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DESCRIPTION:

Ltr re our 12-21-72 ltr.......furnishing info re Suppl 1 to Change Request No. 3 to Tech Specs.......& comments on the Control Rod Drop Accident (RDA).

ENCLOSURES:

Do Not Remove

ACKNOWLEDGED

PLANT NAMES: Monticello

FOR ACTION/INFORMATION 3-8-73 AB

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NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

March 2, 1973

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RECEIVED MAR 7 1973 U.S. ATOMIC ENERGY COMMISSION Regulatory Mail Section

Mr. D L Ziemann
Operating Reactors Branch 2
Directorate of Licensing
United States Atomic Energy Commission
Washington, D C 20545

Dear Mr. Ziemann:

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Answers to December 21, 1972 Questions
Concerning the Rod Drop Accident Analysis

We are writing in response to your December 21, 1972 letter requesting additional information pertaining to our Supplement No. 1 to Change Request No. 3 of our Technical Specifications. We would like to preface our answers to your questions with the following comments on the Control Rod Drop Accident (RDA).

The bases for the RDA postulate a single active component failure as does the Loss-of-Coolant Accident (LOCA) and the Steam Line Break Accident (SLBA). Unlike the LOCA or the SLBA analyses, the RDA further allows for a single operator error. The active component failure in the case of the RDA is assumed to be the separation of the control rod blade from the rod drive, the hangup of the blade and the subsequent drop of the blade out of the core. This sequence in itself can be debated to be a combination of unlikely events constituting multiple active component failures having a very low probability of occurring in this combination, therefore, making the RDA very unlikely. The single operator error is assumed to be the withdrawal of an out-of-sequence rod having a large reactivity worth.

When at power, the RDA involving an out-of-sequence rod can be tolerated as discussed in the FSAR and in Topical Report NEDO-10527. The RDA involving an out-of-sequence rod cannot be tolerated during heatup; therefore, our Technical Specifications require that either the Rod Worth Minimizer (RWM) or a second independent operator monitor the rod withdrawal sequence. Allowing for a single component failure simultaneous with a single operator error,

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the RDA will not occur at low power since one must either assume a second active component failure in that the RWM fails to block the erroneous control rod withdrawal, or a second operator error in that the independent operator observing the rod withdrawal procedure fails to observe the erroneous rod selection by the console operator. A RDA involving an in-sequence rod can be tolerated at any power level. These guidelines for analyzing the RDA are no different than those used in the FSAR.

There are two calculations that must be performed. First, one must select the power level above which the RDA can be tolerated assuming an operator error simultaneous with a component failure, allowing the RWM to be bypassed. Figure 3-9 of NEDO-10527 shows very dramatically why the RWM can be bypassed at power and also why it is required during hot standby. The second calculation, the one in question at this time, is needed to select a limit for the worth of in-sequence control rods which will allow operating flexibility without a risk to the health and safety of the general public in the unlikely event of a RDA involving an in-sequence rod.

Note that a RDA involving an in-sequence control rod can be postulated to occur with only a single active component failure. No operator error must be assumed and the RWM will not supply a block to the withdrawal of an in-sequence rod. Therefore, the limit established for the worth of each in-sequence rod is such that in the unlikely event of a RDA, the consequences are tolerable. Section 14.6.2 of the FSAR states that a RDA involving a 0.025 delta k rod can be tolerated while the worth of the stuck (in-sequence) rod is limited to about 0.01 delta k. The latter fact is reinforced by Figure 3-3-4 which also shows that the maximum worth of an out-of-sequence rod was found to be well in excess of 0.03 delta k and could, therefore, not be tolerated in a RDA. More recent analyses show that while in-sequence rods have approximately the same worth as previously analyzed and that while out-of-sequence rod worths remain above that level where they are tolerable for the RDA, the threshold of rod worths below which the RDA is tolerable is slightly below that previously analyzed. Since this threshold is the technical basis for the limit of in-sequence rod worths, we have requested that the allowable limit specified in our Technical Specifications be reduced from 0.025 delta k to 0.015 delta k.

