Entergy

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Fred Dacimo
Site Vice President
Administration

October 24, 2007

Re: Indian Point Nuclear
Generating Unit No. 2
Docket No. 50-247
NL-07-077

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, D.C. 20555-0001

SUBJECT: **Proposed Changes to the Technical Specifications Regarding Replacement of the Trisodium Phosphate Buffer with Sodium Tetraborate**

REFERENCES:

1) NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004.

2) Entergy Letter NL-07-074, "Request for Extension of Completion Date for Indian Point Unit 2 Corrective Actions and Modifications Required by Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"" dated September 17, 2007.

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Nuclear Operations, Inc. (Entergy) hereby requests an amendment to the Operating License for Indian Point Nuclear Generating Unit No. 2 (IP2), to replace the containment buffering agent from trisodium phosphate (TSP) to sodium tetraborate (STB). The purpose of this change is to minimize the potential for sump screen blockage concerns under post loss-of-coolant accident conditions due to a potential adverse chemical interaction between TSP and certain insulation materials used in containment. This request is an integral part of Entergy's response to GL 2004-02 (Reference 1) and represents one of the remaining modifications required to achieve full compliance with the requirements of GL 2004-02 as documented in Reference 2.

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Entergy has evaluated the proposed change in accordance with 10 CFR 50.91(a)(1) using the criteria of 10 CFR 50.92(c) and Entergy has determined that this proposed change involves no significant hazards considerations as described in Attachment 1. The proposed changes to the Technical Specifications are shown in Attachment 2. The associated TS Bases changes are provided in Attachment 3 for information purposes only. In accordance with 10 CFR 50.91, a copy of this application and the associated attachments are being submitted to the designated New York State official.

Contingent upon NRC approval of the GL 2004-02 extension request, Entergy requests approval of the proposed amendment by March 3, 2008, to support implementation activities and operation with the new buffer following completion of the 2R18 refueling outage in spring 2008. The amendment would be implemented prior to Mode 4 entry following refueling. There are no new commitments identified in this submittal. If you have any questions or require additional information, please contact Mr. R Walpole at (914) 734-6710.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 24th, 2007.

Sincerely,

Fred R. Dacimo
Site Vice President
Indian Point Energy Center

Attachments:

1: Analysis of Proposed Changes to the Technical Specifications Regarding Replacement of the Trisodium Phosphate Buffer with Sodium Tetraborate

2: Markup of Existing Technical Specification Pages for Proposed Changes Regarding Replacement of the Trisodium Phosphate Buffer with Sodium Tetraborate

3: Markup of Technical Specification Bases Pages for Proposed Changes Regarding Replacement of the Trisodium Phosphate Buffer with Sodium Tetraborate

cc: Mr. John P. Boska, Senior Project Manager, NRC NRR DOLR
Mr. Samuel J. Collins, Regional Administrator, NRC Region 1
NRC Resident Inspector's Office, Indian Point Unit 2
Mr. Paul D. Tonko, President, NYSERDA
Mr. Paul Eddy, New York State Department of Public Service

ATTACHMENT 1 TO NL-07-077

ANALYSIS OF PROPOSED CHANGES TO THE TECHNICAL SPECIFICATIONS REGARDING REPLACEMENT OF THE TRISODIUM PHOSPHATE BUFFER WITH SODIUM TETRABORATE

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

1.0 DESCRIPTION

Entergy Nuclear Operations, Inc. (Entergy) requests to amend the Operating License DPR-64, Docket No. 50-247 for Indian Point Nuclear Generating Unit No. 2 (IP2) by revising Technical Specification (TS) 3.6.7, "Recirculation pH Control System".

By Amendment No. 191 (Reference 1), the NRC approved the use of trisodium phosphate (TSP) as the buffering agent for use in the Recirculation pH Control System. Entergy proposes to replace the TSP with an equivalent quantity of sodium tetraborate decahydrate (STB) ($Na_2B_4O_7.10H_2O$). The purpose of this change is to minimize the potential for sump screen blockage concerns under post loss-of-coolant accident (LOCA) conditions due to a potential adverse chemical interaction between TSP and certain insulation materials used in containment. The use of TSP ensures an alkaline pH for the solution recirculated in the containment sumps. The alkaline pH minimizes the evolution of iodine and minimizes the occurrence of chloride and caustic stress corrosion on mechanical systems and components exposed to the fluid. The proposed use of STB serves this same function, maintaining the intent of the TS, but results in less predicted precipitate generation and resultant sump screen blockage.

