PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

LR-N04-0417

PSEG Nuclear LLC

SEP 2 3 2004

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

LCR S03-05, IMPLEMENTATION OF ALTERNATE SOURCE TERM
REQUEST FOR ADDITIONAL INFORMATION (TAC NOS. MC3094 & MC3095)
SALEM GENERATING STATION, UNITS 1 AND 2
FACILITY OPERATING LICENSES DPR-70 AND DPR-75
DOCKET NOS. 50-272 AND 50-311

By letter dated April 26, 2004, PSEG Nuclear, LLC submitted a request for changes to the Salem Nuclear Generating Station, Units No. 1 and 2, Technical Specifications. The proposed changes would revise the source term used for design basis radiological analysis. The proposed change would also revise certain requirements in the Technical Specifications and Updated Final Safety Analysis Report based on the radiological dose analysis margins obtained in the Alternate Source Term application. The Nuclear Regulatory Commission (NRC) staff has been reviewing PSEG's submittal and on August 24, 2004 issued a request for additional information that is necessary in order for the Materials and Chemical Engineering Branch to complete their review.

PSEG's response to this request is included as Attachment 1. Details of this response were discussed with your staff during a meeting held at NRC Headquarters on September 9, 2004.

If you have any questions or require additional information, please contact Mr. Jesus Arias at (856) 339-5245.

I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,

D. F. Garchow
Vice President
Engineering and Technical
Support

Executed on 9/23/04

Attachment (1)

A001

95-2168 REV. 7/99

C: Mr. S. Collins, Administrator – Region I
U. S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. D. Collins, Project Manager - Salem & Hope Creek
U. S. Nuclear Regulatory Commission
Mail Stop 08C2
Washington, DC 20555

USNRC Senior Resident Inspector – Salem Units 1 and 2

Mr. K. Tosch, Manager IV
Bureau of Nuclear Engineering
PO Box 415
Trenton, New Jersey 08625

REQUEST FOR ADDITIONAL INFORMATION

IMPLEMENTATION OF ALTERNATE SOURCE TERM

SALEM NUCLEAR GENERATING STATION, UNITS NO. 1 AND 2

DOCKET NOS. 50-272 AND 50-311

By letter dated April 26, 2004, PSEG Nuclear, LLC submitted a request for changes to the Salem Nuclear Generating Station, Units No. 1 and 2, Technical Specifications. The proposed changes would revise the source term used for design basis radiological analysis. The proposed change would also revise certain requirements in the Technical Specifications and Updated Final Safety Analysis Report based on the radiological dose analysis margins obtained in the Alternate Source Term application. The Nuclear Regulatory Commission (NRC) staff has been reviewing PSEG's submittal and has determined that the following additional information is required to complete their review:

1. Section 4.1, pages 12 and 16, in your submittal state that the containment sump water will remain at a pH greater than 7 following a loss of coolant accident (LOCA). Provide a discussion of the assumptions and calculations used to conclude that the pH will remain above 7 for at least 30 days following a LOCA. This discussion should be in sufficient detail for the NRC staff to perform independent calculations and verify the validity of this conclusion. If the calculations were performed manually, discuss the methodology used and provide sample calculations. If the calculations were performed using a computer code, provide a description of the code including input values and how they were determined. Provide the results at different time intervals and discuss the criteria for selecting the intervals.

2. Provide information on the systems used to ensure that after a LOCA the pH of the sump water will stay basic. Your response should include a description of the methodology and the accompanying calculations used in determining the amounts of chemical agents needed to achieve this objective.

PSEG's response to Question No. 1:

The minimum value of pH of the Salem Unit 1 and 2 Containment sumps following a DBA-LOCA comes from the original Westinghouse design calculation (WCAP-7952, Westinghouse Electric Company Report, Iodine Removal by Spray in the Salem Containment, R.M. Kemper, August 1972). The sump pH value is 8.6 at the start of the recirculation phase. In accordance with Reg. Guide 1.183, dose calculations were performed in support of the License Change Request (LCR S03-

05) and the affect of cable radiolysis was evaluated relative to the original sump design pH value of 8.6.

Assumptions

The ECCS will inject the maximum amount of Refueling Water Storage Tank (RWST) water at the maximum boron concentration and the eductor system will supply the minimum quantity of sodium hydroxide (NaOH) at the minimum concentration via the Containment Spray System.

In a sophisticated pH analysis the Hypalon jacket and EPR (ethylene propylene rubber) insulation are modeled for the absorption of gamma radiation and the effect of conduit shielding is analyzed for those cables in conduit. PSEG performed a simplified confirmation calculation utilizing the Redox Version 2.24 of EPRI's MULTEQ code, which assumes that all the cable material contained within cable trays is broken down by radiolysis and enters the sump, neglecting cable contained in conduits. Cable material will retain most of its original 17.5 weight % chlorine, however it was assumed to be 100% released.

