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DTE Energy

~~Proprietary Information – Withhold Under 10 CFR 2.390~~

10 CFR 54

March 5, 2015
NRC-15-0020

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D C 20555-0001

References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) DTE Electric Company Letter to NRC, "Fermi 2 License Renewal Application," NRC-14-0028, dated April 24, 2014 (ML14121A554)

3) NRC Letter, "Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 19 (TAC No. MF4222)," dated January 26, 2015 (ML15015A194)

4) NRC Letter, "Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 20 (TAC No. MF4222)," dated January 20, 2015 (ML15002A046)

5) NRC Letter, "Requests for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 21 (TAC No. MF4222)," dated February 11, 2015 (ML15026A399)

Subject: Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Sets 19, 20, and 21

In Reference 2, DTE Electric Company (DTE) submitted the License Renewal Application (LRA) for Fermi 2. In References 3 through 5, NRC staff requested additional information regarding the Fermi 2 LRA. The Enclosures to this letter provide the DTE response to the requests for additional information (RAIs). Enclosure 1 provides the responses to Set 19 RAIs 4.3.1.2-1, 4.3.1.2-2, 4.2.4-2, and

~~Enclosure 2 contains Proprietary Information – Withhold Under 10 CFR 2.390.~~
~~When separated from Enclosure 2, this document is decontrolled.~~

4.2.4-3 and Set 21 RAI B.1.38-2a. Enclosure 2 provides the responses to Set 19 RAI 4.2.4-1 and Set 20 RAI 4.7.1-1.

Enclosure 2 contains proprietary information as defined by 10 CFR 2.390. General Electric – Hitachi (GEH), as the owner of the proprietary information, has executed the affidavit in Enclosure 4, which identifies that the enclosed proprietary information has been handled and classified as proprietary, is customarily held in confidence, and has been withheld from public disclosure. The proprietary information was provided to DTE in a GEH transmittal that is referenced by the affidavit. The proprietary information has been faithfully reproduced in the enclosed documentation such that the affidavit remains applicable. GEH herein requests as set forth in the enclosed affidavit of Lisa K. Schichlein that the enclosed proprietary information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390. A non-proprietary version of the documentation in Enclosure 2 is provided in Enclosures 3.

No new commitments are being made in this submittal. However, revisions have been made to a commitment previously identified in the LRA. The revised commitment is in Item 31, Reactor Vessel Surveillance, in LRA Table A.4 as indicated in the response to RAI B.1.38-2a.

Should you have any questions or require additional information, please contact Lynne Goodman at 734-586-1205.

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

Executed on March 5, 2015

Vito A. Kaminskas
Site Vice President
Nuclear Generation

Enclosures:
1) DTE Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Sets 19, 20, and 21
2) Enclosure 1 to GEH Letter 318178-15, "Responses to RAIs 4.2.4-1 and 4.7.1-1" – PROPRIETARY
3) Enclosure 2 to GEH Letter 318178-15, "Responses to RAIs 4.2.4-1 and 4.7.1-1" – NON-PROPRIETARY
4) GE-Hitachi Nuclear Energy Americas LLC Affidavit for Enclosure 1 of 318178-15

cc w/ all Enclosures:
- NRC Project Manager
- NRC License Renewal Project Manager
- NRC Resident Office
- Reactor Projects Chief, Branch 5, Region III
- Regional Administrator, Region III

cc w/o Enclosure 2:
- Michigan Public Service Commission,
  Regulated Energy Division (kindschl@michigan.gov)

Enclosure 1 to
NRC-15-0020

Fermi 2 NRC Docket No. 50-341
Operating License No. NPF-43

DTE Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Sets 19, 20, and 21

RAI 4.3.1.2-1

Background

License Renewal Application (LRA) Section 4.3.1.2 describes the applicant's time-limited aging analysis (TLAA) evaluation for the feedwater nozzle fracture mechanics analysis. The LRA states that transient numbers 10 and 11 in LRA Table 4.3-1 reflect the scram transients that are considered in the analysis. As stated in LRA Table 4.3-1, transient number 10 is for "SCRAM-turbine generator trip," and transient number 11 is for "SCRAM-all others."

Issue

The existing fracture mechanics analysis is based on General Electric Report GE-NE-523-22-0292, "Updated NUREG-0619 Feedwater Nozzle Fatigue Crack Growth Analysis, Enrico Fermi Nuclear Power Plant, Unit 2," which was submitted to the NRC by letter dated July 29, 1992; and Design Calculation 5922, "NUREG 0619 RPV Feedwater Nozzle Crack Growth Reevaluation," which was submitted to the NRC by letter dated June 24, 1998. In both of these documents, power reductions were counted as scram transients for the fracture mechanics analysis. In particular, Design Calculation 5922 states that power reductions to below 50 percent power were counted as scrams. It is not clear from the information in LRA Table 4.3-1 as to whether the projections for transient numbers 10 and 11 include these power reductions.