2.0 PROPOSED CHANGE

The Indian Point Unit 2 TS Surveillance Requirement (SR) 3.6.7.1 currently states:

“Perform a visual inspection of the four trisodium phosphate storage baskets to verify each of the following:

a. Each storage basket is in place and intact; and,

b. Collectively contain ≥8000 pounds (148 cubic feet) of trisodium phosphate (w/12 hydrates), or equivalent.”

The proposed amendment will revise TS SR 3.6.7.1 to state:

“Perform a visual inspection of the four sodium tetraborate storage baskets to verify each of the following:

a. Each storage basket is in place and intact; and,

b. Collectively contain ≥8096 pounds (160 cubic feet) of sodium tetraborate decahydrate, or equivalent.”

The associated TS Bases changes are provided in Attachment 3 for information purposes only.

3.0 BACKGROUND

TS currently require the use of TSP as the buffering agent for the post-LOCA recirculation fluid. The TSP is stored in granular form in four stainless steel, seismically qualified, wire mesh baskets strategically located in the post-accident flooded region of the containment. The baskets become submerged within the containment pool (as the post LOCA water level rises) and release the buffering agent by dissolution. Mixing is achieved as the solution is continuously recirculated.

Initially the containment spray will be boric acid solution from the Refueling Water Storage Tank (RWST) which has a pH of approximately 4.5. Based on titration curves for TSP in boric acid, the current TS value of 8,000 pounds of TSP is sufficient to assure a post-LOCA sump pH of 7.0 with a margin of approximately 41% to account for formation of acids over time in the solution. In addition, the maximum pH due to TSP is 7.61 (Reference 2).

TSP was initially selected as a post-LOCA buffering agent because of its many favorable characteristics. In particular, it dissolves rapidly and the quantity needed to increase the coolant pH above 7.0 is reasonable. It also has corrosion inhibitor properties beyond its ability to moderate pH. For example, steel corrosion is inhibited through the formation of iron phosphate conversion coatings. In the hydrated form, it has a good storage life, and is readily available. Buffering agent addition is mainly required to reduce release of iodine fission products from the coolant to the containment atmosphere as iodine gas, in order to control the radiological consequences of the accident. Long-term iodine retention is assured only when the equilibrium sump solution pH is above 7.0 In addition to dose considerations, raising the pH in the post-LOCA containment pool to a value greater than 7.0 reduces the general corrosion rate of some structural materials and inhibits stress corrosion cracking in austenitic stainless steel.

As demonstrated by the Integrated Chemical Effects Test (ICET) program conducted by the Los Alamos National Laboratory, TSP could react with dissolved calcium to form insoluble calcium phosphates (Reference 3). Of particular concern at IP2 is the potential release of calcium from calcium silicate insulation. The resultant calcium phosphate precipitates may collect on fibrous beds and exacerbate flow restrictions within the Emergency Core Cooling System (ECCS) at the containment sump screens. Tests performed by Argonne National Laboratory (ANL) have demonstrated the reaction between TSP and calcium silicate insulation and the resulting impact on head loss (Reference 4). The Nuclear Regulatory Commission (NRC) communicated these results to the industry in Information Notices 2005-26 "Results of Chemical Effects Head Loss Tests in a Simulated [pressurized water reactor] PWR Sump Pool Environment," dated September 16, 2005, and its associated Supplement 1 to IN 2005-26, "Additional Results of Chemical Effects Tests in Simulated PWR Sump Pool Environment," dated January 20, 2006.