With this in mind we answer each of your four questions as follows:

1. The General Electric Topical Report referenced applies to beginning of life conditions for curtained cores. While the Monticello core is within the scope of this report, it presently has an average burnup of approximately 7000 MWD/STU. Calculations do not exist for this exact condition. Of more importance is the bound for the most critical stage in the life of the Monticello-type core. Based on a parametric evaluation of RDA analyses, General Electric has recently

informed us that Figures 2-1 and 2-2 of Supplement 1 to NEDO-10527 provide conservative bounds for all exposure conditions. (It should be noted that Supplement 1 in its entirety applies to a core design different from that of Monticello.) A topical report soon to be issued will discuss the analytical methods used in evaluating the the exposed core response to a RDA. Using this more recent information, it is concluded that the maximum tolerable worth for a rod involved in a RDA is 0.015 delta k. This in no way changes our initial Technical Specification change request submitted September 22, 1972.

2. The bottom curve in Figure 3-9 of NEDO-10527 shows the worth of that increment of a control rod withdrawn in a normal sequence. In our normal withdrawal sequence the first 50% of the control rods are taken from fully inserted to fully withdrawn as one step in the sequence. After achieving this so called black-white pattern, the remaining rods have a maximum worth approaching 0.02 delta k. These rods are therefore banked out such that each increment of rod withdrawn is as shown in the bottom curve. We see no need to change our operating control rod withdrawal sequence in such a way that the worth of the withdrawn increments of in-sequence rods withdrawn will exceed 0.01 delta k. We are assured that the withdrawn increments of in-sequence rods will not exceed 0.015 delta k.

   We refrain from arbitrarily restricting ourselves to a limit such as 0.01 delta k for an increment of a rod even though we can generally meet that criteria now and in the foreseeable future. Arbitrarily placing a limit that close to operating conditions would require an unwarranted bulk of calculations and loss of flexibility in establishing a control rod withdrawal sequence. Rather we prefer to base this Technical Specification on a conservative, sound technical calculation which allows adequate flexibility while assuring the health and safety of the general public through limits set forth in 10 CFR 100. We feel that we have done this in establishing the 0.015 delta k limit. Our philosophy remains to operate as far as practicable below such a limit.

3. Your question, we assume, applies in particular to rod worths at low power levels. The worth of reactivity withdrawn as an increment of an in-sequence rod might be increased or decreased by specifying different increments of withdrawal in our withdrawal sequence. The worth of a full length out-of-sequence rod would not be affected. Therefore, if the operator error is assumed to be fully withdrawing an out-of-sequence rod, as is shown by the middle curve of Figure 3-9 of the topical report, the consequences of a RDA would not be affected by the specified rod withdrawal sequence. If on the other hand, the operator

error is assumed to be the erroneous selection of an out-of-sequence rod but the withdrawal to only the limit specified for the bank of in-sequence rods, the consequences would be much less than represented by Figure 3-9. Both postulated errors, of course, assume that either the RWM fails to perform its block function or the second independent person monitoring the withdrawal sequence fails to observe the error.

4. The FSAR analysis of the RDA shows that in this unlikely event 330 fuel pins will exceed the threshold for fuel failure of 170 calories per gram; the peak enthalpy was determined to be 250 calories per gram. The revised analysis shows that 600 fuel pins will exceed 170 calories per gram with appeak enthalpy of up to 280 calories per gram. The corrected total doses for FSAR Table 14-6-2 for the most unfavorable meteorlogical conditions are 0.013 rem for the whole body and 0.00062 rem for the thyroid. Using conservative TID multiplication factors, the doses from this unlikely event are still less than 0.2% of the whole body dose limit and less than 10% of the thyroid dose limit specified in 10 CFR Part 100.

Yours very truly,

L. O. Mayer

L O Mayer, P.E.
Director of Nuclear Support Services

LOM/MHV/br

cc: B H Grier
G Charnoff
Minnesota Pollution Control Agency
Attn. K Dzugan