

From: Meredith Brown <racer@lanl.gov>
Subject: Blue Alert: Camera Flash Affects EPROMs

The Project Hanford Lessons Learned below the ++++ line is cleared for public release.

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Project Hanford Lessons Learned

Title: **Camera Flash Affects EPROMs**

Date: February 3, 1998
Identifier: 1998-RL-HNF-0005

Lessons Learned Statement:

Electronic programmable read-only memory (EPROM) microprocessors should be shielded from ambient light to prevent erasure of programming or other unintended effects on plant systems.

Discussion of Activities:

Summary:

A camera flash triggered an EPROM microprocessor in a fire suppression system of a commercial nuclear plant causing Halon to discharge into and a subsequent evacuation of the control room.

Details:

On August 7, 1997, a training department representative at the Haddam Neck nuclear generating plant was taking pictures of the fire system indicators and controls to develop training aids to upgrade the Halon system training manual. The training representative was using a Canon PS1001, Power Shot 600 digital camera to take pictures of the ANSUL Autopulse 2000 Halon control panel mounted on the wall in the control room. When the training representative took a flash photograph of the alarm reset/silence push buttons inside the Fire Detection System (FDS) control panel, the first flash caused an annunciator inside the panel to sound. The cabinet door on the panel was closed, and an examination of the front panel showed no lock-in alarm indications. The cabinet door on the panel was reopened, and a second flash photograph was taken within two minutes of the first picture. The second flash caused a second alarm with a different tone, indicating that system actuation was imminent. Within three to five seconds of the second flash, Halon discharged from the overhead nozzles.

Subsequent testing confirmed that the light from the camera flash affected an EPROM microprocessor located inside the Halon FDS control panel. The camera flash caused the normal one-minute delay to be bypassed and resulted in an almost immediate actuation of the Halon system. Discussions with the manufacturer indicated that a strong light source could cause an

unpredictable perturbation within the EPROM, depending on the light intensity and the angle of incidence to the circuitry through the EPROM's window.

Tests using different light sources and different materials to mask the light flash from the EPROM confirmed that the more intense light from an old-style flashbulb strip on a Polaroid SX-70 camera triggered the EPROM at approximately twice the distance from the EPROM as the Canon digital camera. They also confirmed that the light from the Canon flash and the Polaroid flashbulb could be effectively blocked by "black bagging" the flash, or by blocking the EPROM window with "tin foil" held in place by clear cellulose tape, or by blocking the EPROM window with "standard electrical tape." On the basis of these tests, the licensee concluded that the cause of the inadvertent actuation of the Halon control panel was light from the camera flash on the poorly protected EPROM and not electromagnetic interference. Review by the NRC staff confirmed that EPROM manufacturers recommend that the window be protected with an opaque covering after the programming of the EPROM because even normal ambient light contains the correct wavelength for erasing the EPROM programming.

Analysis:

EPROMs are used in many modern plant systems. Some examples are security E-fields, Foxboro Spec 200 controllers, smoke detectors and other fire protection systems, battery chargers and inverters, Terry Turbine controls, and emergency diesel generator controls. Therefore, the possibility exists that ambient light or a source such as a camera flash could erase programming, unexpectedly initiate system response, or have some other unintended effect on plant systems if the window on the EPROM is not sufficiently shielded.

Recommended Actions:

Facilities with EPROMs should mask the EPROM windows after programming them.

Priority Descriptor: BLUE/Information

Functional Category: Conduct of Operations, Fire Protection,
Instrumentation & Controls

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Keywords: EPROM, fire detection system, control panel, camera flash

References: NRC Information Notice 97-82: Inadvertent Control Room Halon Due to Camera Flash (<http://www.nrc.gov/NRC/FEDWORLD/NRC-GC/IN/1997/in97082.html>)