Request

Indicate whether power reductions to below 50 percent power are included in transient numbers 10 and 11 in LRA Table 4.3-1 as reflected in the above documents, along with any associated changes to your TLAA evaluation. If such power reductions are not included in these transients, provide justification as to why they are not accounted for in the transient projections for this TLAA.

Response:

Power reductions to below 50% power are included in either event number 8 in LRA Table 4.3-1 (loss of FW heaters – turbine trip with 100% bypass), event 9 in LRA Table 4.3-1 (loss of FW heaters – partial FW heater bypass), or event 11 in LRA Table 4.3-1 (SCRAM – all others), depending on the lowest reactor power and feedwater temperature achieved during the event.

A significant contributor to feedwater nozzle crack growth is low-flow feedwater control. For the feedwater loop with reactor water cleanup (RWCU) return, the water entering the feedwater nozzle can rapidly vary between about 440°F (the RWCU return temperature), when feedwater flow is shut off or reduced, and 100°F to 200°F, depending on feedwater flow rate, when feedwater flow is turned on or increased. Long periods of unstable feedwater flow can cause a significant number of thermal cycles for the nozzles for each transient event. SCRAM, startup

and shutdown transient events all involve extended periods of operation near 0% power where feedwater flow is low and more difficult to control. However, the transient events counted as loss of FW heaters are generally events where reactor power (and feedwater flow) does not fall below ~20%. At 20% power, feedwater flow in the RWCU return loop (~1.5 Mlbm/hr) is an order of magnitude larger than RWCU flow (~0.13 Mlbm/hr). Therefore, feedwater flow changes at or above 20% power have much less effect on 'RWCU + Feedwater' temperature and the nozzle transient for this event is limited to a single cycle of slow temperature and flow change associated with the power change. It was conservative to count these power reduction events as SCRAM events.

LRA Revisions:

None.

RAI 4.3.1.2-2

Background

LRA Section 4.3.1.2 describes the applicant's TLAA evaluation for the feedwater nozzle fracture mechanics analysis. The LRA projects that the 620 transients assumed in the existing analysis will not be exceeded during the period of extended operation. As such, the applicant dispositioned this TLAA in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 54.21(c)(1)(i) to demonstrate that the existing analysis remains valid for the period of extended operation.

Issue

The existing fracture mechanics analysis is based on General Electric Report GE-NE-523-22-0292, "Updated NUREG-0619 Feedwater Nozzle Fatigue Crack Growth Analysis, Enrico Fermi Nuclear Power Plant, Unit 2," and Design Calculation 5922, "NUREG 0619 RPV Feedwater Nozzle Crack Growth Reevaluation." The calculations in GE-NE-523-22-0292 are based on a total of 648 transients. However, the results of these calculations do not meet the acceptance standard in Generic Letter (GL) 81-11, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking (NUREG-0619)," dated February 29, 1981. That is, GE-NE-523-22-0292 does not demonstrate that a postulated 0.25-inch flaw would grow to less than 1 inch in 40 years. The calculations in Design Calculation 5922 meet the acceptance standard in GL 81-11; however, these calculations are based on a total of 496 transients. Since neither of these existing calculations is based on a total of 620 transients, it is not clear as to why the transient projections for this TLAA were compared against this value to demonstrate that the existing analysis remains valid for the period of extended operation.

Request

Show how the existing fracture mechanics analysis is based on a total of 620 transients. Alternatively, demonstrate that the projections for startup and shutdown transients plus scram transients, inclusive of power reductions to below 50 percent power, are less than the 496 transients that were used in Design Calculation 5922. Otherwise, provide and justify a different demonstration for this TLAA pursuant to 10 CFR 54.21(c)(1).

Response:

General Electric (GE) Report GE-NE-523-22-0292 is based on a total of 648 startup, shutdown and scram transient event occurrences. The GE calculation results show that a postulated 0.25-inch flaw would grow to greater than 1 inch in 40 years based on a rate of 648 occurrences in 40 years or 16.2 events per year. The GE calculation indicates that in 38.3 years (or 620 transient event occurrences) the postulated 0.25 inch flaw would grow to 1 inch. DTE performed design calculation DC-5922 approximately five years later to evaluate the more recent Fermi 2

history of startup, shutdown and scram transient events to show that the projection of 648 events per 40 years in GE-NE-523-22-0292 was indeed conservative. The resulting projection of 496 transient event occurrences was well below the 620 occurrences necessary to grow the projected flaw to 1 inch. For license renewal, projections for 60 years of operation were based on the information from LRA Table 4.3-1. Applicable events are startup event 3 (246), shutdown event 15-17 (246), scram event 10 (12), and scram event 11 (33), and conservatively, loss of FW heaters – turbine trip with 100% bypass event 8 (10) and loss of feedwater heaters – partial FW heater bypass event 9 (19). Adding the analysis input values for all the applicable events, which in all cases are greater than the project values, gives 566 events. The 566 total events is still less than the 620 transient events necessary to grow a postulated crack from 0.25-inch to 1 inch.

