JUN 20 1980

MEMORANDUM FOR: C. E. Rossi, Director
Division of Operational Events Assessments
Office of Nuclear Reactor Regulation (NRR)

FROM: L. J. Callan, Director
Division of Reactor Safety, Region IV

SUBJECT: DRAFT INFORMATION NOTICES

The attached draft Information Notices, which address potential generic problems pertaining to the identification of electrical splices located within conduit and the potential consequences of a freeze seal failure, are forwarded to you for your consideration.

Please contact T. F. Stetka, FTS 728-8247, if you have any questions regarding the draft Information Notices.

Original Signed By
J. P. Jaudon

L. J. Callan, Director
Division of Reactor Safety

Attachments:
1. Information Notice No. 89-00, Unqualified Electrical Splices in Vendor Supplied Environmentally Qualified (EQ) Equipment
2. Information Notice No. 89-00, Potential Consequences Due to a Freeze Seal Failure

cc w/attachments:
W. Johnson, RI
A. Gibson, RII
H. Miller, RIII
R. Zimmerman, RV

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PDR I&E
MISC PDR

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

DRAFT

NRC INFORMATION NOTICE NO. 89-00: POTENTIAL CONSEQUENCES DUE TO A FREEZE SEAL FAILURE

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is being provided to alert addressees to the consequences that could occur due to the improper application and control of a freeze seal. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

At about 11:45 p.m. on April 19, 1989, at the River Bend Station (RBS), a freeze seal failed on a 6-inch service water line. The freeze seal had been established to allow inspection and repair work on manual isolation valves to a safety-related auxiliary building cooler. The bonnet of the manually operated valve was off the valve and the service water system was in operation at the time of the event. The failure of the freeze seal resulted in flooding portions of the auxiliary building. Approximately 15,000 gallons of service water, covering portions of the 141-foot level of the auxiliary building were discharged through the disassembled valve. A portion of the water flowed through holes in the floor under safety-related 480 VAC motor control centers (MCCs) onto nonsafety-related cabinets on the 114-foot level containing disconnect links and a 13.8 KV/480 VAC transformer. Since the cabinets were not designed to shed the water, an electrical fireball resulted that damaged the cabinet and components. A 13.8 KV supply breaker opened deenergizing that cabinet and two others causing the loss of the operating residual heat removal (RHR) system, normal spent fuel cooling, and normal lighting in the auxiliary building, control building, and the reactor building. The operators isolated the service water system in 15 minutes and restarted RHR in 17 minutes. No increase in reactor temperature was observed. Backup spent fuel cooling (service water) was available but was not immediately needed. Temperature in the spent fuel pool rose to 123°F at which time normal cooling water was restored and temperature was returned to normal.

Discussion:

Freeze seals or ice plugs are routinely used in nuclear reactor fluid and support systems to drain or isolate components which for various reasons cannot be conveniently valved out. Basically, a freeze seal is produced by chilling the outside of the pipe, usually with liquid nitrogen supplied to a jacket surrounding the pipe. Eventually, the water at the inner surface of the chilled pipe freezes and the ice/water interface grows towards the center of the pipe and also along its axis. Although, the above description is rather simplified, there exists certain problem areas about which care must be taken, both for the establishment of an effective freeze seal and for the assurance that the freeze seal will be adequately maintained for the expected duration of the repair. It is essential, therefore, that written procedures be established and that the procedures be followed. It also is obvious that adequate training in the exercise of the procedure be provided.

At RBS, freeze seals were being produced by both outside contractor personnel and plant maintenance personnel. Each organization had its own freeze seal procedure. The RBS procedure permited a freeze seal contractor to use his own procedure. Much of the licensee's knowledge on freeze seal production was gleaned from observation of the freeze seal contractor during the first refueling outage. There has been no formal training or qualified personnel list for RBS maintenance personnel.

The procedures had some notable differences. The freeze seal contractor's procedure required installation of a temperature measuring device into a sleeve in the chamber. The RBS procedure did not require installation of a temperature measuring device. While the RBS procedure discussed use of such a device, it was ambiguous in that it stated that a resistor temperature sensor probe be taped to the pipe surface, but showed a sketch with a thermocouple protruding from the chamber. The freeze seal contractor required recording of temperature every 5 minutes during establishment of the freeze plug and every 15 minutes while the plug was being held. There were no temperature monitoring or recording requirements in the RBS procedure. The freeze seal contractor utilized a manifolded boot and controlled flow by having liquid nitrogen dropping from a vent, whereas the RBS procedure vented gaseous nitrogen (which is not considered to be a very reliable method). In addition to temperature measurement, there were other indications of freeze conditions. These indications are frosting of the pipe at each end of the boot and observation of water flow downstream from the freeze seal. Neither of these methods are very reliable, but both were used in the RBS procedure. In addition, the freeze seal contractor prohibited multiple seals from a single nitrogen bottle, but no such prohibition was stated in the RBS procedure.

In the incident of April 19, 1989, which involved use of the RBS procedure, there were no temperature measuring devices used to monitor temperature. Additionally, two freeze seals were produced from the same nitrogen bottle. Nitrogen flow was controlled by observation of the nitrogen plume at the vent,

and some valve manipulation was required to produce equal plumes from both vents and to maintain roughly uniform plume size for the duration of the freeze. Temperature indication was estimated by the axial length of frosting on the pipe on either end of the boot. Because frost is more readily initiated and maintained on empty pipe than one full of water, the more visible outlet ends of the freeze did not give any indication of loss of freeze.

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

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

Technical Contact: T. Stetka, Region IV
(817) 860-8247