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

Donald C. Cook Nuclear Plant Units 1 and 2
Response to Request for Additional Information Regarding the License Amendment Request to Adopt TSTF-490 and Implement Alternative Source Term

References:

1. Letter from J. P. Gebbie, Indiana Michigan Power Company (I&M), to U. S. Nuclear Regulatory Commission (NRC), "Donald C. Cook Nuclear Plant Units 1 and 2, License Amendment Request to Adopt TSTF-490, Revision 0, 'Deletion of E Bar Definition and Revision to Reactor Coolant System Specific Activity Technical Specification' and Implement Full-Scope Alternative Source Term", dated November 14, 2014, Agencywide Documents Access and Management System (ADAMS) Accession No. ML14324A209.

2. Letter from J. P. Gebbie, I&M, to NRC, "Donald C. Cook, Unit 1 and Unit 2 - Supplemental Information for the License Amendment Request to Adopt TSTF-490, Rev 0, 'Deletion of E Bar Definition and Revision to Reactor Coolant System Specific Activity Technical Specification' and Implement Full-Scope Alternative Source Term," dated February 12, 2015, ADAMS Accession No. ML15050A247.

3. E-mail capture from A. W. Dietrich, NRC, to H. L. Kish, I&M, "D.C. Cook Units 1 and 2 – ESGB RAI Concerning LAR to Adopt TSTF-490 and Implement Full-Scope AST (TAC NOS. MF5184 AND MF5185)," dated April 21, 2015, ADAMS Accession No. ML15112A505.

This letter provides Indiana Michigan Power Company's (I&M), licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, response to a Request for Additional Information (RAI) by the U. S. Nuclear Regulatory Commission (NRC) regarding a license amendment request (LAR) to adopt Technical Specification Task Force (TSTF)-490 and implement Alternative Source Term.

By Reference 1, as supplemented by Reference 2, I&M submitted a request to amend the Technical Specifications to CNP Units 1 and 2 Renewed Facility Operating Licenses DPR-58 and DPR-74. I&M proposes to adopt TSTF-490, Revision 0, and implement full scope alternative source term

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radiological analysis methodology. By Reference 3, the NRC transmitted an RAI regarding the LAR submitted by I&M in Reference 1.

Enclosure 1 to this letter provides an affirmation statement. Enclosure 2 to this letter provides I&M's response to the NRC's RAI. Copies of this letter and its enclosures are being transmitted to the Michigan Public Service Commission and Michigan Department of Environmental Quality, in accordance with the requirements of 10 CFR 50.91.

There are no new regulatory commitments made in this letter. Should you have any questions, please contact Mr. Michael K. Scarpello, Regulatory Affairs Manager, at (269) 466-2649.

Sincerely,

Joel P. Gebbie
Site Vice President

TLC/ams

Enclosures:

1. Affirmation
2. Response to Request for Additional Information Regarding the License Amendment Request to Adopt TSTF-490 and Implement Full-Scope Alternate Source Term

c: A. W. Dietrich, NRC, Washington, D.C.
J. T. King – MPSC
MDEQ – RMD/RPS
NRC Resident Inspector
C. D. Pederson, NRC, Region III
A. J. Williamson, AEP Ft. Wayne, w/o enclosures

Enclosure 1 to AEP-NRC-2015-64

AFFIRMATION

I, Joel P. Gebbie, being duly sworn, state that I am Site Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this request with the U. S. Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

Indiana Michigan Power Company

Joel P. Gebbie
Site Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 17 DAY OF July, 2015

Notary Public

My Commission Expires 04-04-2018

DANIELLE BURGOYNE
Notary Public, State of Michigan
County of Berrien
My Commission Expires 04-04-2018
Acting in the County of Berrien

Enclosure 2 to AEP-NRC-2015-64

Response to Request for Additional Information Regarding the License Amendment Request to Adopt TSTF-490 and Implement Full-Scope Alternate Source Term

By letter dated November 14, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14324A209), as supplemented by letter dated February 12, 2015 (ADAMS Accession No. ML15050A247), Indiana Michigan Power Company (I&M), the licensee for the Donald C. Cook Nuclear Plant (CNP), Units 1 and 2, submitted a license amendment request. The proposed amendment consists of adoption of Technical Specifications Task Force (TSTF)-490, Revision 0, and implementation of a full scope alternative source term radiological analysis methodology. The U.S. Nuclear Regulatory Commission staff in the Steam Generator Tube Integrity and Chemical Engineering Branch (ESGB) of the Office of Nuclear Reactor Regulation is currently reviewing the submittal, as supplemented, and has determined that additional information is needed in order to complete the review. The text of the requests for additional information (RAIs) and I&M's responses are provided below.