LRA Revisions:

None.

RAI 4.2.4-1

Background

LRA Section 4.2.4 describes the TLAA for upper-shelf energy of the reactor pressure vessel beltline materials. The LRA states that the upper-shelf energy values for the beltline materials were evaluated for the period of extended operation using the guidance in NRC Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," dated May 1988.

Issue

LRA Table 4.2-4 provides values for the various parameters used in the revised upper-shelf energy analysis. However, this table appears to be incomplete because it does not provide the un-irradiated upper-shelf energy value or the percent decrease in upper-shelf energy value for the N-16 water level instrumentation nozzle. In addition, it is not clear from the information in this table as to what methodology was used to establish the un-irradiated upper-shelf energy value and calculate the percent decrease in upper-shelf energy value for this component.

Request

(a) Provide the un-irradiated upper-shelf energy value for the N-16 water level instrumentation nozzle and identify and justify the methodology that was used to establish this value.

(b) Provide the percent decrease in upper-shelf energy that is projected for the N-16 water level instrumentation nozzle and identify and justify the methodology that was used to calculate this value.

Alternatively, provide an explanation as to why LRA Table 4.2-4 omits the un-irradiated upper-shelf energy and percent decrease in upper-shelf energy values for the N-16 water level instrumentation nozzle.

Response:

The response contains proprietary information and is provided in Enclosure 2 of this letter.

LRA Revisions:

None.

RAI 4.2.4-2

Background

LRA Section 4.2.4 describes the TLAA for upper-shelf energy of the reactor pressure vessel beltline materials. LRA Table 4.2-4 indicates that Regulatory Position 2.2 from RG 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," was used to determine the percent decrease in upper-shelf energy values for the vertical and girth weld materials at Fermi 2 based on data from the boiling water reactor integrated surveillance program (ISP). LRA Table 4.2-5 provides fluence and upper-shelf energy values from the ISP for plate and weld materials.

Issue

The LRA does not provide the relevant ISP data that is representative of the Fermi 2 reactor pressure vessel vertical and girth welds identified in LRA Table 4.2-4.

Request

(a) Provide all host reactor capsule testing data from the ISP that apply to the upper-shelf energy analyses for the vertical and girth weld materials in the Fermi 2 reactor pressure vessel. Specifically, for each host reactor capsule, provide: (a) the inside diameter and ¼ T fluence values for all irradiated capsules, (b) the specific material heats that apply to the Fermi 2 vertical and girth weld materials, and (c) for those specific material heats, the un-irradiated upper-shelf energy values, measured upper-shelf energy values, and the copper, nickel, phosphorous, and silicon values. This response may be accomplished by appropriate references to documents that are available in the NRC's Agencywide Documents Access and Management System (i.e., ADAMS).

(b) Explain how the ISP data were applied to the upper-shelf energy calculations for the Fermi 2 vertical and girth weld materials. As part of this response, indicate whether there is a direct match between the material heats in the host reactors and those material heats that were used to fabricate vertical welds 2-307 A, B, and C; vertical welds 15-308 A, B, C, and D; and girth weld 1-313 at Fermi 2. If there is not a direct match, justify the basis for applying the ISP data to the upper-shelf energy calculations for these welds.

Response:

(a) The NRC requested that host reactor capsule testing data from the ISP that applies to the weld materials in the Fermi 2 reactor pressure vessel be provided. The applicable information is provided in the subsections below.

Specific material heats that apply to the Fermi 2 weld materials (item b):
The specific material heats that apply to the Fermi 2 weld materials are [13253, 12008].

These material heats correspond to Fermi 2 vertical welds 2-307A, B, & C; and ISP Weld CE-2 [WM]. There are two credible data points for ISP Weld CE-2 [WM], represented by SSP Capsules E & G.

Inside diameter and ¼T fluence values (item a):
Measured fluences for ISP Weld CE-2 [WM] are provided below. There is no distinction between inside diameter and ¼T fluence values for the irradiated capsules, only the measured fluence value. However, the calculated 52 EFPY RPV ¼T fluence value taking ISP data into consideration is 6.51E+17 n/cm^2.