The ICET program and the ANL Head Loss Test program also evaluated a STB buffered environment (References 4 and 5). In contrast to the TSP results, the STB environment did not produce a calcium phosphate precipitate since there is no phosphate source. In addition, limited head loss testing at ANL showed that in the STB environment head losses were much lower when compared to the corresponding tests with TSP. In summary, the ICET and ANL tests have demonstrated that relative to TSP, STB has significant advantages in the areas of chemical precipitate generation and head loss.

In addition to the ICET and ANL tests, the Pressurized Water Reactor Owners Group (PWROG) investigated the ability to reduce or eliminate the risk of calcium phosphate precipitant formation simply by replacing TSP with another chemical that does not react with the materials in containment to form precipitants. The program tested alternative buffering agents to determine the efficacy of these materials to replace TSP. The results of the PWROG activity were reported in WCAP-16596-NP, "Evaluation of Alternative Emergency Core Cooling System Buffering Agents" (Reference 6). The results of the candidate buffer testing were used to determine the appropriate replacement for TSP at IP2 and STB was selected as an acceptable alternative.

4.0 TECHNICAL ANALYSIS

4.1 TS SR 3.6.7.1 changes

The proposed change to TS SR 3.6.7.1, which replaces the use of TSP with STB, maintains consistency with the existing TS. TS SR 3.6.7.1 specifies the use of the hydrated form of TSP because of high humidity in the containment building during normal operation. However, because the use of TSP has been shown to potentially exacerbate post-LOCA sump screen blockage due to a potential adverse chemical interaction with certain insulation materials used in containment, Entergy proposes to replace the buffering agent chemical employed at IP2. Therefore, to preclude the potential for a possible adverse TSP/insulation interaction, Entergy is proposing to replace the TSP with the hydrated form of STB which has essentially the same buffering agent characteristics as TSP but without the potential adverse consequences. The existing four buffer baskets were confirmed to be adequately sized to accommodate the required amount of STB. The proposed operating condition is analogous to the existing operating condition described above except that STB replaces TSP.

TS SR 3.6.7.1 is also revised to replace the buffer mass and volume with a revised mass and volume. A fully hydrated form of STB would be used which makes it is less likely to absorb large amounts of water from the potentially humid containment conditions. If exposed to dry containment conditions, there is a potential for some loss of water. The chemical properties of the buffer do not change as the result of the potential water loss, but weight decreases (Reference 6).

The TS surveillance requirement would continue to be implemented in an onsite procedure by checking level in the baskets to verify volume per TS SR 3.6.7.1.

4.1 STB Minimum Mass and Volume Determination

Based on NUREG-0800, "Standard Review Plan," Section 6.5.2, "Containment Spray as a Fission Product Cleanup System," long-term iodine retention is assumed only when the equilibrium sump solution pH is above 7.0. Subsection 11.1.g specifies that the pH of all solutions in the containment sump and all additives for reactivity control, fission product removal, or other purposes (boric acid) should be maintained at a level high enough to assure that significant long-term iodine re-evolution does not occur. Long-term iodine retention may be assumed only when the equilibrium sump solution pH, after mixing and dilution with primary coolant and ECCS injection sources (RWST and Accumulators), is above 7.0.

Entergy performed an analysis to determine the amount of STB needed to maintain the post-LOCA containment sump pH ≥7.0 following recirculation at IP2 (Reference 7). STB pH and dissolution tests were performed and were used for the analysis. The test data showed that the buffer dissolves readily, confirming the information contained in WCAP-16596-NP. The analysis considered the minimum and maximum quantities of boron and borated water and the timedependent post-LOCA sump temperatures. In addition, radiolysis of air and water, radiolysis of chloride bearing electrical cable insulation and jacketing, and spilled reactor core inventory were included. The quantity of STB required to maintain the pH of the sump pool was determined at the onset of recirculation and for 30 days (by which time the sump pool pH has reached an equilibrium value). The minimum amount of sodium tetraborate decahydrate required to maintain a minimum sump pH of ≥7.0 is a STB mass ≥ 8,096 pounds. The corresponding minimum volume requirement is 160 cubic feet based on the use of STB with a minimum density of 50.6 lb/ft^3.

