Vito A. Kaminskas
Site Vice President

DTE Energy Company
6400 N. Dixie Highway, Newport, MI 48166
Tel: 734.586.6515 Fax: 734.586.4172
Email: kaminskasv@dteenergy.com

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September 24, 2015
NRC-15-0089

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 37 (TAC No. MF4222)," dated September 1, 2015 (ML15237A044)

Subject: Response to NRC Request for Additional Information for the Review of the Fermi 2 License Renewal Application – Set 37

In Reference 2, DTE Electric Company (DTE) submitted the License Renewal Application (LRA) for Fermi 2. In Reference 3, NRC staff requested additional information regarding the Fermi 2 LRA. Enclosure 1 to this letter provides the DTE response to the request for additional information (RAI). Enclosure 2 to this letter provides an additional LRA revision that was identified as a result of a DTE corrective action document.

No new commitments are being made in this submittal.

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 September 24, 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 – Set 37
2) Additional License Renewal Application Revision

cc: NRC Project Manager
NRC License Renewal Project Manager
NRC Resident Office
Reactor Projects Chief, Branch 5, Region III
Regional Administrator, Region III
Michigan Public Service Commission,
Regulated Energy Division (kindschl@michigan.gov)

Enclosure 1 to
NRC-15-0089

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 – Set 37

Set 37 RAI 4.3.3-1b

Background

By letter dated May 21, 2015, the staff issued follow-up RAI 4.3.3-1a regarding the plant-specific implementation of the generic procedures in EPRI Technical Report 1024995. Item 2 of RAI 4.3.3-1a requested that the applicant:

> *Select a number of representative systems and provide the evaluation of the EAF analysis, ranking of sentinel locations, and selection of limiting sentinel locations. The systems should be selected so that they demonstrate the adequacy of the methodology to identify the limiting plant-specific component locations. Consideration should be given to the thermal zones, materials, transients, and complexity of the systems selected. The systems selected should demonstrate that the methodology conservatively evaluates EAF effects, with the same degree of analytical rigor for all locations, to identify the bounding locations.*

Item 3 of RAI 4.3.3-1a requested that the applicant:

> *Describe and justify any engineering judgement, plant-specific assumptions, and plant-specific criteria used in the EAF analysis or screening process. This should include the systematic process used to eliminate sentinel locations as limiting and examples showing how the process was implemented.*

In its response dated June 18, 2015, the applicant stated that the same degree of analytical rigor was not always applied when determining the EAF CUF (CUF_{en}) values of a location. The response for item 2 also states that the methodology used to determine bounding locations accounts for differences in the degree of analytical rigor. The response to item 3 does not provide the technical justification or systematic process used to account for differences in degree of analytical rigor.

Issue

The relative ranking of analyzed locations based on CUF_{en} values may be influenced by applying different degrees of analytical rigor. Therefore, the subsequent identification of bounding locations may also be affected. The staff cannot determine the adequacy of the bounding locations because it lacks sufficient information regarding the approach used to account for differences in analytical rigor.

Request

Describe the approach used to account for differences in analytical rigor when determining bounding locations. Justify that the approach retains an appropriate level of conservatism in the methodology being used to identify plant-specific bounding locations.

Response:

Differences in analytical rigor in fatigue analyses are associated with the following:

- Analysis using design severity plant transients produces different cumulative usage factor (CUF) values for a component location than analysis of actual severity plant transients. Fatigue calculations performed using actual severity plant transients, when available, are used to calculate lower CUFs than those performed using design severity plant transients.
- Design by analysis (ASME Section III, NB-3200) versus design by rule (ASME Section III, NB-3600), where design by analysis is a more rigorous method that is often used to reduce calculated fatigue usage obtained by a design by rule method.
- Fatigue calculations where each set of load set transient pairs are used versus calculations that reduce the number of load set transient pairs by enveloping multiple plant transients to one or a very few sets of bounding transients ("bundled transients") that are applied to the total number of transients applicable to the location being analyzed. Combining transients is a common practice used to reduce the time required to perform fatigue analysis where fatigue usage margin is sufficiently large, which artificially inflates the fatigue usage for these component locations as compared to other component locations.