- SSP Capsule E Fluence = 1.76E+18 n/cm^2
- SSP Capsule G Fluence = 1.95E+18 n/cm^2

Data for applicable specific material heats (item c):
Un-irradiated and measured upper-shelf energy (USE) values for ISP Weld CE-2 [WM] are provided below. The measured % decrease of USE as compared to the predicted values using NRC Regulatory Guide (RG) 1.99 is also provided for each capsule.

- Un-irradiated USE = 119.3 ft-lb

- SSP Capsule E Measured USE = 67.7 ft-lb
- SSP Capsule E Measured % Decrease = 43.3 (Charpy Curves)
- SSP Capsule E RG 1.99 Predicted % Decrease = 23.6 (RG 1.99 Rev. 2, Figure 2)

- SSP Capsule G Measured USE = 70.1 ft-lb
- SSP Capsule G Measured % Decrease = 41.2 (Charpy Curves)
- SSP Capsule G RG 1.99 Predicted % Decrease = 23.9 (RG 1.99 Rev. 2, Figure 2)

Material chemistry data for ISP Weld CE-2 [WM], including copper, nickel, phosphorous, sulfur, and silicon are provided below. The values are taken from BWRVIP-135 Rev. 2.

Cu (wt%)	Ni (wt%)	P (wt%)	S (wt%)	Si (wt%)
0.21	0.86	0.012	0.012	0.23

(b) ISP data is not a match for Fermi 2 vertical welds 15-308A, B, C, D, and girth weld 1-313. The ISP does not consider these welds limiting beltline materials. Vertical welds 2-307A, B, and C are considered the limiting beltline welds, and ISP Weld CE-2 [WM] (Material Heat [13253, 12008]) is a match to the weld heat for 2-307A, B, and C. Sufficient un-irradiated test data exist for this heat of material. The ISP determined that the initial USE is 119.3 ft-lbs. This value is used in the USE evaluation for Fermi 2. NRC RG 1.99 Position 2.2 is applied to determine the decrease in USE. The calculated 52 EFPY USE of 77 ft-lb remains above the 50 ft-lb value specified in 10 CFR 50 Appendix G.

It was noted that the measured percent decrease in USE for the ISP weld material using RG 1.99 Position 2.2 exceeded what the predicted percent decrease in USE would have been, if determined by RG 1.99 Position 1.2. Therefore, in addition to determining RG 1.99 Position 1.2 predicted USE for all the beltline welds, Position 2.2 was also used. LRA Table 4.2-4 shows both the results using the predicted USE determination per Position 1.2 of RG 1.99 and using Position 2.2 of RG 1.99, considering the measured decrease from the ISP results, which resulted in more conservative USE values. The latter entries are shown by footnote "d" in the table. This was done to assure the weld materials will meet RG 1.99 requirements. Even for the more conservative USE results, the 52 EFPY USE remains above 50 ft-lb as required by 10 CFR 50 Appendix G.

INTEGRATED SURVEILLANCE PROGRAM							
BWRVIP-135 R2							
Location	Heat	Initial Longitudinal USE (ft-lb)	Initial Transverse USE (ft-lb)	% Cu	52 EFPY ¼T fluence (n/cm^2)	% Decrease USE [1]	52 EFPY USE [2] (ft-lb)
Weld [3]	CE-2 [WM] [13253, 12008]	--	119	0.21	6.51E+17	35.5	77
[1] Values are obtained from Figure 2 of RG 1.99, Rev. 2 for the applicable 52 EFPY ¼T fluence. [2] 52 EFPY Transverse USE = Initial Transverse USE * {1 - (% Decrease USE / 100)} [3] The ISP weld is the identical heat to the Fermi 2 target weld, and is presented using ISP chemistry.							

LRA Revisions:

None.

RAI 4.2.4-3

Background

LRA Section A.2.1.4 provides the Updated Final Safety Analysis Report (UFSAR) supplement summarizing the TLAA for upper-shelf energy of the reactor pressure vessel beltline materials.

Issue

The proposed description for this TLAA does not compare the results of the revised upper-shelf energy analysis against the upper-shelf energy requirements in 10 CFR Part 50, Appendix G. As such, the description does not contain adequate information regarding the basis for the demonstration for this TLAA made pursuant to 10 CFR 54.21(c)(1)(ii).

Request

Provide justification as to why the results of the TLAA are not included in the UFSAR supplement. Otherwise, revise LRA Section A.2.1.4, as appropriate, to include a comparison of the results of the revised upper-shelf energy analysis against the upper-shelf energy requirements in 10 CFR Part 50, Appendix G.

