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NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

November 20, 1980

Director of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Washington, D C 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Request for Relief from Implementation Schedule for NUREG-0737, Item II.F.2, Instrumentation for Detection of Inadequate Core Cooling

In a letter dated October 31, 1980 from Mr D G Eisenhut, Director, Division of Licensing, USNRC, we were provided with a copy of NUREG-0737, "Clarification of TMI Action Plan Requirements," and requested to submit, within 45 days, confirmation that completion dates specified in NUREG-0737 will be met. Mr Eisenhut's letter stated that the NRC Staff will consider requests for relief from various aspects of the TMI Action Plan Requirements as clarified in NUREG-0737. The purpose of our letter is to request relief from the specified dates for submission of a description of the proposed final instrumentation for detection of inadequate core cooling (January 1, 1981) and installation of the system (January 1, 1982). A response to Mr Eisenhut's October 31, 1980 letter with respect to other TMI Action Plan Requirements will be submitted by December 25, 1980.

The characteristics which an acceptable inadequate core cooling instrumentation system must possess are specified in NUREG-0737. Included are the following requirements:

a. Unambiguous indication of inadequate core cooling.

b. Reactor water level indication.

c. Advance warning of the approach of inadequate core cooling.

d. Cover full range from normal operation to complete core uncovery.

e. Final design must be selected in time to submit design details, design analysis, test program description, evaluation of qualification criteria, computer system reliability analysis, installation schedule, procedural guidelines for operation, and a summary of key operator action instructions by January 1, 1981.

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There are currently five instrumentation systems in various stages of development which have the potential for satisfying the NRC's requirements for inadequate core cooling instrumentation. These systems are:

a. A differential pressure system designed by Westinghouse.

b. A heated junction thermocouple system designed by Combustion Engineering.

c. A neutron detector system being investigated by National Nuclear Corporation and the Electric Power Research Institute (EPRI).

d. An acoustic torsional wave system being investigated at the Oak Ridge National Laboratory (ORNL).

e. A conceptual swept-frequency microwave liquid level detection system proposed by Davco Manufacturing Company.

Only two of these systems, the Westinghouse differential pressure system and the Combustion Engineering heated thermocouple system, are commercially available. The other systems each have certain attractive features, but are at least one year and probably two years away from being commercially available. Our evaluation of each of the five systems follows:

Westinghouse Differential Pressure System

This method measures the differential pressure (D/P) between the top and bottom of the reactor vessel. A single upper tap using a spare head penetration and a single lower tap at the seal table serves two instrument trains. Narrow range and wide range instruments are provided for each train. In addition, a third detector is installed between the top of the vessel and the hot leg.

Any D/P system raises questions related to performance under dynamic accident conditions and post accident conditions and of the ability of the system to adequately accomodate temperature compensation, long instrument lines, and effects of coolant pump operation. Westinghouse has analytically investigated the performance of the D/P system under various primary system transients for generic three loop and four loop cases. While these analyses are responsive to many of these questions, the applicability of these results to Prairie Island is uncertain. Westinghouse has assured us they will do whatever is necessary to license the D/P method, but they cannot assume contractual risk in guaranteeing the acceptability of their system to the NRC.

Combustion Engineering Heated Junction Thermocouple System

This system requires the installation of a probe within the reactor vessel. Heated and unheated thermocouples respond to the heat removal capabilities of the fluid surrounding sensors located at various elevations between the top of the core and the vessel head. By itself, this method can measure water level above the core, but cannot measure level within the core. It must be supplemented by other indicators such as in-core thermocouples (also under development) which must detect the existence of inadequate core cooling and the extent of core uncovery. We have been informed that tests at ORNL show that heated junction thermocouples can provide a workable system. Since the system provides an "on-off" output in response to sensor setpoints, it cannot provide a variable output corresponding to the degree of voiding and frothing. We must also consider the possibility of the installed probe becoming a "loose part" within the reactor. We also have no data on the expected durability of these new detectors.

National Nuclear and EPRI Neutron Detector System

This is the only system which does not require a reactor vessel penetration. There are many unknowns associated with this scheme. We believe in its present configuration it cannot provide the unambiguous level information required by the NRC.

ORNL Acoustic Torsional Wave Level Detector

The Oak Ridge Acoustic Torsional Wave level detector concept can potentially satisfy all of the NRC requirements. Much developmental work would be needed before a prototype could be installed in a commercial reactor.

