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Subject: Yellow Alert: Switch Configuration Results in Ventilation Shutdown and Evacuation

Title: Switch Defect Causes Electrical Spike Resulting in Ventilation Shutdown and Evacuation

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LESSONS LEARNED: New electrical equipment configurations should be tested in a manner that minimizes their impact on programmatic work in case the new configurations cause unexpected power conditions. Tests are recommended even if the configurations are approved by the manufacture.

DISCUSSION: When personnel at the Laboratory's Plutonium Processing Facility installed redundant controls for instrument air in Building PF4, a manual selector switch was needed that could switch power between three electrical sources and shut off one source before switching to the alternate source. A Laboratory electrical engineer contacted the Square D Company to discuss construction of a selector switch. A Square D representative proposed a configuration of components for the switch, and the engineer reviewed the component specifications. The engineer determined that the unusual configuration would be acceptable and he assembled the selector switch in the suggested configuration. The switch was made in the manner listed in the Square D manual as a valid assembly made with correct components.

A service outage was scheduled during the facility's weekly maintenance period to test the redundant controls system. No programmatic work is conducted during the maintenance periods.

When the switch moved from the second position to the third position, both power supplies were momentarily connected. This resulted in a phase-to-phase connection that introduced a high-voltage spike into the electrical system. The spike did not trip the system breakers but it did cause two modules in the facility control system to fail, resulting in the actuation of the emergency evacuation alarm and the safe shut down of process ventilation.

Investigators determined that a defect in the switch components allowed a momentary phase-to-phase connection during the switching between two electrical sources that in turn caused the voltage spike.

The switch was constructed using a 9001 operator mechanism with an "L" cam. Whenever a KA1 or KA2 contact block was selected, the momentary jumpering problem appeared with a normally closed contact. The problem, which existed between two of the three positions when the selector switch was moving between positions, was still present when the "L" was replaced with a "C" cam. An ohm meter test did not reveal the problem unless the selector lever was held between positions, balancing the actuator mechanism between the detents.

Square D was contacted and provided with the schematic drawings for the switch and a components list. Square D reported that they were able to duplicate the incident. Square D representatives stated that this was the first failure of this type reported.

The switch was removed and reconfigured with an off position between the first and second power sources to ensure that one power source was disconnected before the second power source was

activated. The third power source was removed from the switch. It is now accessed through an alternative method.

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DOE FUNCTIONAL CATEGORY: Configuration Management

WORK ACTIVITY: Inspection and Testing

HAZARDS: Radiological, Electrical

KEYWORDS: switch, jumpering, evacuation, configuration

REFERENCES: Occurrence Report ALO-LA-LANL-TA55-1999-0024

FOLLOW-UP ACTIONS: Information in this report is accurate to the best of our knowledge. As a means of measuring the effectiveness of this report, please contact the originator of significant action(s) taken as a result of this report or of any technical inaccuracies you find. Your feedback is appreciated.