4.3 STB Evaluation

Use of STB is predicted to result in a significant reduction in precipitate formation with no adverse side effects as demonstrated by the ICET with TSP (Reference 3) and STB (Reference 5), the results of the PWROG chemical effects testing in WCAP-16530-NP, Rev. 0, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support Generic Safety Issue (GSI) -191," February 2006 (Reference 8), and alternate buffer testing documented in WCAP-16596-NP (Reference 6). Additionally:

- STB provides a comparable buffering capacity to TSP with a comparable quantity of buffering agent, so no modification to the existing buffer delivery scheme is required;

- No new types of precipitates are formed in the target pH range of 7.0 to 8.0, which is within the range of IP2 pH control (Reference 6);

- Corrosion of steel structural materials is comparable to that expected with TSP. Corrosion of submerged aluminum in STB is higher than in TSP for equivalent pH; however, the overall effect of the increased corrosion with STB has been factored into the current chemical effects evaluation and addressed in subsequent testing (Reference 6).

- STB will provide additional dissolved boron for reactivity control.

- STB is readily dissolved. STB is expected to form clumps due to local dissolution and re-precipitation under the in-service conditions of the containment environment (Reference 6). This phenomenon does not chemically change the STB portion of the material. Test results showed that relative to that of the granular form, the clumped STB took longer to dissolve as a result of the surface area reduction but nevertheless dissolved readily.

- The stability of STB in the containment environment can be considered comparable to or slightly better than TSP (Reference 6). The stability of STB to radiation exposure has been demonstrated to be satisfactory based on years of use in PWR environments.

- An assessment of the use of STB has concluded that there are no adverse effects on the corrosion of zirconium-based alloys and stainless steel which are used in the fabrication of fuel assemblies and core components; therefore, replacement of the TSP containment buffer with STB is not expected to have any detrimental effects on the fuel.

- STB has been approved for use at PWRs utilizing an ice condenser containment building. Although the method for introducing STB to the post-accident containment sump pool differs from that at ice condenser plants (dissolving versus released from melting ice), environmental considerations are not significantly different. Both systems are passive in nature releasing the buffering agent only in the event of a high energy line break inside containment.

- Replacing TSP with STB as a buffering agent for containment sump pH control was designed to negate Equipment Qualification (EQ) concerns by maintaining the same pH range as the current buffering agent, TSP. Chemical effects on EQ equipment from the new STB buffering agent were also evaluated. It was determined that the change from TSP to STB had no impact on the post-accident pH conditions in containment. In addition, any chemical interaction between STB with organic sub-components of EQ equipment would not be significantly different than the interaction between TSP and the organic sub-components of EQ equipment. Therefore, the use of STB does not conflict with the existing EQ equipment design requirements and is enveloped by the current program.

- NUREG-0800, "Branch Technical Position MTEB 6-1 ," (Reference 9) sets a minimum pH of 7.0 for post-accident emergency coolant water to reduce the probability of Stress Corrosion Cracking (SCC) of austenitic stainless steel components, non-sensitized or sensitized, non-stressed or stressed. Replacing the TSP buffering agent with STB would not increase the potential for SCC because the STB would ensure that a pH of ≥7.0 is maintained during recirculation. Additionally, both TSP and STB are used as corrosion inhibitors for carbon/low alloy steels (Reference 10).

Application of the WCAP-16530-NP (Reference 8) chemical model for IP2 specific conditions predicts that under LOCA conditions, 64.8 pounds of sodium aluminum silicate ($NaAlSi_3O_8$) will form as precipitates for both TSP and STB. No aluminum oxyhydroxide (AlOOH) is formed with either TSP or STB. Under the same conditions, an additional 673.0 pounds of calcium phosphate ($Ca_3(PO_4)_2$) precipitate could be generated using TSP, compared to no $Ca_3(PO_4)_2$ formation using STB. The following table provides a summary of the predicted precipitate generation. The values presented here may not represent final conditions credited for IP2; however, they present a comparison of the differences associated with the two buffering agents.