Response:

License Renewal Application (LRA) Section A.2.1.4 will be revised as indicated to include a comparison of the results of the revised upper-shelf energy analysis against the requirements in 10 CFR Part 50 Appendix G.

LRA Revisions:

LRA Section A.2.1.4 is revised as shown on the following page. Additions are shown in underline and deletions are shown in strike-through.

A.2.1.4 Upper Shelf Energy

Upper-shelf energy (USE) is evaluated for beltline materials. Fracture toughness criteria in 10 CFR 50 Appendix G require that beltline materials maintain USE no less than 50 ft-lb during operation of the reactor. The 52 EFPY USE values for the beltline materials were determined using methods consistent with RG 1.99. The determination used the peak ¼T fluence. The results of the evaluation demonstrate that all beltline material remains above 50 ft-lb throughout the period of extended operation.

The time-limited aging analysis for upper shelf energy has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

RAI 4.7.1-1

Background

License Renewal Application (LRA) Section 4.7.1 describes the applicant's time-limited aging analysis evaluation for erosion of the main steam line flow restrictors. The LRA states that Updated Final Safety Analysis Report (UFSAR) Section 5.5.4.4 summarizes the existing analysis. Per the UFSAR, it was postulated that even with an erosion rate of 0.004 inches per year, the increase in choked flow through the restrictors after 40 years of operation would be no more than 5 percent. The LRA states that the applicant re-evaluated this erosion rate and established a new rate for the period of extended operation. Based on re-calculating the analysis with the new erosion rate and a time frame of 60 years, the LRA states that the increase in choked flow will remain within the 5 percent limit specified in the UFSAR.

Issue

The LRA does not provide the new erosion rate, nor does it describe how this rate was calculated. The LRA also does not describe how the choked flow rate was calculated or quantify by how much it will increase as a result of re-calculating the analysis. As such, the LRA does not provide sufficient information to demonstrate that the increase in the choked flow rate will remain less than the 5 percent limit identified in UFSAR Section 5.5.4.4. Considering these issues, the LRA does not satisfactorily demonstrate that the existing analysis has been projected to the end of the period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii).

Request

(a) Quantify the new erosion rate and describe and justify the methodology that was used to calculate it. As part of the response, indicate whether wall thickness measurements of all the Fermi 2 main steam line flow restrictors were considered in the determination of the new erosion rate. If such measurements were taken, provide the results in terms of the date of measurement and the amount of wall loss. Provide justification if such measurements were not considered in the determination of the new erosion rate.

(b) Quantify the increase in the choked flow rate that was determined as a result of re-calculating the analysis using the new erosion rate and a time frame of 60 years. Indicate whether the methodology used for this calculation is the same as the methodology used in the existing analysis. Provide justification if the methodology is different.

Response:

The response contains proprietary information and is provided in Enclosure 2 of this letter.

LRA Revisions:

None.

RAI B.1.38-2a

Background

By letter dated January 5, 2015, the applicant responded to RAI B.1.38-2 that addressed the implementation schedule for the applicant's program enhancement regarding data sharing of new fluence projections and adjusted reference temperatures (ARTs). In its response, the applicant indicated that Boiling Water Reactor Vessel and Internals Project (BWRVIP)-135, Revision 2, provides the guidance to ensure that the transmittal of new fluence projections and associated ART tables in support of license renewal are shared with the BWRVIP. The applicant also indicated that the requirements in BWRVIP-86, Revision 1, or BWRVIP-135, Revision 2, do not specify a specific time period in which new fluence projections and ART tables should be provided to the BWRVIP for the BWRVIP Integrated Surveillance Program (ISP). The applicant further indicated that the intent of the enhancement committing that the identified information would be provided prior to the period of extended operation with a commitment date of September 20, 2024, is to formalize the need for information exchange, specifically for license renewal. In addition, the applicant stated that it has had no previous issues in promptly submitting changes affecting the requested information to the BWRVIP.