Organic acid from paints was neglected. The $[H^+]$ from the production of organic acid from paint in the sump at Salem is expected to be a small fraction of the total $[H^+]$ from the acid calculated to be produced by the RCS boric acid and radiolysis of cable (Hypalon) material.

Calculations

This confirmation calculation uses one of the EPRI chemWORKS suites of codes called MULTEQ. The results give only a bounding value of the change in pH with and without Hypalon. The effect of Hypalon generating hydrochloric acid (HCl) is not large enough to significantly affect the overall recirculation water pH.

Methodology

Following a LOCA, containment spray is used to scrub iodine from the containment atmosphere and, thereby, reduce iodine release to the environment. The pH of the sump water mixture is determined. The water mixture is primary coolant water with boric acid, refueling water storage tank (RWST) injection, and NaOH from the Containment Spray System Spray Additive Tank. The methodology is as follows:

- Start with 1) the boric acid solutions of the reactor coolant, RWST, and Accumulators, 2) the sodium hydroxide solution of the Spray Additive Tank, and 3) the quantity of the water in the containment sump post-LOCA.
- Determine the concentrations of boron and sodium in the containment sump and calculate the sump pH.

- Apply the radiolysis of cable (Hypalon) to determine the [HCl] concentration in the sump and calculate the sump pH.

Input Values

Component	Volume/Mass	Units	Boron, ppm	NaOH, weight %	Chlorine, weight %	Sulfur, weight %
RWST	313,000	gal	2500	0	0	0
Accumulators	24,892	gal	2500	0	0	0
RCS	12,872	ft^3	2300	0	0	0
Spray Add. Tank	2,568	gal	0	30.0	0	0
Hypalon	30,000	lbm	0	0	17.5	1.1

Time Intervals

The calculation was done at a time step when the sump will reflect a mixture of the above inputs, which is the start of the recirculation phase. This time step was selected since it represents the pH values in the containment sump during the recirculation phase when iodine is to be maintained in solution. During the earlier injection spray phase, the pH of the spray solution is of primary concern for scrubbing iodine out of the containment atmosphere. In accordance with Reg. Guide 1.183, the timing of the release of fission products from the fuel is not as rapid as it was in the former regulation TID-14844. With AST the release does not reach a peak until about 1.8 hours after the LOCA. Therefore, any minimum sump pH values before the recirculation phase will not affect injection spray pH or be subject to ESF leakage outside containment. Additionally, Table 2.3 of NUREG/CR-5950, "Iodine Evolution and pH Control" shows the slow generation of HCl from radiolysis of Hypalon.

Results

The design basis minimum equilibrium pH of 8.6 in the containment sump in WCAP-7952 is achieved at the start of the recirculation phase. The same calculated pH based on the above input values, is 8.4. The degradation of 30,000 pounds of cable (a conservative bounding assumption) reduces the pH to 7.4 by forming HCl.

PSEG Response to Question No. 2:

The system to ensure that after a LOCA the pH of the sump water will stay basic is the Spray Additive System, which is required by the Salem Units 1 and 2 Technical Specification 3.6.2.2. The design basis of the Salem Unit 1 and 2 Spray Additive Tank given in the Salem UFSAR, Section 6.2.2.2, page 21 is ". . . to contain enough sodium hydroxide solution which, upon mixing with the refueling water from the RWST, the boric acid from the boron injection tank (BIT), the borated

water contained within the accumulators, and primary coolant, will bring the containment sump to a pH of at least 7.0." Section 6.2.3.1 states, "To enhance this iodine absorption capacity of the spray, the spray solution is adjusted to an alkaline pH which promotes iodine hydrolysis to nonvolatile forms." UFSAR Section 6.2.3.4.1 states, "An eductor system, described in Section 6.2.2.1, is used to maintain the injection spray solution at a pH in the range of 8.5 to 10.0 to ensure efficient and rapid removal of the iodine from the containment atmosphere." Figure 6.2-14 (Revision 6, February 15, 1987) shows that the sump water pH is approximately 8.6 at 58 minutes. The Spray Additive System design was provided by Westinghouse Letter BURL-636, dated April 25, 1969.

The Bases for Salem Technical Specification 3.6.2.2. states: "The OPERABILITY of the spray additive system ensures that sufficient NaOH is added to the containment spray in the event of a LOCA. The limits on NaOH minimum volume and concentration ensure that 1) the iodine removal efficiency of the spray water is maintained because of the increase in pH value, and 2) corrosion effects on components within containment are minimized. The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics. These assumptions are consistent with the iodine removal efficiency assumed in the accident analyses."