Nebraska Public Power District

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NSD930061
January 13, 1993

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: Response to Request for Additional Information Related to Proposed Change No. 100 to the Cooper Nuclear Station Technical Specifications, "Elimination of Main Steam Line Radiation Monitor Scram and Isolation Functions," (TAC No. M83768) Cooper Nuclear Station, NRC Docket 50-298, DPR-46

References: 1. Letter from H. Rood (NRC) to G. R. Horn (NPPD) dated December 1, 1992, same subject

2. Letter from G. R. Horn (NPPD) to NRC dated May 4, 1992, "Proposed Change NO. 100 to Technical Specifications, Elimination of Main Steam Line Radiation Monitor Scram and Isolation Functions, Cooper Nuclear Station, NRC Docket 50-298, DPR-46"

3. Letter from A. C. Thadani (NRC) to G. J. Beck (BWROG) dated May 15, 1991, "Acceptance for Referencing of Licensing Topical Report NEDO-31400, 'Safety Evaluation for Eliminating the Boiling Water Reactor Main Steam Line Isolation Valve Closure Function and Scram Function of Main Steam Line Radiation Monitor'"

The Nebraska Public Power District (District) hereby provides its response to the NRC Staff's Request for Additional Information (RAI) (Reference 1) relating to the District's Proposed Change No. 100 (Reference 2) to the Cooper Nuclear Station (CNS) Technical Specifications. Proposed Change No. 100 would remove the Technical Specifications associated with the Main Steam Line Radiation Monitor (MSLRM) scram and Main Steam Line Isolation Valve (MSIV) isolation functions.

The District's proposed change is based, in part, on the results of a Boiling Water Reactors Owners' Group (BWROG) effort, which performed an evaluation of the radiological consequences for the postulated Control Rod Drop Accident (CRDA), assuming elimination of the MSLRM scram and MSIV isolation functions. This evaluation is documented in Licensing Topical Report NEDO-31400, "Safety Evaluation for Eliminating the Boiling Water Reactor Main Steam Isolation Valve Closure Function and Scram Function for the Main Steam Line Radiation Monitor," dated May 1987. Following NRC review of this evaluation, the NRC Staff issued its evaluation documenting its acceptance for referencing the licensing topical report for use in license amendment applications (Reference 3).

The NRC's evaluation identified several conditions which licensees must meet to demonstrate the acceptability of referencing NEDO-31400 in license amendment

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applications. As stated in the District's Proposed Change 100, the assumptions used in the evaluation documented by NEDO-31400 bound those used in the CNS CRDA analysis which form part of the CNS licensing basis. The NRC's RAI requests the District to compare the CNS licensing basis assumptions to those used in the NEDO-31400 analysis, and identify the procedural controls which will be in place to minimize occupational doses, and control environmental releases. The following discussion provides the District's response to the NRC Staff's request for additional information.

QUESTION 1

The Staff SE requires that "The applicant demonstrated that the assumptions with regard to input values (including power per assembly, Chi/Q, and decay times) that are made in the generic analysis bound those for the plant." Your response to this is the statement that "The District has also evaluated the CRDA [Control Rod Drop Accident] analysis for CNS and concludes that the assumptions used in NEDO-31400 bound those used in the CNS CRDA accident analysis."

This statement asserts, but does not demonstrate, that the CNS assumptions are bounded by the generic analysis. To permit the staff to evaluate your compliance with this requirement, we request that you demonstrate that the CNS input values are bounded by the NEDO-31400 values by providing a list of the input values used in the analysis of CNS and those used in the NEDO-31400 analysis, and a discussion of any values for which the CNS value is not bounded by the NEDO-31400 analysis.

RESPONSE

As demonstrated in the table below, the District's CRDA analysis is bounded by the assumptions used in the NEDO-31400 evaluation. The NEDO-31400 evaluation utilized the conservative radiological source term assumptions provided in the Standard Review Plan, Section 15.4.9, "Spectrum of Rod Drop Accidents (BWR)." CNS was licensed based on a General Electric analysis documented in APED-5756, "Analytical Methods for Evaluating the Radiological Aspects of the General Electric Boiling Water Reactor," March 1969. The APED-5756 source term, although conservative, is significantly smaller than obtained using the source term assumptions provided in the Standard Review Plan; hence the NEDO-31400 analyses are more conservative than, and accordingly, bound the CNS licensing basis. A comparison of key input assumptions is provided in the table below.