During its review of the RAI response, the staff noted that Section 5.7, "Planning for ISP Changes," of BWRVIP-86, Revision 1, states:

> *As time progresses, actual plant operating experience will provide more accurate data about each plant for predicting end-of-life vessel fluences and target capsule fluence values. This information will be factored into the ISP planning and, if necessary, adjustments will be made to the remaining capsule test matrix and withdrawal schedule in order to maintain an optimized program. Minor reassessments in the ISP test matrix will take into account plant-specific variations in scheduled withdrawal dates due to modifications in fuel cycles, or changes in target fluences caused by power uprates or variation in capacity factor. For example, target fluences in the original plan assume a nominal capacity factor of 80 percent for all BWR plants, and actual plant operation may vary from this assumed value.*

Issue

The staff noted that BWRVIP-86, Revision 1, indicates that the BWRVIP ISP continues to consider updated reactor vessel fluence values in the ISP planning in order to maintain an optimized program. The staff also noted that, upon receipt of a renewed license, the new fluence projections and adjusted reference temperatures are incorporated into the applicant's current licensing basis (CLB). The staff noted that this CLB information should be communicated with the BWRVIP in a timely manner in order to ensure the effectiveness of the ISP. By contrast, the staff noted that the applicant's response did not provide sufficient justification for why the applicant's enhancement regarding the data sharing will be implemented prior to the period of extended operation, but not within a specific time period upon receipt of a renewed license.

In addition, it is not clear to the staff what the time frame is for sharing fluence projections and associated ARTs with the BWRVIP when these values are revised.

Request

1. *Provide sufficient justification for why the applicant's program enhancement regarding the data sharing of new fluence projections and associated ARTs will not be implemented within a specific time period upon receipt of a renewed license. In addition, clarify the timeframe for sharing fluence projections and associated ARTs with the BWRVIP when these values are revised (e.g., revised data will be shared with the BWRVIP within a specific time period upon the revision).*

Response:

The Reactor Vessel Surveillance Program enhancement regarding provision of new fluence projections and adjusted reference temperatures (ART) to the BWRVIP prior to the period of extended operation will be deleted. As discussed in the response to RAI B.1.38-2 (DTE letter NRC-15-0001 dated January 5, 2015), BWRVIP guidelines do not define a specific time period for data sharing of new fluence projections and associated ARTS upon their acquisition by the utility. DTE will continue to follow the provisions of BWRVIP-135 and BWRVIP-86 for "Licensee Responsibilities Regarding Information Exchange." Data relevant to license renewal will be provided to the BWRVIP in a manner consistent with previous Fermi 2 data submittals. A Reactor Vessel Surveillance Program enhancement for this activity is not needed because Fermi 2 has had no issues in submitting the requested information to the BWRVIP as previously indicated in the response to RAI B.1.38-2.

LRA Revisions:

LRA Sections A.1.38, A.4, and B.1.38 and LRA Table B-3 are revised as shown on the following pages. Additions are shown in underline and deletions are shown in strike-through. Note that previous changes to these same LRA sections made in the January 5, 2015 letter (NRC-15-0001) are not shown in underline or strike-through such that only the new changes due to RAI B.1.38-2a are shown as revisions.

A.1.38 Reactor Vessel Surveillance Program

~~The Reactor Vessel Surveillance Program will be enhanced as follows.~~

- ~~Revise Reactor Vessel Surveillance Program procedures to ensure that new fluence projections through the period of extended operation and the latest vessel beltline adjusted reference temperature (ART) tables are provided to the BWRVIP prior to the period of extended operation.~~

~~This enhancement will be implemented prior to the period of extended operation.~~

A.4 LICENSE RENEWAL COMMITMENT LIST

No.	Program or Activity	Commitment	Implementation Schedule	Source
~~31~~	~~Reactor Vessel Surveillance~~	~~Enhance Reactor Vessel Surveillance Program as follows:~~ ~~a. Revise Reactor Vessel Surveillance Program procedures to ensure that new fluence projections through the period of extended operation and the latest vessel beltline adjusted reference temperature (ART) tables are provided to the BWRVIP prior to the period of extended operation.~~	~~Prior to September 20, 2024.~~	~~A.1.38~~

Table B-3

Fermi 2 Program Consistency with NUREG-1801

Program Name	NUREG-1801 Comparison			Plant-Specific
	Consistent with NUREG-1801	Programs with Enhancement	Programs with Exception to NUREG-1801	
Reactor Vessel Surveillance	X	~~X~~		

B.1.38 REACTOR VESSEL SURVEILLANCE

NUREG-1801 Consistency

The Reactor Vessel Surveillance Program~~, with enhancement,~~ is consistent with the program described in NUREG-1801, Section XI.M31, Reactor Vessel Surveillance.

Exceptions to NUREG-1801

None

Enhancements

None.
~~The following enhancement will be implemented prior to the period of extended operation.~~

~~Element Affected~~	~~Enhancement~~
~~5. Monitoring and Trending~~	~~Revise Reactor Vessel Surveillance Program procedures to ensure that new fluence projections through the period of extended operation and the latest vessel beltline adjusted reference temperature (ART) tables are provided to the BWRVIP prior to the period of extended operation.~~

Enclosure 3 to
NRC-15-0020

Fermi 2 NRC Docket No. 50-341
Operating License No. NPF-43

Enclosure 2 to GEH Letter 318178-15, "Responses to RAIs 4.2.4-1 and 4.7.1-1" – NON-PROPRIETARY

ENCLOSURE 2

318178-15

Responses to RAIs 4.2.4-1 and 4.7.1-1

Non-Proprietary Information – Class I (Public)

INFORMATION NOTICE

This is a non-proprietary version of Enclosure 1 of 318178-15, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space inside open and closed bracket as shown here [[ ]].

