NRR-PMDAPEm Resource

From: Wengert, Thomas
Sent: Monday, April 04, 2011 9:40 AM
To: Hazelhoff, Amy
Cc: Gunderson, Lynne
Subject: Prairie Island - Revised Alternative Source Term LAR Draft RAI 4-4-2011
Attachments: PINGP AST Revised Draft RAI Letter 4-4-2011.pdf

Amy,

Attached is the revised draft RAI based on the 3/29/2011 clarification teleconference. I have clarified RAI Items A.2.b, A.2.d, and A.2.e based on the discussion.

Please let me know if you need any further clarification of the RAI questions, and let me know what date Xcel can provide a response to this RAI.

Regards,

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REQUESTS FOR ADDITIONAL INFORMATION

LICENSE AMENDMENT REQUEST REGARDING

ALTERNATIVE SOURCE TERM (AST)

PRAIRIE ISLAND NUCLEAR GENERATING PLANT (PINGP), UNITS 1 AND 2

DOCKET NOS. 50-282 AND 50-306

In reviewing the Northern States Power Company, a Minnesota corporation (NSPM, the licensee), doing business as Xcel Energy, submittal dated October 27, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML093160605) as supplemented by letters dated April 29, 2010 (ADAMS Accession No. ML101200083), May 25, 2010 (ADAMS Accession No. ML101460064), June 23, 2010 (ADAMS Accession No. ML101760017), August 12, 2010 (ADAMS Accession No. ML102300295), and December 17, 2010 (ADAMS Accession No. ML103510322), which requested adoption of the AST Methodology, in addition to technical specification changes supported by the AST design-basis accident radiological consequences analysis for PINGP, Units 1 and 2, the U.S. Nuclear Regulatory Commission (NRC) staff has determined that the following information is needed to complete its review:

Background

The PINGP licensee voluntarily requested to adopt the AST method for license amendments, as allowed by Title 10 of the *Code of Federal Regulations*, Section 50.67 (10 CFR 50.67), "Accident source term." In support of its AST application, the licensee performed the required radiological releases analysis for the applicable design-basis-events to demonstrate that the dose limits specified in 10 CFR 50.67(b)(2) are not exceeded.

In the radiological releases analysis for an steam generator tube rupture (SGTR) event, the licensee made a key assumption that the steam generator (SG) overfill will not occur and the affected SG can be isolated during an SGTR event, and thus, only steam releases carrying radioactive material are considered for the radiological releases analysis. Water releases have a significantly greater concentration of radioactive material when compared with that of steam releases and will result in worse radiological releases. If the SG overfill occurs, the assumption of the steam releases cannot be validated. As a result, the radiological releases analysis for the SGTR event becomes invalid and is unacceptable for the AST application.

The margin-to-overfill (MTO) analysis is a method that can be used to validate the assumption that the SG will not overfill and only steam releases will occur during an SGTR event. Without an acceptable MTO analysis, the NRC staff cannot determine the validity of the key assumption, and thus, can accept neither the calculated steam mass releases used as inputs to the radiological releases analysis, nor the associated SGTR radiological releases analysis for supporting the AST application. Therefore, the NRC staff determines that the conclusion drawn on the results of the MTO analysis is an essential consideration in the NRC staff's determination

of acceptability of the SGTR radiological releases analysis, which is used to support the AST application.

Applicable Regulations and Regulatory Guidance

The regulation at 10 CFR 50.67 stipulates that the NRC may issue an AST amendment only if an applicant's analysis demonstrates with reasonable assurance that the dose limits specified in 10 CFR 50.67(b)(2) would be met.

Regulatory Position 1.3.2, specified in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," states that an analysis is considered to be affected if the proposed modification changes one or more assumptions or inputs used in that analysis such that the results, or the conclusions drawn on those results, are no longer valid.

Section 5.1.3 in Regulatory Guide 1.183 states that the numeric values that are chosen as inputs to the analyses should be selected with the objective of determining a conservative postulated dose.

