

Date Mon, 06 Dec 1999 110806 -0700
From Meredith Brown <racer@lanl.gov>

Subject: Yellow Alert- Electrical Shock from Gradient Furnace

Title: Yellow Alert- Electrical Shock from Gradient Furnace

Date 11/19/99 Identifier RL-PNNL-PNNLBOPER-1999-0030

Lessons Learned Statement- Certain designs of gradient furnaces have a helical heating coil that will induce an unexpected voltage on metal objects inserted axially, even when the coils are insulated. In addition, furnaces used outside of the manufacturer's intended purpose may cause additional electrical hazards to the operator.

Discussion of Activities- As a worker was loading experimental samples into an electrical furnace housed in a fume hood, the tweezers he was using to handle the samples came into contact with the wall of the sample chamber and he received a shock similar to a "static charge." The sample chamber is a mullite tube fixed along the axis of the cylindrical furnace.

Analysis- While the heating tube is made of a normally insulating material, an induced voltage of approximately 90 volts was later determined to be present at the tube surface. Upon contact, this voltage caused a low amperage current from the sample holder to the tweezers, through the right arm, chest, and left arm of the staff member, terminating at the metal fume hood sill.

Recommended Actions- Furnace operators should use safe work practices when inserting metal objects into furnaces with this type of configuration such as deenergizing the furnace, using appropriate personal protective equipment or insulating tools, grounding equipment, and operating at a safe work distance. Periodic inspections of these furnaces must also be performed to determine the level of induced voltage. When modifying electrical furnaces to accommodate an experiment (e.g., adding a tube, increasing the element), perform a safe condition check on the furnace to ensure electrical safety. Checked guarding of live parts, heat effects at higher temperatures, stored energy, leakage of current, and induced voltage. Line managers are accountable to ensure that staff are trained in the selection of appropriate work practices (e.g., personal protection equipment, de-energizing methods, safe work distances) and in safe operating procedures before operating the furnace.

Priority Descriptor YELLOW/Caution

DOE Functional Category Occupational Safety and Health

PNNL Functional Categories Electrical Safety

Work Activity Research and Development

Hazard Electrical

ISM Core Function Analyze Hazards

Originator Pacific Northwest National Laboratory

Contact PNNL Lessons Learned Coordinator; (509) 373-7664; FAX 376-5243; email

lessonslearned@pnl.gov

Authorized Derivative Classifier NA

Reviewing Official Patti Johnson

Keywords gradient furnace, induced voltage

References RL-PNNL-PNNLBOPER-1999-0030