Predicted Chemical Precipitate Formation for IP2

Generated Precipitates	**Buffering Agent**	
	TSP	**STB**
$NaAlSi_3O_8$ (lb)	64.8	64.8
AlOOH (lb)	0.0	0.0
$Ca_3(PO_4)_2$ (lb)	673.0	0.0
Total (lb)	737.8	64.8

Thus, the change of buffering agent from TSP to STB is expected to eliminate the calcium phosphate precipitate, resulting in a reduction in the mass of chemical precipitate of approximately 673 pounds that represents a net decrease of approximately 91% in the quantity of precipitate generated.

4.4 Conclusion

Entergy has determined that STB is an acceptable alternative to TSP based on industry testing of buffers outlined in WCAP-16596-NP "Evaluation of Alternative Emergency Core Cooling System Buffering Agents," and through plant-specific application of the chemical model developed in WCAP-16530-NP, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support [generic safety issue] GSI-191," as modified. In addition, Entergy has determined that in order to maintain a sump pH of ≥ 7.0 a minimum weight of sodium tetraborate decahydrate of ≥8,096 pounds is required. A minimum sump pH of 7.0 prevents significant amounts of iodine, released from failed fuel and dissolved in the recirculation water, from converting to a volatile form and evolving into the containment atmosphere. The proposed amendment does not affect the dose analyses, as the initial condition of reducing the amount of re-evolving iodine is achieved by maintaining a sump pH of ≥ 7.0. Therefore, 10 CFR 50.67 limits during a LOCA would not be exceeded.

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Consideration

Entergy has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by assessing the change using the three criteria of 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response – No

   The proposed amendment does not involve a significant increase in the probability of an accident previously evaluated because the containment buffering agent is not an initiator of any analyzed accident. The proposed change does not impact any failure modes that could lead to an accident.

   The proposed amendment does not involve a significant increase in the consequences of an accident previously evaluated. The buffering agent in containment is designed to buffer the acids expected to be produced after a LOCA and is credited in the radiological analysis for iodine retention. Utilizing STB as a buffering agent ensures the post LOCA containment sump mixture will have a pH ≥ 7.0. The proposed change of replacing TSP with STB results in the radiological consequences remaining within the limits of 10 CFR 50.67 as demonstrated by existing analyses of record.

Therefore, operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response - No

   The proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated. STB is a passive component that is proposed to be used at IP2 as a buffering agent to increase the pH of the initially acidic post-LOCA containment water to a more neutral pH. Changing the proposed buffering agent from TSP to STB does not constitute an accident initiator or create a new or different kind of accident previously analyzed. The proposed amendment does not involve operation of any required systems, structures or components in a manner or configuration different from those previously recognized or evaluated. No new failure mechanisms will be introduced by the changes being requested.

   Therefore, the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response - No

   The proposed amendment does not involve a significant reduction in a margin of safety. The proposed amendment of changing the buffering agent from TSP to STB results in equivalent control of maintaining sump pH at 7.0 or greater, thereby controlling containment atmosphere iodine and ensuring the radiological consequences of a LOCA are within regulatory limits. The use of STB also reduces the potential for exacerbating sump screen blockage due to a chemical interaction between TSP and certain calcium sources used in containment. This proposed amendment eliminates the formation of calcium phosphate precipitate thereby reducing the overall amount of precipitate that may be formed in a postulated LOCA. The buffer change would minimize the potential chemical effects and should enhance the ability of the emergency core cooling system to perform the post-accident mitigating functions.

   Therefore, the proposed amendment does not involve a significant reduction in the margin of safety.

Based on the above, Entergy concludes that the proposed amendment to replace the containment sump buffering agent requirement for the use of TSP with STB presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

10 CFR 50.49 Environmental Qualification of Electrical Equipment Important to Safety

Replacing TSP with STB as a buffering agent for containment sump pH control has been designed to negate EQ concerns by maintaining the same pH range as the current buffering agent. Chemical effects on EQ equipment from the new STB buffering agent were also evaluated. It was determined that the change from TSP to STB had no impact on the post-accident pH conditions in containment and any chemical interaction between STB with organic sub-components of EQ equipment will not be significantly different than the interaction between TSP and the organic sub-components of EQ equipment. Therefore, the use of STB does not conflict with the existing EQ equipment design requirements and thus is enveloped by the current program.