The approach used to account for differences in analytical rigor is as follows:

- Design severity transients were used, appropriately adjusted for power uprate conditions (encompassing recent measurement uncertainty recapture/thermal power optimization uprate and previous uprate), with the single exception of the Reactor Water Cleanup (RWCU) Out Of Service transient. Although the RWCU Out Of Service transient is not a design basis transient for Fermi 2, it is known to contribute to fatigue usage in the RWCU system and connected systems (i.e., reactor recirculation, feedwater, reactor pressure vessel (RPV) drain) for plants which have this as a design basis transient. Fermi 2 elected to develop this transient based on plant-specific information and include it as part of the fatigue update for the License Renewal Application (LRA). Including this transient when it was not part of the plant design basis is conservative.
- As discussed in DTE's response to RAI 4.3.3-1a dated June 18, 2015 (DTE letter NRC-15-0067), plant fluid systems were subdivided into subsystems in a manner consistent with the fatigue analyses comprising the current design basis and the screening process compared all components with calculated fatigue usage in the same fluid subsystem. As demonstrated in Tables 1 and 2 of the DTE response to RAI 4.3.3-1a dated June 18, 2015, the method used to calculate fatigue usage (design by analysis (NB-3200) or design by rule (NB-3600)) was identified. In many cases the CUF values resulting from the design by analysis method were larger than those calculated using the more conservative design by rule method due to their being associated with nozzles where the transients are more severe. Therefore, their inclusion as bounding locations is conservative. In cases where a more refined design by analysis method was used to reduce calculated fatigue usage (e.g., location FW-04 in Table 1), CUF values using the

design by rule method were used to ensure fatigue usage was being compared on a consistent basis. This is the process used for each subsystem.

- Similarly to the review for analytical method, fatigue calculations were reviewed to identify where bundled transients were applied. Engineering experience and judgment were applied to ensure that locations with higher calculated fatigue usage simply due to the use of a lesser degree of rigor (e.g., bundling of individual transients) are not inappropriately identified as bounding locations in a given system/subsystem. Compared to analysis using individual transients, bundling of some of these individual transients will produce artificially high CUFs. An example of this was provided in Table 1 of the DTE response to RAI 4.3.3-1a dated June 18, 2015 for the feedwater penetration where the penetration body fatigue usage was calculated by bundling transients. If one were to simply use the design CUF to select bounding locations, this would appear to be bounding as compared to the FW-04 location where feedwater, reactor core isolation cooling (RCIC) and RWCU flows converge. However, FW-04 and the feedwater nozzles experience more severe thermal transients and selection of the penetration body as a bounding location would be non-conservative, so selection of the feedwater nozzles and RCIC/RWCU tee locations are appropriate for this system. This process is used consistently throughout the evaluation.

LRA Revisions:

None.

Set 37 RAI 4.3.3-2

Background

By letter dated June 26, 2015, the applicant submitted the annual update for LRA Section 4.3.3. Page 22 of Enclosure 1 states that prescreening is performed to identify all ASME Class 1 reactor coolant pressure boundary locations with CUF calculations and that the components with the highest CUF values are evaluated for EAF effects. On the following page of the annual update, there is a seven step summary of the screening approach. The third step in the approach (including the prescreening step) is to apply the NUREG/CR-6909 fatigue curves. Therefore, the first screening step includes CUF_{en} values determined using ASME fatigue curves.

By letter dated June 18, 2015, the applicant responded to follow-up RAI 4.3.3-1a. Page 7 of Enclosure 1 lists the site-specific activities for identifying the bounding locations. Page 7 lists two primary activities, each of which have three subtasks. The second subtask under the first primary activity involves selecting the highest CUF_{en} values, which were determined using the design fatigue curves from NUREG/CR-6909, for further EAF analysis. The following page of the letter provides a three step process for selecting additional bounding locations, which are focused on reducing bounding locations.

Issue

The process used to screen locations, identify bounding locations, and reduce bounding locations has been partially summarized in the response to RAI 4.3.3-1, response to follow-up RAI 4.3.3-1a, and the annual update. However, none of these documents fully describe the process. Additionally, when reviewed as a group, the documents still leave areas of uncertainty and potentially inconsistent steps/activities. The process is not defined clearly enough to be evaluated by the staff.

Request

Describe the steps (from prescreening to establishing the final bounding locations) of the screening process in sufficient detail to be performed independently on a random system. Each step should include plant-specific criteria that was used in the analysis. Describe and justify any engineering judgment, all plant-specific assumptions, and all plant-specific criteria for each step in the process.

Response:

The steps in the process used at Fermi 2 are described below. This process was used consistently. Engineering judgment was applied only where differences in analytical rigor exist as described in the responses to RAIs 4.3.3-1b and 4.3.3-3. No plant-specific criteria were used. The only plant-specific assumptions are related to dissolved oxygen (DO) content associated with each chemistry zone used to calculate F_{en} multipliers.

Fatigue usage was previously updated using projected 60 year transient cycles and accounting for applicable power uprate conditions in calculation DC-6222, Revision A, "ASME Operating Plant Fatigue Assessment for License Renewal – RCPB Components." This calculation addressed each material type evaluated for fatigue for the entire scope of Class 1 components. These locations are described in LRA Table 4.3-2 (Reactor Pressure Vessel), LRA Table 4.3-4 (Reactor Recirculation Pumps), LRA Table 4.3-6 (Class 1 Piping), and LRA Table 4.3-7 (Class 1 Valves).