Davco Microwave Level Detector

Little is known of this promising system other than what was presented at the LOFT Utility Technology Trnasfer Meeting held at Idaho Falls in October 1980. This system has the apparent ability to meet all NRC requirements, but will require a small wave guide pressure boundary seal at the reactor vessel head. Material transparent to microwaves must be qualified for this penetration. Much developmental work remains.

The conclusion we have reached after evaluating each of these concepts is that none of them are both commercially available and satisfy existing NRC requirements. Since the two commercially available systems may have an installed cost per unit approaching one million dollars, and questions remain concerning their acceptability, we believe it would be inappropriate at this time to commit to installing either one of them. We therefore request relief from the requirement to select and submit design information by January 1, 1981 and complete installation by January 1, 1982. We believe that a reasonable approach to resolving this issue would be through an EPRI or other utility sponsored development program working in close cooperation with the NRC and the Department of Energy's LOFT and Semiscale project organizations. We would agree to:

a. Commit, by January 1, 1981, to participate in an industry program to develop, test, and certify instrumentation systems for detection of inadequate cooling. Funding for this program would be provided by each utility participating in the program. Non-participating utilities would conform to the schedule presented in NUREG-0737.

b. Submittal of design details and a schedule for installation, testing and calibration, six months after certification by the NRC Staff of acceptable instrumentation systems for detection of inadequate core cooling.

c. Installation of an acceptable system within eighteen months of submittal of design details.

It is understood such a development program would require a period of at least two years and equipment installation would require up to two more years. We believe that operation for this period can be safely continued based on the modifications, procedural changes, and training completed thus far dealing with detection and recovery from inadequate core cooling conditions. Actions we have taken in this regard have been previously reported to the Commission and include:

a. Installation of subcooling monitors in each unit.

b. Operator and Shift Technical Advisor training in reactor thermal-hydraulics and in detection of inadequate core cooling using installed instrumentation.

c. Upgrading of the core exit thermocouple system to have a post-accident survival capability. The cable system will be replaced in each unit at the first extended outage following receipt of material. Both units will be upgraded by early 1982.

In summary, we do not believe that a suitable system providing unambiguous full range vessel level indication currently exists which can be selected by January 1, 1981 and installed by January 1, 1982. We cannot reasonably commit to a cost risk exposure of this magnitude for unproved systems involving the degree of uncertainties of performance and acceptability that prevails in the alternatives at hand. We have proposed a program of further development which we will participate in if found acceptable to the Commission. We also believe that equipment and procedural changes made following the TMI accident provide a high degree of assurance that we can detect and correct an inadequate core cooling condition without additional instrumentation. Continued plant operation while pursuing development of a vessel level measuring system is therefore an acceptable course of action.

Please contact us if you require further information in support of this request or if you have any questions related to the information we have presented.

L. O. Mayer

L O Mayer, PE
Manager of Nuclear Support Services

LOM/DMM/bd

cc: J G Keppler
G Charnoff
NRC Resident Inspector

attachment

UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Docket Nos. 50-282
50-306

License Nos. DPR-42
DPR-60

LETTER DATED NOVEMBER 20, 1980
REQUEST FOR RELIEF FROM IMPLEMENTATION SCHEDULE FOR
NUREG-0737, Item II.F.2, INSTRUMENTATION FOR DETECTION
OF INADEQUATE CORE COOLING

Northern States Power Company, a Minnesota corporation, by this letter dated November 20, 1980, hereby submits a Request for Relief from Implementation Schedule for NUREG-0737, Item II.F.2, Instrumentation for Detection of Inadequate Core Cooling.

This response contains no restricted or other defense information.

NORTHERN STATES POWER COMPANY

By L. O. Mayer
L O Mayer, PE
Manager of Nuclear Support Services

On this 20th day of November, 1980, before me a notary public in and for said County, personally appeared L O Mayer, Manager of Nuclear Support Services, and being first duly sworn acknowledged that he is authorized to execute this document on behalf of Northern States Power Company, that he knows the contents thereof and that to the best of his knowledge, information and belief, the statements made in it are true and that it is not interposed for delay.

Jeanne M Hacker
Jeanne M Hacker
Notary Public - Minnesota
Hennepin County
My Commission Expires May 6, 1986

JEANNE M. HACKER
NOTARY PUBLIC - MINNESOTA
HENNEPIN COUNTY
My Commission Expires May 6, 1986