UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
NORTHERN STATES POWER COMPANY
PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNIT NOS. 1 AND 2
GENERIC LETTER 82-33
SAFETY PARAMETER DISPLAY SYSTEM (SPDS)

I. BACKGROUND

In order to satisfy the NRC requirements concerning the Safety Parameter Display System (SPDS), Northern States Power Company, the licensee for Prairie Island Nuclear Generating Plant, submitted a Safety Analysis Report (SAR) on April 10, 1984. This report provided a description of the SPDS as part of the Safety Assessment System (SAS). The SAR did not include enough information addressing the requirement that the SPDS must be suitably isolated from equipment and sensors that are used in safety systems to prevent electrical and electronic interference. On January 4, 1985, Human Factors Engineering Branch (HFEB) completed its Safety Evaluation (SE) for the Prairie Island SPDS. The SE included a request for additional information on electrical and electronic isolation. The licensee provided the information for confirmatory review on April 17, 1985. Our evaluation addresses the qualification and documentation of the isolators as an acceptable interface between the Class 1E safety-related instrumentation systems and the SPDS.

II. EVALUATION

The SPDS at Prairie Island Nuclear Generating Plant (PINGP) is part of the plant Safety Assessment System (SAS). The PINGP SAS is being implemented based on the generic SAS design developed by Westinghouse Owners Group. The purpose of the SPDS is to continuously display information to the operators on the overall plant safety status in terms of how well the Critical Safety Functions are being maintained or accomplished.

The computer driven SPDS has electrical inputs from plant sensors and plant instrumentation and control circuits which are terminated at remote multiplexers. These multiplexers are qualified as Class 1E safety-related units powered by IE qualified sources. The multiplexers communicate with non-safety related SPDS computer equipment by means of fiber optic cable. The fiber optic cable is performing the function of isolation, between safety related and non-safety related equipment and the isolation between redundant multiplexers.

This fiber optic cable which transmits digital information using light instead of electric current is a unique isolator which possesses inherent characteristics that eliminate ground loops and common ground shifts in electronic circuits and provides complete electrical ground isolation between transmitter and receiver. Fiber optic cables present no fire hazards when their fibers are damaged. In addition, no local secondary damages can occur because fiber optics neither produce sparks nor dissipate heat. The construction of the fiber optic cable is such that the cable contains no electrically conductive material. The voltage breakdown rating of a typical fiber-optic cable is on the order of 250 KV per meter.

A fault at either end of the data link might destroy the modem but will not propagate over the fiber-optic cable. For example, one of the tests that must be performed to qualify an isolator is the application of the maximum credible fault (voltage, current) to the output of the device to verify that the fault does not propagate or degrade the input (Class 1E) side. This postulated failure does not affect fiber-optic cable, as stated above, the optical fibers are totally dielectric (i.e., the electrical energy resulting from the fault will not propagate through the optical fiber). Another characteristic of the optical fiber cable is its nonsusceptibility to the coupling of cross-talk and electromagnetic interference (EMI).

III. CONCLUSION

Based on our audit of the Northern States Power Company information on the isolation devices used in the Prairie Island design, the staff concludes that the design methodology and the hardware (fiber-optic cable) used for interfacing the SPDS with safety-related systems are acceptable, and that this equipment meets the NRC's requirements of NUREG-0737, Supplement No. 1.

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