1) Pre-screening is performed on the population of Class 1 components with calculated CUFs to establish whether the component requires further environmentally assisted fatigue (EAF) evaluation.
   a) Locations not exposed to reactor water are screened out, since EAF is not applicable.
   b) Locations that are not part of the reactor coolant pressure boundary are screened out since they do not pose a threat to pressure boundary leakage and, in the case of RPV internal components, aging is managed using BWRVIP Inspection and Evaluation guidelines, consistent with NUREG-1801.
2) The remaining components are evaluated. Because a system/subsystem or component location with a lower design CUF could have a higher resultant CUF_{en} once the F_{en} multiplier is applied, each material type for each of the locations listed in the LRA tables is retained for further EAF evaluation (refer also to Tables 1 and 2 of DTE response dated June 18, 2015).
3) To determine the bounding EAF locations for these Class 1 component locations in each system/subsystem:
   a) NUREG/CR-6909 fatigue curves are applied, making use of design information for alternating stresses, to obtain NUREG/CR-6909 CUF values to which NUREG/CR-6909 F_{en} multipliers can be applied in Step 3c.
   b) Time-weighted F_{en} multipliers reflecting periods of normal water chemistry as well as hydrogen water chemistry and on-line noble metal chemistry availability are calculated using the least favorable conditions for sulfur content in metal, strain rate and temperature along with the zone-specific DO values.
   c) CUF_{en} values are obtained for each of the evaluated Class 1 component locations by multiplying the NUREG/CR-6909 CUFs by time-weighted average F_{en} multipliers that take into account normal water chemistry, hydrogen water chemistry and online noble metal chemistry conditions.
   d) The CUF_{en} values are tabulated for each of the Class 1 component locations by system/subsystem.
4) Bounding locations consist of locations meeting either of the following criteria:
   a) NUREG/CR-6260 locations (including each material type for these locations).
   b) For locations with $CUF_{en} \geq 0.8$, the highest CUF_{en} values in each system/subsystem prior to any further refinement to F_{en} values to reduce CUF_{en} values.

LRA Revisions:

None.

Set 37 RAI 4.3.3-3

Background

LRA Table 4.3-8, "EAF Screening of Fermi 2 Locations," contains bounding locations with CUF_{en} values projected to exceed 1.0. These locations will be managed by the Fatigue Monitoring Program and further actions will be taken in accordance with the AMP. Additional actions may include refining the fatigue analyses to produce CUF_{en} values below 1.0.

Issue

It is unclear to the staff how bounding locations with CUF_{en} values projected to exceed 1.0 will be affected if the fatigue analyses are refined to reduce the CUF_{en} value.

Request

Describe the process used to rank locations and identify leading locations that have been (or will be) re-evaluated because the environmentally adjusted CUF exceeds the limit of 1.0. Justify that the process retains an appropriate level of conservatism to identify plant-specific bounding locations.

Response:

The overall process used to rank and identify leading locations is described in the responses to RAIs 4.3.3-1b and 4.3.3-2 above.

In the original LRA submittal, LRA Table 4.3-8 listed EAF CUF (CUF_{en}) values based on application of a simple multiplier from NUREG/CR-6583 for carbon and low-alloy steels, NUREG/CR-5704 for austenitic stainless steels and NUREG/CR-6909 for nickel alloys. LRA Table 4.3-8 only listed NUREG/CR-6260 generic locations. Subsequent to this, as noted in the DTE response to RAI 4.3.3-1a dated June 18, 2015 and in the response to RAI 4.3.3-2 above, usage and EAF CUF values were re-calculated using NUREG/CR-6909 for each of the locations exposed to reactor coolant (i.e., those retained following the pre-screening process described above). These calculations applied the air fatigue curves and F_{en} values from NUREG/CR-6909, thereby providing a more consistent basis for comparison and ranking of component locations. F_{en} values were calculated based on plant-specific dissolved oxygen chemistry concentrations and initially used the design temperature to maximize the calculated EAF CUF.

For component locations where the environmentally adjusted CUF exceeded the limit of 1.0, F_{en} values were re-calculated using average transient temperatures or maximum operating temperatures, consistent with NUREG/CR-6909. This use of average transient or maximum operating temperature reduced the fatigue usage for the SLC piping inside containment and core spray penetration X-16A/B body. While other locations are exposed to hot fluid, the core spray penetrations are not exposed to hot fluid. Also, at the location where the SLC piping inside containment has higher usage due to the large geometric discontinuity at the piping to valve weld, the temperature is well below 302°F (150°C) because the line is stagnant. Below 302°F (150°C), the multiplier for the transformed service temperature used in calculating F_{en} values is at a minimum for stainless steel. Therefore, it is appropriately conservative to use lower temperature values for these locations. After re-calculation, the CUF_{en} values for the SLC piping inside containment and the core spray penetrations body were below 0.8.