ASSUMPTION	NEDO-31400	CNS LICENSING BASIS
SOURCE TERM		
1) Number of Failed Fuel Rods	850	330 originally for 7X7 fuel adjusted to 850 for 8X8 fuel (CNS USAR p. XIV-6-7)

ASSUMPTION	NEDO-31400	CNS LICENSING BASIS
2) Basis for Fission Product Inventory	Based on previous long-term operation at full power with no allowance for decay prior to initiation of the event	The reactor is assumed to have operated at design power for 1000 days until 30 minutes before event. (CNS USAR p. XIV-6-8)
3) Assumed Power Level of Failed Fuel Rods	1.5 times core average fuel rod power	Nominally 1.3 times average fuel rod power (CNS USAR p. XIV-6-7)
4) Effective Release Fractions for Failed Fuel Rods	0.107 (nobles) 0.103 (iodines)	0.0198 (nobles) 0.0032 (halogens)[1] (CNS USAR p. XIV-6-8)
5) Power Level of Rods Assumed to Fail	0.12 MW/rod	The power level of the fuel rods assumed to fail are not addressed in the CNS USAR; however, based on the NEDO assumptions of operation @ 105% of licensed core thermal power (2381 MWth), and a 1.5 peaking factor, the CNS power/rod with 548 assemblies of 8X8 design (limiting assembly design of 60 plus one water rod per assembly) is 0.11 MW/rod.
6) Fission Products Transported to Condenser	100% nobles released to coolant 10% iodines released to coolant (90% of iodines reaching condenser are assumed to be removed due to washout/plateout).	100% nobles released to coolant No plateout of iodines assumed; however some washout assumed.[2] (CNS USAR p. XIV-6-10)
7) Reduction of Source Term Due to MSIV closure?	NO	NO (CNS USAR p. XIV-6-9)
DOSE ASSESSMENT		
8) Rate of Condenser Leakage	1% per day	0.5% per day (CNS USAR p. XIV-6-10)

1. These release fractions are based on and conservatively bound the results of measurement made in actual defective fuel experiments. This evaluation is documented in APED-5756, "Analytical Methods for Evaluating the Radiological Aspects of the General Electric Boiling Water Reactor," March, 1969.

2. The assumptions concerning washout/plateout of iodines have little impact on the evaluation as the NEDO-31400 evaluation of a CRDA without MSIV closure assumes negligible iodine release because of retention in the AOG charcoal beds.

ASSUMPTION	NEDO-31400	CNS LICENSING BASIS
9) Dispersion coefficient (Chi/Q)	2.5×10^{-3} sec/m^3 (2-hour ground level) at exclusion area boundary 3.0×10^{-4} sec/m^3 (2-hour elevated release) at exclusion area boundary	$< 5.3 \times 10^{-4}$ sec/m^3 (2-hour ground level) at site boundary $< 1.4 \times 10^{-5}$ sec/m^3 (2-hour elevated release) at site boundary (CNS SER p. 2-8)[3]
10) 2-hour Doses With MSIV Closure	4.3 Rem thyroid 0.31 Rem whole-body	2.6×10^{-8} rem thyroid 1.8×10^{-6} rem whole body (CNS USAR p. XIV-6-12 multiplied by two per GESTAR[4] p. US-13)
11) Percentage of 10 CFR 100 guidelines	5.7% of thyroid limit 5.2% of whole-body limit	<< 1% thyroid << 1% whole body
12) Augmented Off-Gas System Noble Gas Holdup Times	Kryptons - 8 hours minimum Xenons - 22 hours minimum for low temperature AOG System	Kryptons - 44.5 hours Xenons - 37 days (CNS USAR p. IX-5-6)

QUESTION 2

The Staff SE requires that "The applicant includes sufficient evidence (implemented or proposed operating procedures, or equivalent commitments) to provide reasonable assurance that increased significant levels of radioactivity in the main steam lines will be controlled expeditiously to limit both occupational doses and environmental releases." Your response is the statement that "The District commits to revise its procedures as necessary to ensure that adequate controls exist to provide prompt control of significant increased in Main Steam Line activity..."

In order to determine whether or not this requirement will be met at CNS, we request that you provide a discussion of any procedure changes that you plan to make in response to this requirement, and how the revised (or existing, if no changes are planned) procedures ensure that significant increases in Main Steam Line activity will be promptly controlled in the absence of automatic containment

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3. "Safety Evaluation By the Directorate of Licensing, U. S. Atomic Energy Commission, in the Matter of Nebraska Public Power District Cooper Nuclear Station, Nemaha County, Nebraska, Docket No. 50-298," issued February 14, 1973.

