SSINS No.: 6835
IN 87-49

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

October 9, 1987

NRC INFORMATION NOTICE NO. 87-49: DEFICIENCIES IN OUTSIDE CONTAINMENT FLOODING PROTECTION

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is provided to alert recipients to a potentially significant problem pertaining to the flooding of safety-related equipment as a result of the inadequate design, installation, and maintenance of features intended to protect against flooding. It is expected that recipients will review the information for applicability to their facilities and consider action, if appropriate, to preclude a similar problem. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Beaver Valley Power Station, Unit 2

In September 1986, during an Engineering Assurance Program, an incorrect, nonconservative assumption in the outside containment flooding analysis was discovered. After this assumption was corrected, a reanalysis showed that without operator action, (1) higher flooding levels would occur in the auxiliary and service buildings than were originally expected and (2) essential Class 1E floor-mounted switchgear in the service building could be affected, jeopardizing safe shutdown capability.

The analysis in question addresses a double-ended rupture of a main feedwater line in the service building in which it was erroneously assumed that 100 percent of the process fluid above 212°F would flash to steam as it exited the rupture. Reanalysis showed that, in fact, only about 25 percent of the escaping feedwater would flash, leaving the remaining 75 percent in a liquid form that would contribute to flooding.

The Class 1E equipment threatened in this scenario is not located in the immediate vicinity of the postulated feedwater line break, but is several levels lower in the service building and would be flooded by water flowing through door openings.

To limit the consequences of this postulated flooding event to an acceptable level, the licensee changed plant operating procedures to require manual tripping of the main feedwater pumps if a reactor trip occurs on steam flow/feed flow mismatch. Since a reactor trip on this signal could indicate a feedwater line break, securing the main feed pumps would minimize the amount of water pumped out of the break. Also, the licensee installed gaskets on doors to prevent the flood water from reaching Class 1E equipment. In addition, a service building wall blowout panel, previously determined as necessary to mitigate the temperature and pressure effects of a main steam line break, has been installed at floor level to also provide for flooding protection.

Trojan Nuclear Plant

In March 1987, during a review of the turbine building flooding design basis analysis it was found that the flood relief louvers in the turbine building wall would not pass sufficient flow to prevent flooding of safety-related equipment in the event of a break of the main circulating water system.

The major assumptions used in the main circulating water system break analysis were that (1) full-diameter breaks would occur simultaneously in both circulating water pipes at the condenser inlet and (2) the motor-operated valves at the suction and discharge of both main circulating water pumps would fail to close. It was originally believed that the flooding expected under these conditions would be shunted to the exterior of the turbine building with no detrimental effect. Further review has shown, however, that the flooding relief capacity called for in the original plant design would be too small to prevent overflow of flood barriers in the turbine building. Overflow of these barriers would flood the auxiliary feedwater pumps and emergency diesel generators.

In addition to the turbine building flooding concern described above, omission or degradation of originally installed flood protection design features were identified in several other areas: (1) drains in the auxiliary feedwater pump room and service water strainer pit did not have required check valves installed; (2) although the emergency diesel generator room drain line check valve was properly installed, it was blocked open by a 1-foot long wooden 2 X 4; and (3) an auxiliary building pipeway flood barrier intended to protect a centrifugal charging pump had not been installed. In each case, the potential existed for equipment important to the plant's safe shutdown capability to become disabled as a consequence of a flooding event.

To correct these problems, the licensee installed the missing check valves and flood barrier, and removed debris from drain lines as necessary. A preventive maintenance program is being developed to ensure that flood protection features are inspected periodically. The flood relief louver problem was addressed by building up the turbine building flood barriers an additional 12 inches. Pending development of a modified design, the portion of the turbine building wall that formerly housed the louvers will remain open. Since the licensee's reassessment led to the conclusion that the assumption of simultaneous rupture of both circulating water lines was overly conservative, the turbine building flooding analysis in the Final Safety Analysis Report will be revised to postulate the rupture of a single circulating water line. This change, in conjunction with the programmatic and design changes described above, will ensure that engineered safeguards features equipment will be protected from a circulating water line failure.

Nine Mile Point Nuclear Station, Unit 2

In December 1986, it was discovered that a main circulating water piping failure could disable Class 1E electrical equipment and both trains of the service water system.

An electrical system manhole cover located in the decontamination area of the turbine building was not watertight. Since electrical duct banks and conduit running from the manhole also were found not to be fully sealed, flooding paths existed that could make the safety-related service water pumps and Class 1E electrical equipment in the control building inoperable.