Following re-calculation of CUF_{en} values using average transient temperatures or maximum operating temperatures, four component locations have values whose environmentally adjusted CUF exceeds the limit of 1.0. They are the stainless steel safe end of the feedwater nozzles, core ΔP nozzle, CRD nozzles, and condensing chambers. The stainless steel safe end of the feedwater nozzles and the CRD nozzles were included in the list of locations where the environmentally adjusted CUF exceeds the limit of 1.0 in LRA Table 4.3-8. The core ΔP nozzle and condensing chambers were not initially included in original LRA Table 4.3-8 and the process used to evaluate all Class 1 component locations is more conservative than that originally used in the LRA. These components were added to Table 4.3-8 by DTE letter NRC-15-0068, dated June 26, 2015, which provided the LRA annual update.

The component locations to be re-evaluated include the feedwater nozzles (stainless steel safe end), core ΔP nozzle, CRD nozzles and condensing chambers. Locations with a CUF_{en} value greater than 1.0 will remain the bounding locations unless the re-evaluation shows that the current CUF_{en} values are a result of significant over-conservatisms in the current analysis that would have resulted in them not being selected initially if they had been analyzed in a manner consistent with other component locations.

The intended evaluation approach is as indicated below for each component.

<u>Feedwater nozzles:</u>
Fatigue usage for the safe end of the feedwater nozzles is dominated by the hot standby transient and the majority of these are associated with RCIC, which was significantly influenced by the Northeast blackout event of 2003. Therefore, the hot standby transient and RCIC injection will be treated as unique transients. Reductions in CUF_{en} can be significant, but this location is known to be a high fatigue usage location and will not be excluded.

<u>Core ΔP nozzle / CRD nozzles:</u>
Since the current analysis uses bundled transients, the transients will be separated and fatigue usage re-calculated by taking information for each transient in the design stress report (including power uprate effects). This is expected to result in lower fatigue usage and lower F_{en} multipliers being applied to some transient pairs. This is likely to be sufficient to lower projected CUF_{en} values below 1.0, but these two locations will be retained as bounding locations.

<u>Condensing chambers:</u>
A comparison of the design fatigue calculation for Fermi 2 with analytical work performed at other plants suggests that the calculated usage at this location may be significantly over-

predicted. A NB-3200 stress and fatigue analysis is planned which is expected to identify the level of conservatism in the current CUF_{en} value. This location will be retained as a bounding location unless the revised CUF_{en} value demonstrates that the recalculated value is less than that of any of the NUREG/CR-6260 locations in the same chemistry zone. Therefore, since the lowest value for the RPV upper region is the feedwater nozzle-vessel intersection with a CUF_{en} value of 0.115, this location will be retained as a bounding location if the CUF_{en} value is greater than 0.115.

Therefore, since the process identified additional locations not evaluated originally in the LRA and all locations with reduced CUF_{en} values are retained unless they are found to be significantly over-conservative and bounded by other locations accounting for analytical rigor, the process retains the appropriate level of conservatism.

LRA Revisions:

None.

Enclosure 2 to
NRC-15-0089

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

Additional License Renewal Application Revision

As part of a Fermi 2 condition assessment resolution document (CARD), it was identified that a revision to the License Renewal Application (LRA) was needed. The aging management review results of the emergency diesel generator (EDG) system are provided in LRA Table 3.3.2-10. The EDG air start system contains components with the following attributes: the component type is tubing, the material is copper alloy, and the environments are indoor air (external) and condensation (internal). LRA Table 3.3.2-10 does include a line item for copper tubing in an indoor air environment, but does not include a line item for copper tubing in a condensation environment. LRA Table 3.3.2-10 is revised as indicated on the following page to add the line item.

Table 3.3.2-10
Emergency Diesel Generator System
Summary of Aging Management Evaluation

Table 3.3.2-10: Emergency Diesel Generator System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Tubing	Pressure boundary	Copper alloy	Air – indoor (ext)	None	None	VII.J.AP-144	3.3.1-114	A
Tubing	Pressure boundary	Copper alloy	Condensation (int)	Loss of material	Compressed Air Monitoring	VII.D.AP-240	3.3.1-54	D
Tubing	Pressure boundary	Copper alloy	Lube oil (int)	Loss of material	Oil Analysis	VII.H2.AP-133	3.3.1-99	A, 302