4. "General Electric Standard Application for Reactor Fuel (Supplement for United States), General Electric Document No. NEDE-24011-P-A-10-US, dated March, 1991.

isolation on high MSLRM signal. Also, we request that you provide an evaluation of the time that it takes to isolate, and the occupational doses and environmental release with and without automatic isolation on a MSLRM signal so that we may review this aspect of the proposed change.

RESPONSE

CNS has two independent radiation monitoring systems which provide prompt indication of increased reactor coolant activity. These include the Main Steam Line Radiation Monitoring (MSLRM) and the Steam Jet Air Ejector Off-Gas Radiation Monitor (Off-Gas Monitor). These two systems each have a High alarm setpoint, as well as a High-High trip setpoint. While Proposed Change No. 100 will remove the MSLRM High-High MSIV and reactor scram trip, a High-High alarm will be installed in its place. The Off-Gas Monitor currently initiates an alarm at the High alarm setpoint, and an Off-Gas System isolation at the High-High setpoint; these functions will be retained. The MSLRM and the Off-Gas radiation monitor together provide the operators with prompt identification, via control room annunciation, of increased levels of reactor coolant activity, while the CNS Station Procedures, discussed below, provide the necessary guidance to provide rapid response to indication of increased levels of activity in the reactor coolant. These radiation monitoring systems and associated procedures provide rapid indication and response to increased reactor coolant activity levels and together minimize the radiological consequences associated with increases in reactor coolant activity.

As part of the design change implementing the physical plant changes associated with removing the MSLRM MSIV isolation and scram functions, the Off-Gas radiation monitor alarm (High) will be set at slightly greater than 1.5 times background;[5/] the MSLRM alarm (High) will be retained at 1.5 times background. While the District already has in place procedures for controlling increased activity levels as identified at the MSLRMs and the Off-Gas Radiation monitor, some revision to these procedures will be necessary to reflect the physical plant changes planned to be implemented and commitments made in the District's Proposed Change 100. Although a number of station procedures collectively contribute to the process of controlling increased coolant activity, the significant controlling procedures are discussed below.

The initial operator actions taken in response to the alarm conditions are outlined in existing Annunciator Alarm Procedure 2.3.2.24, "Panel 9-4-1." (The MSLRM High Rad Trip which is now annunciated on Panel 9-5-2 will be removed and a MSLRM High High alarm will be provided on Panel 9-4-1 with the MSLRM High

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5. The District has determined that setting the Off-Gas radiation monitor at 1.5 times the normal background would create the potential for nuisance alarms in the Control Room while performing weekly grab sampling and monthly source checks. Therefore, the District will set the alarm slightly higher to provide additional margin to avoid unnecessary control room distractions.

alarm) This procedure provides immediate operator actions and refers to several other existing procedures which provide more detailed guidance for investigating the cause of the alarms, and taking appropriate actions to reduce activity, or shutdown the plant. Briefly, Annunciator Alarm Procedure 2.3.2.24 will identify the following immediate operator actions (asterisk denotes revisions to procedure):

MSLRM Radiation High Alarm

1. Verify alarm
2.* Inform chemistry to sample the reactor coolant
3. Reduce power as necessary to reduce radiation levels
4. Refer to Procedure 2.4.1.2, "Fuel Element Failure"

Off-gas Radiation Monitor High Alarm

1. Verify alarm
2.* Inform chemistry to sample the reactor coolant
3. Take necessary action to reduce off-gas radiation level to below alarm setting
4.* Refer to Procedure 2.4.7.1, "High Off-Gas Activity or Abnormal Off-Gas Flow"

MSLRM High-High Alarm

1.* Verify alarm
2.* Reduce power as necessary to reduce radiation levels
3.* Refer to Procedure 2.4.1.2 "Fuel Element Failure"

Off-Gas High-High Alarm (Off-Gas Timer Initiated)

1. Reduce power to clear alarm
2. Refer to Procedure 2.4.7.1, "High Off-Gas Activity or Abnormal Off-Gas Flow"

Abnormal Procedure 2.4.1.2, "Fuel Element Failure," directs operators to 1) determine if an Emergency Action Level has been reached, and 2) obtain from Reactor Engineering recommended actions in accordance with Nuclear Performance Procedure 10.31, "Fuel Reliability," and provides detailed steps to assist operators in determining the cause of the elevated main steam line activity and to trend key process parameters.

