UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

November 28, 1997

NRC INFORMATION NOTICE 97-82: INADVERTENT CONTROL ROOM HALON ACTUATION DUE TO A CAMERA FLASH

Addressees

All holders of operating licenses for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to an inadvertent actuation of the Halon fire suppression system inside the control room at the Haddam Neck Plant. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On August 7, 1997, with the Haddam Neck plant defueled and preparing for decommissioning, an inadvertent actuation of the Halon fire suppression system resulted in an evacuation of the control room. The control room was fully remanned within one hour.

At the time of the event, an electrician was conducting tests at the fire detection system (FDS) panel and a training department representative was taking pictures of the fire system indicators and controls to develop training aids. 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 southwest corner of the control room. The pictures were being taken for an upgrade of the Halon system training manual.

At 9:45 a.m., the training representative took a flash photograph of the alarm reset/silence pushbuttons inside the 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 2 minutes of the first picture. The second flash caused a second alarm with a different tone, indicating that system actuation was imminent. Within 3 to 5 seconds of the second flash, Halon discharged from the overhead nozzles. The discharge occurred at 9:47 a.m. and lasted for 10 to 12 seconds. It was characterized by a loud roar, fog, and significant air turbulence. The discharge scattered loose papers around the control room and dislodged several ceiling tiles, support frame pieces, and lighting fixture plexiglass covers. One ceiling panel support piece broke the cover glass and bent the case fastener on a relay that provided backup line protection to a 345-kv line. One falling ceiling tile struck an operator as he exited the control room (he was not injured).

Within 30 seconds after system actuation, personnel in the control room exited to the access foyer and communications room immediately adjoining the control room. Both the access foyer and the communications room have picture windows that allow an unrestricted view of the control room. Some personnel also exited to the turbine hall.

Following the evacuation of the control room, the shift manager (SM) and a licensed reactor operator immediately reentered to ensure that all personnel had evacuated and to verify that there was no fire. Neither the SM nor the operator wore self-contained breathing apparatus (SCBA) because, on the basis of their training, they knew that exposure to Halon for short periods was not immediately life threatening. The SM and the operators remained stationed in the adjoining rooms to monitor the status of the control boards and entered the control room as necessary in response to alarms. An auxiliary operator was sent to verify that the spent fuel pool temperature and level were satisfactory (this was done as an extra set of rounds). Following verification that the control room was habitable, the control room was fully remanned at 10:34 a.m.

The procedure for loss of fire systems was used since the Halon system had discharged and was no longer operable. Actions included implementation of compensatory measures for the inoperable fire system, resetting of the Halon system, and placing control room ventilation in the normal mode to clear the Halon from the room. The procedure for station fires was not applicable since there was no fire.

The SM declared a notice of unusual event (NOUE) at 10:45 a.m. on the basis of "potential plant degradation" and ended the NOUE at 12:35 p.m. when plant conditions were stable and habitability surveys were acceptable.

Followup activities included a detailed walkdown inspection of the control room to assess damage, postings on all fire system control panels to warn personnel that photography was prohibited inside the cabinets, rehanging of tags blown off during the discharge, medical assessments of personnel exposed to the Halon (no acute affects identified), and restoration of the Halon system.

There was no adverse safety impact on the plant because the unit was defueled. There were no major injuries and the spent fuel pool temperature remained at approximately 94 degrees F throughout the event.

Discussion

In Haddam Neck Licensee Event Report 97-013-00, dated September 5, 1997 (Accession No. 9709100216), the licensee reported that subsequent testing had confirmed that the light from the camera flash affected an electronic programmable read-only memory (EPROM) microprocessor located inside the Halon FDS control panel. This camera flash caused the normal one minute delay to be bypassed and resulted in an (almost) immediate actuation of the Halon system. The licensee's 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.

The licensee also ran tests using different light sources and different materials to mask the light flash from the EPROM. The tests confirmed that the more intense light from the 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 any other type of 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 erasure of the EPROM programming.