Technical Issues

The NRC staff reviewed the SGTR analysis in the license amendment request (LAR) dated October 27, 2009, and the associated response in the licensee's letter dated May 25, 2010, to the staff's request for additional information (RAI). As stated in its submittals, the licensee used its plant simulator to perform the SG MTO analysis during a SGTR event for the AST application. Specifically, the simulator was used in combination with Emergency Operating Procedures (EOP) E-0, "Reactor Trip or Safety Injection," and E-3, "Steam Generator Tube Rupture," to determine the response time for the break flow termination. Based on the response times (including the operator action times and the reactor coolant system (RCS) response times), the flow rates for the break flow into the ruptured SG, and the volume available in the ruptured SG, the SG MTO was determined.

As a result of its review, the NRC staff observes that the assumptions used in the analysis for various initial plant conditions (such as the pressure difference between the RCS primary side and secondary side in the ruptured SG) are conservative with respect to calculating the break flow rates into the ruptured SG. The NRC staff also notes that the operator action and the RCS response times affect the overall conservatism of the SGTR MTO analysis, as they are used to determine the total amount of the break flow into the ruptured SG. Therefore, the use of a method acceptable to the NRC for determining the response times is equally as important as the assumptions that maximize break flow rates into the ruptured SG in assuring the adequacy of the SGTR MTO analysis.

During the review, the NRC staff noted that the licensee used its simulator in determining the response times in the MTO analysis. The computer codes and RCS thermal-hydraulic models used in the simulator at PINGP were not previously submitted to the NRC to review and approved for use in the analysis of transients and accidents (including the SGTR event) in support of licensing applications. The NRC staff notes that the simulator was built as a tool for the purpose of training operators, and was not designed for performing analysis in support of the licensing applications. Its physical models are relatively simple compared to those used in

the licensing codes. The results of the MTO analysis (in the May 25, 2010, supplement), based on the longest response time from the licensee's simulator exercises show no MTO. In addition, the NRC staff compared the results from the simulator exercises to the results from the NRC-approved MTO method for two other Westinghouse 2-loop plants (PINGP is a Westinghouse 2-loop plant). The comparison revealed that the total response time to terminate the break flow from the primary-to-secondary RCS using the simulator at PINGP was significantly shorter (approximately 30 minutes vs. 50 minutes) than the response times of the other plants. The response time is used to determine the total amount of the break flow to the SG secondary side, which determines the SG MTO. A shorter response time is, therefore, not conservative with respect to the SG overfill analysis.

Request for Additional Information (RAI)

In order for the NRC staff to continue its review, the following additional information is needed:

A. RAI Related to the MTO Analysis

1. If the licensee chooses to continue to use its simulator for the MTO analysis, it should provide additional information related to the computer codes and RCS physical models in the simulator for the NRC staff to review and approve. The additional information provided should include: a discussion of the methodology; computation device manuals; user's manuals and guidelines; scaling reports; assessment reports and uncertainty assessment reports as described in the applicable sections of Regulatory Guide 1.203, "Transient and Accident Analysis Methods."

   The information should show that: the constituent equations representing the RCS thermal-hydraulics are correct and complete; the correlations for the heat transfer and flow rate determination are adequately supported by the applicable test data; the nodal scheme appropriately models the RCS; the mathematical methods provide stable solutions; the time step used for the mathematical solution does not result in divergent conditions; the system responses of the RCS for both with and without a loss of alternating current power are validated by comparing with the applicable integrated and separated effects test data; and the MTO analyses show that the assumptions and the plant conditions used result in a maximum response time for the AST application.

2. Alternatively, the licensee may perform an SGTR MTO analysis for PINGP at current licensed thermal power (CLTP) conditions. The analysis should align as closely as possible to an NRC-approved methodology described in a Westinghouse topical report, WCAP-10698-P-A. However, since the licensee has stated that a limiting single failure is not in the PINGP licensing basis, this exception to the WCAP-10698-P-A methodology will be acceptable. The requested analytical results should include sequences of the event with specification of operator actions and the associated times credited in the analysis, and the response of key plant parameters versus time.