RAI 4.2.4-1

Background:

LRA Section 4.2.4 describes the TLAA for upper-shelf energy of the reactor pressure vessel beltline materials. The LRA states that the upper-shelf energy values for the beltline materials were evaluated for the period of extended operation using the guidance in NRC Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," dated May 1988.

Issue:

LRA Table 4.2-4 provides values for the various parameters used in the revised upper-shelf energy analysis. However, this table appears to be incomplete because it does not provide the un-irradiated upper-shelf energy value or the percent decrease in upper-shelf energy value for the N-16 water level instrumentation nozzle. In addition, it is not clear from the information in this table as to what methodology was used to establish the un-irradiated upper-shelf energy value and calculate the percent decrease in upper-shelf energy value for this component.

Request:

(a) Provide the un-irradiated upper-shelf energy value for the N-16 water level instrumentation nozzle and identify and justify the methodology that was used to establish this value.

(b) Provide the percent decrease in upper-shelf energy that is projected for the N-16 water level instrumentation nozzle and identify and justify the methodology that was used to calculate this value.

Alternatively, provide an explanation as to why LRA Table 4.2-4 omits the un-irradiated upper-shelf energy and percent decrease in upper-shelf energy values for the N-16 water level instrumentation nozzle.

Response

The following RAI response contains GEH proprietary information:

(a) The un-irradiated upper-shelf energy (USE) value for the N-16 water level instrumentation nozzle is [[ ]]. The un-irradiated USE was determined by GEH calculating a mean plus statistical 95/95 lower tolerance limit as defined in NUREG 1475 Section 9.12. The inputs to the statistical analysis come from fleet-wide certified material test reports (CMTR) with known initial upper shelf energies for SA-508 Class 1 materials.

(b) The percent decrease in upper-shelf energy that is projected for the N-16 water level instrumentation nozzle is 16%. Figure 2 of NRC Regulatory Guide (RG) 1.99 Revision 2 was applied to evaluate USE. The calculated 52 EFPY USE of 52 ft-lb remains above 50 ft-lb as required by 10 CFR 50 Appendix G.

Location	Heat	Initial Longitudinal USE (ft-lb)	Initial Transverse USE (ft-lb)	%Cu	52 EFPY ¼T Fluence (n/cm^2)	% Decrease USE [1]	52 EFPY USE [2] (ft-lb)
NOZZLES:							
N16 (Water Level Instrumentation)	2127273	N/A	[[		2.47E+17	16	52
N16 (Water Level Instrumentation)	6397860	N/A		]]	2.47E+17	16	52

[1] Values are obtained from Figure 2 of RG 1.99, Revision 2 for the applicable 52 EFPY 1/4T fluence.
[2] 52 EFPY Transverse USE = Initial Transverse USE * (1-(% Decrease USE / 100))

RAI 4.7.1-1

Background:

License Renewal Application (LRA) Section 4.7.1 describes the applicant's time-limited aging analysis evaluation for erosion of the main steam line flow restrictors. The LRA states that Updated Final Safety Analysis Report (UFSAR) Section 5.5.4.4 summarizes the existing analysis. Per the UFSAR, it was postulated that even with an erosion rate of 0.004 inches per year, the increase in choked flow through the restrictors after 40 years of operation would be no more than 5 percent. The LRA states that the applicant re-evaluated this erosion rate and established a new rate for the period of extended operation. Based on re-calculating the analysis with the new erosion rate and a time frame of 60 years, the LRA states that the increase in choked flow will remain within the 5 percent limit specified in the UFSAR.

Issue:

The LRA does not provide the new erosion rate, nor does it describe how this rate was calculated. The LRA also does not describe how the choked flow rate was calculated or quantify by how much it will increase as a result of re-calculating the analysis. As such, the LRA does not provide sufficient information to demonstrate that the increase in the choked flow rate will remain less than the 5 percent limit identified in UFSAR Section 5.5.4.4. Considering these issues, the LRA does not satisfactorily demonstrate that the existing analysis has been projected to the end of the period of extended operation pursuant to 10 CFR 54.21(c)(1)(ii).