Most plants are exempted from the requirement to have automatic fire suppression systems in their control room (Section III.G.3 of Appendix R to 10 CFR Part 50) because the control room is a continuously manned space and any fire that occurs there can be quickly detected and extinguished and because acceptable alternate shutdown capability is provided. However, many plants that do not have an automatic fire suppression system for their entire control room do have fire suppression systems that are designed to protect individual cabinets within the control room, or areas immediately adjacent to the control room and connected by way of shared ventilation systems. Plants that have automatic gaseous fire suppression systems in the control room or in control room panels and/or flooring may be subject to an inadvertent discharge, which could subject equipment to damage from the discharge and force occupants to evacuate the control room and move to alternate plant control stations (such as remote shutdown panels) or take other operator actions, such as donning of SCBAs in order to reenter the control room.

Although this inadvertent actuation of the Halon system occurred in the control room at Haddam Neck, it could have occurred in other locations at other plants. Many plants have Halon or carbon dioxide fire suppression systems in other areas (e.g., cable-spreading rooms, relay rooms, emergency diesel generator rooms) that have initiation circuits that contain these EPROMs. These EPROMs are also used in many other 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 cause an erasure of programming, unexpected initiation, or have some other unintended effect on plant systems if the window on the EPROM is not sufficiently shielded.

Related Generic Communications

Information Notice (IN) 83-41, "Actuation of Fire Suppression System Causing Inoperability of Safety-Related Equipment," dated June 22, 1983.

IN 83-83, "Use of Portable Radio Transmitters Inside Nuclear Power Plants," dated December 19, 1983.

IN 85-85, "Systems Interaction Event Resulting in Reactor System Safety Relief Valve Opening Following a Fire-Protection Deluge System Malfunction," dated October 31, 1985.

IN 87-14, "Actuation of Fire Suppression System Causing Inoperability of Safety-Related Ventilation Equipment," dated March 23, 1987.

IN 91-60, "False Alarms of Alarm Ratemeters Because of Radiofrequency Interference," dated September 24, 1991.

IN 94-12, "Insights Gained from Resolving Generic Issue 57: 'Effects of Fire Protection System Actuation on Safety-Related Equipment,' " dated February 9, 1994.

This information notice requires no specific action or written response. However, recipients are reminded that they are required by 10 CFR 50.65 to take industry-wide operating experience (including information presented in NRC information notices) into consideration, where practical, when setting goals and performing periodic evaluations. If you have any questions about the information in this notice, please contact the technical contacts listed below or the Office of Nuclear Reactor Regulation (NRR) project manager.

Jack W Roe

Jack Roe, Acting Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Richard J. Conte, RI
(610) 337-5183
E-mail: rjc@nrc.gov

E.L. (Monte) Conner, RI
(610) 337-5399
E-mail: elc@nrc.gov

Patrick M. Madden, NRR
301-415-2854
E-mail: pmm@nrc.gov

Chuck Petrone, NRR
301-415-1027
E-mail: cdp@nrc.gov

Eric J. Lee, NRR
301-415-3201
E-mail: exl@nrc.gov

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LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
97-81	Deficiencies in Failure Modes and Effects Analyses for Instrumentation and Control Systems	11/24/97	All holders of OLs for nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the vessel
97-80	Licensee Technical Specifications Interpretations	11/21/97	All holders of OLs for nuclear power reactors
97-79	Potential Inconsistency in the Assessment of the Radiological Consequences of a Main Steam Line Break Associated with the Implementation of Steam Generator Tube Voltage-Based Repair Criteria	11/20/97	All holders of OLs for pressurized-water reactors implementing a steam generator tube voltage-based repair criteria in accordance with the guidance presented in Generic Letter 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," issued August 3, 1995
97-78	Crediting of Operator Actions in Place of Automatic Actions and Modifications of Operator Actions, Including Response Times	10/23/97	All holders of OLs for nuclear power reactors except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel

OL = Operating License
CP = Construction Permit

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original signed by

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Office of Nuclear Reactor Regulation

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(610) 337-5183
E-mail: rjc@nrc.gov

E.L. (Monte) Conner, RI
(610) 337-5399
E-mail: elc@nrc.gov

Patrick M. Madden, NRR
301-415-2854
E-mail: pmm@nrc.gov

Chuck Petrone, NRR
301-415-1027
E-mail: cdp@nrc.gov

Eric J. Lee, NRR
301-415-3201
E-mail: exl@nrc.gov

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