RAI-ESGB-1

Identify all sources of post loss of coolant accident (LOCA) strong acid generation in containment and time-dependent or bounding values of strong acid concentrations in the sump for a period of 30 days post-LOCA.

a. *Provide the amounts of strong acids used in the calculations and the decrease of sump water pH due to strong acids generation.*

I&M Response to RAI-ESGB-1:

The major sources of post-LOCA strong acid generation in containment are nitric acid produced by the irradiation of water and air, and hydrochloric acid produced by the radiolysis of chlorine-bearing cable material as outlined in NUREG/CR-5950. The concentrations of nitric acid (C_{HNO3}) and hydrochloric acid (C_{HCl}) in gram-mols per liter (gm-mol/L) are presented at various times of interest in Table 1 below.

Table 1: Time-Dependent Nitric Acid and Hydrochloric Acid Concentrations

End of Injection		End of Spray Additive Tank Eduction		8 Hours		30 Days	
C_{HNO3} (gm-mol/L)	C_{HCL} (gm-mol/L)	C_{HNO3} (gm-mol/L)	C_{HCL} (gm-mol/L)	C_{HNO3} (gm-mol/L)	C_{HCL} (gm-mol/L)	C_{HNO3} (gm-mol/L)	C_{HCL} (gm-mol/L)
4.50E-06	1.53E-04	4.50E-06	1.47E-04	3.45E-05	8.14E-04	2.29E-04	3.00E-03

The response to RAI-ESGB-2 provides information regarding the minimum sump pH calculation. Refer to the "Results and Conclusions" section of the response to RAI-ESGB-2 for the sump pH values at various times of interest over 30 days.

RAI-ESGB-2

Describe the analysis used, including assumptions and inputs, to determine the pH in the sump water during a period of 30 days post-LOCA. Include detailed calculations of time-dependent or bounding pH values in the sump during a 30-day period post-LOCA to demonstrate that the pH remains greater than 7 throughout this time period.

I&M Response to RAI-ESGB-2:

The CNP current licensing basis (CLB) sump pH analysis does not consider strong acid generation via irradiation of water and air (nitric acid) and radiolysis of chlorinated cable insulation (hydrochloric acid). A plant-specific sump pH evaluation has been performed to determine the effect of the post-LOCA acid generation. Specific details of the calculation are provided below.

Methodology

The sump pH is calculated by accounting for water sources containing chemicals that affect the solution pH: boric acid in the refueling water storage tank (RWST), accumulators, and reactor coolant system (RCS); sodium hydroxide (NaOH) in the spray additive tank (SAT); and sodium tetraborate contained in the ice condenser. Additionally, strong acids are generated via irradiation of water and air (nitric acid) and radiolysis of chlorinated cable insulation (hydrochloric acid).

The CLB sump pH analysis for CNP considers various postulated events including large break loss-of-coolant accident (LBLOCA), small break loss-of-coolant accident (SBLOCA), and main steam line break (MSLB) scenarios. Single active failures were also considered for each scenario. The current limiting case for the lowest sump pH is a LBLOCA with one eductor operating at the surveillance test minimum flow criteria. CLB sump pH results are presented at specific times of interest including the end of injection, end of SAT eduction, at 8 hours, and at the end of ice melt.

A system of equations was derived in the CLB calculation to determine the sump pH. Given temperature, boron concentration, and sodium concentration, the sump pH can be determined by simultaneous solution of the system of equations. The boron and sodium concentrations are calculated from the boric acid, sodium hydroxide, and sodium tetraborate concentrations. Specialized computer codes were not employed in the CLB calculation of the sump pH, although Mathcad was utilized to assist in completion of cumbersome hand calculations.

Since the CLB calculation did not account for strong acid generation due to radiation effects in containment post-LOCA, a calculation was performed to include the previously omitted effects of strong acid generation in response to RAI-ESGB-1 and RAI-ESGB-2. The system of equations previously utilized in the CLB was modified to include necessary components to account for the effect of hydrochloric and nitric acids. In accordance with NUREG/CR-5950, the mass of nitric acid from irradiation of water in the presence of air and hydrochloric acid produced by irradiation of electrical cable insulation has been calculated.