10 CFR 50.67 Accident Source Term

The regulatory requirements associated with accident assessments are summarized below:

Offsite and Control Room Doses:

- An individual located at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release should not receive a radiation dose in excess of the accident-specific total effective dose equivalent (TEDE) value noted in RG 1.183, Table 6.
- An individual located at any point on the outer boundary of the LPZ who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) should not receive a radiation dose in excess of the accident-specific TEDE value noted in RG 1.183, Table 6.
- Adequate radiation protection is provided to permit occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 0.05 Sv (5 rem) TEDE for the duration of the accident.

The proposed amendment does not affect the dose analyses, as the initial condition of reducing the amount of re-evolving iodine is achieved by maintaining a sump pH of ≥ 7.0. Therefore, 10 CFR 50.67 limits during a LOCA would not be exceeded, as demonstrated by existing analyses of record.

5.3 Environmental Consideration

The proposed change does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 PRECEDENCE

STB is already in use at ice condenser plants (Reference 11) and has a long and acceptable track record. Utilization of STB in place of TSP as a buffering agent at IP2 serves an analogous function to its use in ice condenser plants, albeit via a different delivery mechanism (dissolution of granular STB versus melting STB ice).

By letter dated August 21, 2006 (ADAMS Accession # ML062340039), as supplemented by letters dated September 6, 2006 (ADAMS Accession # ML062570173), and October 10, 2006 (ADAMS Accession # ML062860428), Omaha Public Power District (OPPD) submitted a similar license amendment request for Fort Calhoun. OPPD requested to replace TSP with STB due to minimizing the potential for exacerbating sump screen blockage due to a potential chemical interaction between TSP and certain calcium sources used in containment that result in the formation of calcium phosphate precipitate. The proposed change for IP2 is similar in that both requests replace TSP with STB. By letter dated November 13, 2006 (ADAMS Accession # ML063120248), the NRC approved the license amendment request for OPPD.

7.0 REFERENCES

1. Jefferey F. Harold to Mr. Stephen E. Quinn, "Issuance of Amendment for Indian Point Unit No. 2 (TAC No. M96548)", April 23, 1997

2. IP2 Updated Final Safety Analysis Report, Section 6C.1.3

3. LA-UR-05-6996, "Integrated Chemical Effects Test: Test #3 Data Report," October 2005

4. Oras, J., et al., "Chemical Effects/Head Loss Testing Quick Look Report, Tests ICET 3-4 to 11," January 20, 2006

5. LA-UR-05-9177, "Integrated Chemical Effects Test Project: Test #5 Data Report," January 2006

6. WCAP-16596-NP, "Evaluation of Alternative Emergency Core Cooling System Buffering Agents," Revision 0, July 2006

7. IP-CALC-07-00129, "Calculation of Post-Accident pH with NaTB Buffer for Indian Point Unit 2," Revision 1, September 18, 2007

8. WCAP-16530-NP, "Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191," Revision 0, as modified by Westinghouse errata letters WOG-06-102, WOG-06-232, WOG-06-273, and the responses to the NRC Requests for Additional Information (RAI) in WOG-06-387

9. NUREG-0800, Standard Review Plan, Section 6.1.1, "Engineered Safety Features" attachment: Branch Technical Position MTEB 6-1, "pH for Emergency Coolant for PWRs"

10. Uhlig's Corrosion Handbook, 2nd Edition. Edited by Revie, R. Winston: John E. Wiley & Sons, 2000

11. NUREG-1431, Rev 3, Volume 2, "Standard Technical Specifications, Westinghouse Plants"

ATTACHMENT 2 TO NL-07-077

MARKUP OF EXISTING TECHNICAL SPECIFICATION PAGES FOR PROPOSED CHANGES REGARDING REPLACEMENT OF THE TRISODIUM PHOSPHATE BUFFER WITH SODIUM TETRABORATE