This flood protection deficiency was corrected by the installation of a redesigned, watertight manhole cover, which would prevent entry of flood water into the affected manhole.

Discussion:

The events described above illustrate the potential for the loss of safe shutdown capability as a consequence of potential flooding of safety-related equipment outside containment. A break in the main circulating water system or main feedwater system has the potential to release an extremely large volume of water in a very short period of time. Serious consequences may result if the design features of the plant are not adequate to direct the resulting flood water safely away from important equipment. Such design inadequacies may result from (1) the inadvertent use of nonconservative assumptions in the flooding design analysis, (2) the failure to recognize all possible flooding flow paths, (3) the failure to install flood protection features that have been determined to be necessary, or (4) the failure to properly maintain installed flood protection features.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.

Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: Kevin P. Wolley, AEOD
(301) 492-8373

Attachment: List of Recently Issued NRC Information Notices

Attachment
IN 87-49
October 9, 1987

LIST OF RECENTLY ISSUED
INFORMATION NOTICES 1987

Information Notice No.	Subject	Date of Issuance	Issued to
87-48	Information Concerning the Use of Anaerobic Adhesive/ Sealants	10/9/87	All nuclear power reactor facilities holding an OL or CP.
87-47	Transportation of Radiography Devices	10/5/87	All NRC licensees authorized to manufacture, distribute and/or operate radiographic exposure devices and/or source changers.
87-46	Undetected Loss of Reactor Coolant	9/30/87	All PWR facilities holding on OL or CP.
87-45	Recent Safety-Related Violations of NRC Requirements by Industrial Radiography Licensees	9/25/87	All NRC licensees authorized to possess and use sealed sources for industrial radiography.
87-44	Thimble Tube Thinning in Westinghouse Reactors	9/16/87	All PWR facilities employing a W nuclear steam supply system holding an OL or CP.
87-43	Gaps in Neutron-Absorbing Material in High-Density Spent Fuel Storage Racks	9/8/87	All nuclear power reactor facilities holding an OL or CP.
87-42	Diesel Generator Fuse Contacts	9/4/87	All nuclear power reactor facilities holding an OL or CP.
87-41	Failures of Certain Brown Boveri Electric Circuit Breakers	8/31/87	All nuclear power reactor facilities holding an OL or CP.
87-40	Backseating Valves Routinely to Prevent Packing Leakage	8/31/87	All nuclear power reactor facilities holding an OL or CP.

OL = Operating License
CP = Construction Permit

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*SEE PREVIOUS CONCURRENCES

		D/DOEA:NRR	*C/OGCB:DOEA:NRR	*PPMB:ARM
		CERossi	CHBerlinger	TechEd
		09/15/87	10/01/87	09/23/87
*OGCB:DOEA:NRR	*IRB:DOA:AEOD	*IRB:DOA:AEOD	*C/IRB:DOA:AEOD	*D/DOA:AEOD
RJKiessel	KPWolley	EWeiss	KEPerkins	RLSpessard
09/14/87	09/15/87	09/15/87	09/15/87	09/17/87

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Nine Mile Point Nuclear Station, Unit 2

In December 1986 it was discovered that the potential existed for a main circulating water piping failure to disable Class 1E electrical equipment and both trains of the service water system.

An electrical manhole located in the decontamination area of the turbine building, which would be exposed to flood water from a postulated main circulating water pipe break, was found to have a nonwatertight manhole cover. Electrical duct banks and conduit running from the manhole to the control building and to the service water pump bays were also found not to be fully sealed. Therefore, flooding paths were established such that, in the event of a circulating water piping failure, the safety-related service water pumps and Class 1E electrical equipment in the control building could have been rendered inoperable.

This flood protection deficiency was corrected by the installation of a redesigned, watertight manhole cover, which would prevent entry of flood water into the affected manhole.

Discussion:

The events described above illustrate the potential for the loss of the plants' safe shutdown capability due to flooding of safety-related equipment outside containment. A break in the main circulating water system or main feedwater system has the potential to release an extremely large volume of water in a very short period of time into the area around the break. Serious consequences may result if the design features of the plant are inadequate to direct the resulting flood safely away from important equipment. Such inadequacies may result from the inadvertent use of nonconservative assumptions in the flooding analysis, failure to recognize all possible flooding flow paths, failure to install flood protection features that have been determined to be necessary, or failure to properly maintain installed flood protection features.

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