirements for an adequate assured grounding inspection.• The electricians did not have a procedure for assured grounding inspections.

Important Considerations for Eliminating Wiring Errors (Lessons Learned)

- Is testing for proper wiring following maintenance or repair required or just assumed that it will be performed as skill-of-the-craft? Do work instructions typically include inspections and testing?
- Do workers know the configuration of the electrical wiring, plug, or circuit? Are terminals labeled and wires color coded to prevent confusion?
- What type of checks should be performed (e.g., voltage, continuity, phasing, polarity)?
- What are the proper methods for using test meters and instruments when checking for proper wiring? Are all workers trained and qualified to use these meters? How can you verify their qualifications?
- Is there an assured grounding program, in accordance with NEC (Section 305) and OSHA 29CFR1926.404(b)(1), at this facility/site? Have electrical workers (including subcontractors) been trained on the program and understand management's expectations?

The cited events are examples of electrical wiring errors that have occurred since January 2002.