Bold, italics for added text   ~~Strikeout~~ for deleted text

Affected Tech Spec Page: 3.6.7-1

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

3.6 CONTAINMENT SYSTEMS

3.6.7 Recirculation pH Control System

LCO 3.6.7 The Recirculation pH Control System shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Recirculation pH Control System inoperable.	A.1	Restore Recirculation pH Control System to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1	Be in MODE 3.	6 hours
	AND		
	B.2	Be in MODE 5.	84 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Perform a visual inspection of the four ~~trisodium phosphate~~ ***sodium tetraborate*** storage baskets to verify each of the following: a. Each storage basket is in place and intact; and, b. Collectively contain ≥ ~~8000~~ ***8096*** pounds ~~(148~~ ***160*** cubic feet) of ~~trisodium phosphate~~ ***sodium tetraborate decahydrate***~~(w/12 hydrates)~~, or equivalent.	24 months

ATTACHMENT 3 TO NL-07- 077

MARKUP OF EXISTING TECHNICAL SPECIFICATION BASES PAGES FOR PROPOSED CHANGES REGARDING REPLACEMENT OF THE TRISODIUM PHOSPHATE BUFFER WITH SODIUM TETRABORATE

Bold, italics for added text ~~Strikeout~~ for deleted text

Affected Tech Spec Bases Pages: B 3.6.6-2
B 3.6.7-1
B 3.6.7-2
B 3.6.7-3

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

BASES

BACKGROUND (continued)

iodine removal during the containment recirculation phase. In this configuration, the RHR heat exchangers provide the necessary cooling of the recirculated containment spray.

The Containment Spray System provides a spray of cold borated water into the upper regions of containment to reduce the containment pressure and temperature and to reduce fission products from the containment atmosphere during a DBA. The RWST solution temperature is an important factor in determining the heat removal capability of the Containment Spray System during the injection phase. In the recirculation mode of operation, heat is removed from the recirculation sump or the containment sump water by the residual heat removal coolers. Both trains of the Containment Spray System provides adequate spray to meet the system design requirements for containment heat removal even if the Fan Cooler System is not OPERABLE.

The recirculation system pH control system will add ~~trisodium phosphate~~ ***sodium tetraborate*** to the sump when the level of the boric acid solution from the containment spray and the coolant lost from the reactor coolant system rises above the level of the ~~trisodium phosphate~~ ***sodium tetraborate*** baskets in containment. The resulting alkaline pH of the spray enhances the ability of the re-circulated spray to scavenge fission products from the containment atmosphere. The ~~trisodium phosphate~~ ***sodium tetraborate*** also ensures an alkaline pH for the solution recirculated in the containment sump. The alkaline pH of the recirculation sump or the sump water minimizes the evolution of iodine and minimizes the occurrence of chloride and caustic stress corrosion on mechanical systems and components exposed to the fluid.

The Containment Spray System is actuated either automatically by a containment High-High pressure signal or manually. An automatic actuation starts the two containment spray pumps, opens the containment spray pump discharge valves, and begins the injection phase. A manual actuation of the Containment Spray System requires the operator to actuate two separate push buttons on the main control board to begin the same sequence. The injection phase continues until the RWST water supply is exhausted. After the Refueling Water Storage Tank has been exhausted, the containment recirculation pumps or the Residual Heat Removal (RHR) pumps may be used to supply the Containment Spray ring headers for the long-term containment cooling and iodine removal during the containment recirculation phase. In this configuration, the RHR heat exchangers provide the necessary cooling of the recirculated containment spray. The Containment Spray System in the recirculation mode may be used to maintain an equilibrium temperature between the containment atmosphere and the

B 3.6 CONTAINMENT SYSTEMS

B 3.6.7 Recirculation pH Control System

BASES

BACKGROUND

The recirculation pH control system is a passive safeguard with baskets of ~~trisodium phosphate~~ ***sodium tetraborate*** located in the containment sump area. ~~Trisodium phosphate~~ ***Sodium tetraborate*** is stored in four baskets at the 46 foot elevation inside the containment building (Ref. 1).

Section 6.5.2 of the Standard Review Plan (Ref. 2) specifies a pH value greater than or equal to 7.0 to assure continued retention of iodine in the sump solution. The initial containment spray will be boric acid solution from the refueling water storage tank which has a pH of approximately 4.5. As the initial spray solution and, subsequently, the recirculation solution comes in contact with the ~~TSP~~ ***STB***, the ~~TSP~~ ***STB*** dissolves raising the pH of the sump solution to an equilibrium value between 7.0 and ~~9.5~~ ***7.6***.