Request:

(a) Quantify the new erosion rate and describe and justify the methodology that was used to calculate it. As part of the response, indicate whether wall thickness measurements of all the Fermi 2 main steam line flow restrictors were considered in the determination of the new erosion rate. If such measurements were taken, provide the results in terms of the date of measurement and the amount of wall loss. Provide justification if such measurements were not considered in the determination of the new erosion rate.

(b) Quantify the increase in the choked flow rate that was determined as a result of re-calculating the analysis using the new erosion rate and a time frame of 60 years. Indicate whether the methodology used for this calculation is the same as the methodology used in the existing analysis. Provide justification if the methodology is different.

Response

a. The new erosion-corrosion rate was evaluated to be [[ ]] for the main steam line (MSL) flow restrictor castings. Wall thickness measurements of all the Fermi MSL flow restrictors were not measured for the determination of the new erosion rate. However, the methodology that was used to calculate the revised erosion-corrosion rate is applicable to all Fermi MSL flow restrictors and is summarized by the following:

- For carbon steel (at a flow velocity of [[ ]] and [[ ]]) the corrosion rate is bounded by [[ ]].
- The use of high chromium material (Grade CF8) provides resistance to erosion-corrosion damage for the upstream casting in the MSL flow restrictor.

- The cases where 12% chromium steels have shown erosion-corrosion damage have involved higher moisture content fluids relative to the [[ ]] liquid present in the MSL flow.
- The gradual reduction in diameter minimizes the angle of impact on the narrowest section of the element reducing the effect of erosion-corrosion within the region containing the minimum diameter.
- The relative erosion-corrosion rate for steels begins to reduce at temperatures above approximately 302°F and is dramatically reduced in the presence of oxygen (over approximately 100 ppb).
- Increasing the chromium content reduces the dependence of flow velocity on erosion-corrosion rate in steels.
- Chloride intrusion is not expected to occur in the MSL; therefore, the Grade CF8 material will not experience the potential for pitting and/or stress corrosion cracking associated with chloride ions.
- Evaluation of an advanced boiling water reactor (ABWR) MSL elbow concluded that [[ ]] in the carbon steel components that are more susceptible to erosion-corrosion than components made from Grade CF8 material.

b. The key input used to calculate choked flow for current licensed thermal power (CLTP) and for CLTP operation over 60 years assuming the new erosion-corrosion rate of [[ ]] is an increase in area of [[ ]]. This increase in area results in an approximately proportional increase in choke flow independent of choke flow model and methodology applied. Therefore, it can be concluded that the UFSAR increase allowance of less than 5% is met.

   The method used in the calculation of choke flow is as mentioned in Reference 4.7.1-1-1, which is an enhanced method from previous analysis used to generate the UFSAR Section 5.5.4.4 analysis results. This choke flow model is the GEH proprietary Homogenous Equilibrium Method (HEM) model, which was utilized in both cases (design and 60 year projected) to calculate the before and after choked flow values using the method in Reference 4.7.1-1-1. This method results in a reduced choke flow compared to the more conservative method applied in the UFSAR. However, this reduced choke flow has not been credited in meeting the 5% allowance given in the UFSAR. The flow is calculated to quantify the effect.

Reference

4.7.1-1-1 GE Hitachi Nuclear Energy, "Main Steam Line High Flow Trip Setting," SIL 438, Revision 2, May 13, 2013.

Enclosure 4 to
NRC-15-0020

Fermi 2 NRC Docket No. 50-341
Operating License No. NPF-43

GE-Hitachi Nuclear Energy Americas LLC
Affidavit for Enclosure 1 of 318178-15

ENCLOSURE 3

318178-15

Affidavit for Enclosure 1

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Lisa K. Schichlein, state as follows:

(1) I am a Senior Project Manager, NPP/Services Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC (GEH), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter 318178-15, "Proprietary Review of Fermi 2 License Renewal Application RAI 4.2.4-1 and Revised GEH Response to Fermi 2 License Renewal Application RAI 4.7.1-1," dated February 24, 2015. The GEH proprietary information in Enclosure 1, which is entitled "Responses to RAIs 4.2.4-1 and 4.7.1-1," is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the *Freedom of Information Act* ("FOIA"), 5 U.S.C. Sec. 552(b)(4), and the *Trade Secrets Act*, 18 U.S.C. Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F.2d 871 (D.C. Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2d 1280 (D.C. Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary or confidentiality agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains details on the GEH methodology for determining erosion-corrosion rates and choked flow rates for boiling water reactors (BWRs). Development of these methods, techniques, and information and their application for the design, modification, and analyses methodologies and processes was achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to

quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

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

Executed on this 24th day of February 2015.

Lisa K. Schichlein

Lisa K. Schichlein
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