   In addition to providing the analytical results, please address the following:

   a. Address compliance with the conditions and restrictions specified in the NRC safety evaluation reports approving the WCAP-10698-P-A methodology.

b. List in a table the nominal values with the associated uncertainties, and corresponding values used in the MTO analysis for the major input initial conditions described in WCAP-10698-P-A. Discuss the bases used to select the numerical values of the input parameters and show that the numerical values used are conservative, resulting in a minimum SG MTO during an SGTR event. In addition, provide a basis for the target cooldown temperature used in the analysis.

c. Ensure that the limiting liquid release pathway and scenario are identified. Include consideration of the steam line equipment water-release failures discussed in WCAP-11002-P (Note that the NRC staff discussed WCAP-11002-P in its evaluation of WCAP-10698-P-A, but did not find that it provided an acceptable method for performing a licensing basis safety analysis). If a liquid release is predicted, provide analyses of the static and dynamic structural effects in the main steam system and of the consequences of passing water through the steam pressure relief valves.

d. Under the assumed LOOP conditions, address the functionality of each power-operated relief valve (PORV). Discuss what, if any, mitigating function the PORV provides, and its capability to perform that function under the assumed LOOP conditions. If the valve's actuation must be manual, provide information to demonstrate that the operator is capable of actuating the valve within the analytically assumed time.

e. One of the key parameters that will affect the results of the steam generator SG MTO analysis during an SG tube rupture event is the initial SG water level, which is a function of the initial power level. The MTO analysis to be submitted should consider the effects of initial SG water levels corresponding to power levels that capture 95 percent of the operating time during a fuel cycle. Also, for the range of power levels that envelop 95 percent of operating time, provide trending data for the corresponding SG water levels to show that conservative initial SG water levels (with the inclusion of measurement uncertainties, thus resulting in a smaller margin to SG overfill) have been selected.

f. Identify operator actions and associated action times credited in the analysis. Where an operator action is credited, confirm that such action is consistent with station procedures and action times are conservative, resulting in a minimum SG MTO.

g. Update the licensing basis radiological consequence analyses for the AST conditions to reflect radiological consequences of the above-identified limiting release, should they be more severe than the current, proposed, radiological analysis. Since the NRC staff is allowing the single failure exception to the WCAP-10698-P-A methodology, the above requested analysis represents an event that has a significantly higher likelihood of occurrence.

Please also provide the following additional information:

h. Identify how procedures address the SG overfill condition. What parameters do operators monitor to help ensure that overfill does not occur?

i. For any revised radiological consequence analyses, provide the basis for the assumed flashing fraction, if it is less than 100 percent.

B. RAI Related to the SGTR Mass Release Analysis

1. Information on page 116 of the October 27, 2009, LAR, indicates that the results of a recent Westinghouse SGTR analysis were used to determine: (1) primary coolant releases to the ruptured SG; (2) steam mass releases from ruptured SG to the environment; and (3) steam mass releases from intact SG to the environment.

   Provide a discussion of the Westinghouse SGTR analysis for mass releases determination and verify that the methods used in the analysis are NRC-approved methods, and address compliance with restrictions and conditions specified in the NRC safety evaluation report approving the methods and computer codes. The requested information should also include the plant parameters considered in the analysis, identify the major input initial conditions and the worst single failure used in the analysis, discuss the bases used to select the numerical parameters and demonstrate that the numerical values with consideration of the uncertainties and fluctuations around the nominal values are conservative, resulting in maximum mass releases during an SGTR event. The results to be provided should include sequences of the event with specification of operator actions, associated times credited in the analysis and their bases for acceptance, and the response of key parameters versus time.

   Also, address the acceptability of the analysis performed at the extended power uprate power level to the AST application, which is based on the current power level.

2. Page 116 of the LAR indicates that, based on the current PINGP licensing basis, the "termination of release from ruptured SG" was completed within 30 minutes from initiation of the SGTR event.

   Discuss the "current licensing basis" for the event termination time of 30 minutes, its effect on and acceptability of the radiological release analysis, and its relationship with the break flow termination time of 30 minutes assumed in the MTO analysis.

C. RAI Related to Update of Updated Safety Analysis Report

   Discuss PINGP's plans to reflect the information provided in response to above items A and B in an update of the Updated Safety Analysis Report, pursuant to the requirements of 10 CFR 50.71, "Maintenance of records, making of reports."