APPLICABLE SAFETY ANALYSES

The recirculation pH control system is a passive safeguard with the baskets of ~~trisodium phosphate~~ ***sodium tetraborate*** located in the containment sump area. The OPERABILITY of the recirculation pH control system ensures that there is sufficient ~~trisodium phosphate (TSP)~~ ***sodium tetraborate (STB)*** available in containment to guarantee a sump pH >7.0 during the recirculation phase of a postulated LOCA. The mass of ~~trisodium phosphate (TSP)~~ ***sodium tetraborate (STB)*** required to provide an equilibrium sump solution pH of >7.0 is ***8,096*** ~~less than 6,000~~ pounds. ~~To address the potential for long term generation of acids in the containment, this amount is increased to 8,000 pounds.~~ The initial containment spray will be boric acid solution from the refueling water storage tank which has a pH of approximately 4.5. As the initial spray solution and, subsequently, the recirculation solution comes in contact with the ~~TSP~~ ***STB***, the ~~TSP~~ ***STB*** dissolves raising the pH of the sump solution to an equilibrium value between 7.0 and ***7.6*** ~~9.5~~ (Ref. 1).

The Recirculation pH Control System satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

Credit for retention of iodine in the sump solution is assumed for the rod ejection accident (Ref. 3), the Small Break Loss of Coolant Accident (Ref. 4), and the Large Break Loss of Coolant Accident (Ref. 4).

BASES

LCO

The recirculation pH control system is necessary to reduce the release of radioactive material to the environment in the event of a DBA. To be considered OPERABLE, each of the four storage ~~trisodium~~ ***sodium tetraborate*** baskets must be in place and intact and collectively contain ≥ ~~8000~~ ***8096*** pounds (~~148~~ ***160*** cubic feet) of ~~trisodium phosphate~~ ***sodium tetraborate decahydrate*** ~~(w/12 hydrates)~~, or equivalent.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment requiring the operation of the recirculation pH control system. The recirculation pH control system assists in reducing the iodine fission product inventory prior to release to the environment.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations in these MODES. Thus, the recirculation pH control system is not required to be OPERABLE in MODE 5 or 6.

ACTIONS

A.1

If the recirculation pH control system is inoperable, it must be restored to OPERABLE within 72 hours. The pH adjustment of the recirculation pH control system flow for corrosion protection and iodine removal enhancement is reduced in this condition. The Containment Spray system would still be available and would remove some iodine from the containment atmosphere in the event of a DBA. The 72 hour Completion Time takes into account the low probability of the worst case DBA occurring during this period.

B.1 and B.2

If the recirculation pH control system cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 84 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems. The extended interval to reach MODE 5 allows 48 hours for restoration of recirculation pH control system in MODE 3 and 36 hours to reach MODE 5.

BASES

ACTIONS (continued)

This is reasonable when considering the reduced pressure and temperature conditions in MODE 3 for the release of radioactive material from the Reactor Coolant System.

SURVEILLANCE REQUIREMENTS

SR 3.6.7.1

This SR provides visual verification that each of the four storage ~~trisodium~~ ***sodium tetraborate*** baskets is in place and intact and collectively contain ≥ ~~8000~~ ***8096*** pounds ~~(148~~***160*** cubic feet) of ~~trisodium phosphate~~ ***sodium tetraborate decahydrate*** ~~(w/12 hydrates)~~, or equivalent. This amount of ~~TSP~~ ***STB*** is sufficient to ensure that the recirculation solution following a LOCA is at the correct pH level. The 24 month Frequency is sufficient to ensure that the stainless steel baskets are intact and contain the appropriate amount of ~~TSP~~ ***STB***.

REFERENCES

1. UFSAR, Section 6.3.
2. Standard Review Plan, Section 6.5.2.
3. UFSAR, Section 14.2.
4. UFSAR, Section 14.3.