Abnormal Procedure 2.4.7.1, "High Off-Gas Activity or Abnormal Off-Gas Flow," directs operators to perform several actions to reduce main steam line activity, and if the Off-Gas System isolates from main steam line high-high radiation, to scram the reactor and isolate the main steam lines.

Nuclear Performance Procedure 10.31, "Fuel Reliability," provides guidance for determining the appropriate course of action based on increasing steps of Off-Gas activity readings. Based on the applicable activity level, actions include reduction of reactor power level/derate, and evaluation of reactor shutdown.

These and other supplementary station procedures with the identified revisions thereto will provide the necessary controls to promptly respond to increased activity levels in the main steam line.

The time required to isolate the main steam lines will depend on the applicable conditions at the time. In the event an Off-Gas System isolation occurs, Procedure 2.4.7.1, discussed above, directs operators to scram the reactor and isolate the MSIVs. Therefore, following the 15 minute Off-Gas isolation timer delay, the MSIVs would be isolated within a matter of minutes.[6/] This procedure has been and will remain in place, and the Off-Gas timer setpoint is tied to CNS Technical Specification 3.21.C.6.a, which limits Air Ejector effluent rate to $\leq$ 1 Ci/sec. In addition, CNS Technical Specification 3.6.B, "Coolant Chemistry," provides additional limitations on coolant activity and specifies appropriate actions, up to and including plant shutdown. The time required for this evolution is dependant upon the conditions prevailing. However, as the procedural guidance, with the exceptions of the changes identified above, has been and will remain in place, the occupational and radiological consequences of an event resulting in increased reactor coolant activity and without MSIV closure will not significantly differ from the same event with MSIV closure.

Since the District has shown, in the response to Question 1 above, that the NEDO-31400 analyses bound the CNS CRDA analysis, comparison of the environmental doses for a CRDA with and without the MSIV isolation can be provided by utilizing Figures 2, 3, and 4 of NEDO-31400 and the CNS Chi/Q values and Augmented Off-Gas System Noble Gas holdup times. Using this means of comparison, the 2-hour doses for a CRDA <u>with MSIV closure</u> is approximately 1 rem thyroid and 7 X 10^{-2} rem whole body, while the 2-hour doses for CRDA <u>without MSIV closure</u> is less than 2 X 10^{-3} rem whole body.[7/] Although this comparison is not entirely based on the current CNS licensing basis analytical methods, the comparison is based on the NEDO-31400 evaluation which the which the NRC has already evaluated and accepted.

Based on the above discussion, the procedures already in place collectively with the applicable supporting procedures and the planned revisions thereto provide ample guidance for timely disposition and mitigation of increased coolant activity levels, and will continue to ensure that expeditious actions will be

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6. Fifteen minutes following a Steam Jet Air Ejector Radiation Monitor High-High trip (Off-Gas Timer initiated), the Off-Gas 30-minute holdup line will be isolated if the trip cannot be cleared.

7. The dose for a CRDA without MSIV closure does not consider a separate thyroid dose, because it is assumed that 100% of the iodines are held up in the charcoal beds.

taken to minimize both occupational exposure and environmental releases during periods when increased coolant activity is experienced.

QUESTION 3

The staff SE requires that the MSLRM and the offgas radiation monitor alarm setpoint be standardized at 1.5 times the nominal full-power nitrogen-16 background dose rate at the monitor locations, and that the applicant commits to promptly sample the reactor coolant to determine possible contamination levels in the plant reactor coolant if the MSLRM or offgas radiation monitors exceed their alarm setpoints. Your response to this requirement states that the MSLRM alarm setpoint will be retained at 1.5 times the nominal background, and commits to promptly sample the reactor coolant if this setpoint is exceeded. However, you make no mention of the offgas radiation monitor. We request that you explain how this aspect of requirement 3 is met at CNS.

RESPONSE

As discussed in the response to Question 2 above, the Off-Gas Radiation Monitor will be set at slightly greater than 1.5 times background to prevent control room nuisance alarms during radiation monitor surveillance testing. The District will revise CNS Annunciator Alarm Procedure 2.3.2.24, "Panel 9-4-1," as described above, to require reactor coolant sampling if this alarm actuates.

Please contact me if you have any questions on the above or require any additional information.

Sincerely,

G. R. Horn
Nuclear Power Group Manager

GRH/MJB

cc. NRC Regional Administrator
Region IV
Arlington, TX

NRC Resident Inspector
Cooper Nuclear Station