Other sources of acid were also considered but not used in the calculation because their effect on pH is negligible. Hydriodic acid (HI) which is generated from iodine, was judged to be negligible in the calculation when considering the comparatively large volume of the sump. The maximum quantity of HI generated would be less than 0.4 mols. Also, carbonic acid is produced by diffusion of carbon dioxide through water, which is primarily a concern for pools that are exposed to a carbon dioxide-rich environment over a long period (e.g., a boiling water reactor suppression pool). This was judged to not have an impact on a pressurized water reactor recirculation sump for the time frame of interest. Additionally, pyrolysis of chlorine-bearing cable insulation, which may generate hydrochloric acid, was considered but not included in the calculation due to the containment not reaching the extreme temperatures necessary for this phenomenon to occur.

Assumptions and Inputs

The new calculation retained the inputs and assumptions utilized in the CLB and incorporated additional inputs and assumptions related to the calculation of long-term strong acid generation. A major assumption common to both the previous CLB and new calculations is that the recirculation sump water is a homogeneous mixture. The location of the containment spray system (CTS) spray nozzles and ice condenser drains ensures that containment spray and ice melt are well distributed throughout the containment lower compartment. With a LBLOCA or MSLB, the blowdown will be forceful and mix the discharged coolant with the other fluids in the lower compartment. For a SBLOCA, the RCS break flow is a relatively small contributor and there is no mechanism that would concentrate the reactor coolant in one location for any significant length of time.

For the minimum pH calculation, the entire deliverable RWST volume is assumed to be pumped to the containment prior to switchover of the CTS pumps to recirculation. This ensures that the maximum quantity of boric acid is achieved in the sump prior to switchover. Likewise, the pressurizer is assumed to be filled with reactor coolant, which maximizes the contribution of boric acid from the RCS. Also, the minimum time delay of zero minutes is used for the SAT isolation time following the restart of the associated CTS pump. This bounding value minimizes the amount of NaOH injected into containment.

The following conservative assumptions were utilized in the calculation of the lowest sump pH:

1. Maximum RWST boron concentration of 2600 ppm from Technical Specification 3.5.4, "Refueling Water Storage Tank (RWST)".

2. Maximum RCS boron concentration of 2600 ppm equal to the maximum RWST boron concentration.

3. Maximum accumulator boron concentration of 2600 ppm from Technical Specification 3.5.1, "Accumulators".

4. Minimum SAT NaOH concentration of 30 wt% from Technical Specification 3.6.7, "Spray Additive System".

5. The mass of chlorine-bearing cable insulation (i.e., Hypalon®) is conservatively assumed to be 100,000 lb_m.

6. The dose field used to evaluate acid generation by radiolysis inside containment is consistent with the plant-specific Environmental Qualification dose analysis.

7. The "End of Ice Melt" time from the CLB is conservatively assumed to occur at 30 days.

Results and Conclusions

The new calculation determined an overall minimum sump pH value of 7.23. The long-term sump pH was determined to be 7.87 at 30 days. After a series of scenarios were reanalyzed, the LBLOCA case with one eductor operating at the surveillance test minimum flow criteria remained limiting. The minimum sump pH value of 7.23 represents a reduction of 0.03 from the CLB analysis, while the long-term value, which realized the most significant impact, was reduced by less than 0.1. The minimum sump pH value was found to occur at the end of injection. The new calculation demonstrates that the lowest sump pH value, although minimally impacted, remains above the specified value of 7.0.

The nitric acid and hydrochloric acid generated by radiolysis of sump water and cable insulation were found to have an inconsequential impact on the sump pH. Table 2 shows the results of the limiting case, as well as the delta sump pH for each time analyzed.

Table 2: Limiting Sump pH Results (LBLOCA with Eductor at Minimum Flow)

End of Injection Sump pH (Updated Value/CLB Delta)	End of SAT Eduction Sump pH (Updated Value/CLB Delta)	8 Hour Sump pH (Updated Value/CLB Delta)	30 Day Sump pH (Updated Value/CLB Delta)
7.23/-.03	7.26/0	7.33/-.03	7.87/-.08