June 29, 2009

MEMORANDUM: Jeffrey Cruz, Chief
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FROM: Mark Tonacci, Senior Project Manager ***/RA/***
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SUBJECT: TRIP REPORT – JUNE 9-11, 2009, HYDROLOGY-RELATED SITE VISIT IN SUPPORT OF FERMI 3 COMBINED LICENSE APPLICATION

This report summarizes the results of U.S. Nuclear Regulatory Commission (NRC) travel to Detroit, Michigan and Fermi 3 in Newport, Michigan during the period of June 9 and 11, 2009, to review hydrology related portions of Detroit Edison's (DTE) final safety analysis report (FSAR) associated with the combined license application (COLA) for Fermi 3. Audit team members are listed in Enclosure 1.

On the morning of June 9, 2009, the staff met with the applicant at the Fermi 3 site in Newport, Michigan. The staff viewed key hydrologic features of the site including the following areas: cooling tower for the new unit; lower Swan Creek, shore of Lake Erie, and existing and proposed storm drainage systems for Fermi 2 and 3 respectively. On June 10 and 11, 2009, the team met at DTE corporate offices in Detroit, Michigan to review documentation that supported the COLA and began discussions on the specific items on the list of information needs that the staff had prepared in anticipation of the site audit. This list is attached as Enclosure 2.

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The enclosure reflects augmentation by the staff to include a summary disposition of each item. Many of the items identified by the staff were resolved with respect to information needs for this audit. Resolved items include applicant commitments to make detailed information available to the staff and its contractors for audit in more proximate locations. Other resolved items are "linked" to the resolution of other items or were resolved as result of documentation review and applicant clarification. Finally, items requiring further action on the part of the applicant are identified as unresolved. The staff intends to issue requests for additional information (RAIs) to address unresolved items. Review of the detailed information made available to the staff and its contractors for follow-up audit, including review of any supplemental information submittals to the COLA provided by the applicant, could result in additional RAIs if necessary for the staff to complete its review. A closure meeting was conducted to summarize the results of the staff's audit.

Docket No. 52-033

Enclosures:
As stated

The enclosure reflects augmentation by the staff to include a summary disposition of each item. Many of the items identified by the staff were resolved with respect to information needs for this audit. Resolved items include applicant commitments to make detailed information available to the staff and its contractors for audit in more proximate locations. Other resolved items are "linked" to the resolution of other items or were resolved as result of documentation review and applicant clarification. Finally, items requiring further action on the part of the applicant are identified as unresolved. The staff intends to issue requests for additional information (RAIs) to address unresolved items. Review of the detailed information made available to the staff and its contractors for follow-up audit, including review of any supplemental information submittals to the COLA provided by the applicant, could result in additional RAIs if necessary for the staff to complete its review. A closure meeting was conducted to summarize the results of the staff's audit.

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Enclosure 1
NRC Audit Team Members

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Ron Yuen, Argonne National Laboratory, for NRC
Eugene Yan, Argonne National Laboratory, for NRC

Enclosure 2

FERMI Unit 3 Hydrology (Chapter 2.4) Site Audit Information Needs

ITEM NO.		INFORMATION NEED
1	**Field Tour**	Provide a site tour to show the following features of the Fermi site: • Locations of safety related facilities and their drainage area for Fermi 3 • Existing drainage area for Fermi 2 power block facilities • The lower reach of Swan creek at 3 locations: near Dixie Highway, Lake Erie, and about midway between the above two locations • Shore of Lake Erie at three locations: the Fermi site, south of the site (Stony Point, end of Pointe aux Peaux Road), and north of the site (Lakeshore Drive) • Existing storm drainage system for Fermi 2 • Proposed storm drainage system for Fermi 3 *Audit discussion:* *Staff toured site on Tuesday, June 9, 2009. All requested areas were seen during the tour.* **RESOLVED**
2	**Maps**	Provide the following during the site audit • Large-scale topographic maps of the site • 1:24,000 topographic maps of the Swan Creek watershed. **RESOLVED** See below for requested maps
3	**Electronic Datasets**	Provide the following electronic data o Electronic copy of topography map of the site. o Electronic copy of the topography map of the Swan Creek watershed. o Digital elevation of the site and surrounding area including watershed o *Drawing for the drainage systems at and surrounding Fermi 3 and elevation contours of the system* o *Survey coordinates, including elevation for the boundaries of the safety-related area*, o Stream network of the Swan Creek watershed o Landuse/landcover of the Swan Creek watershed

		○ Soil type of the Swan Creek watershed ○ *The calculation packages for HRM51 and HMR52 for PMP and PMS.* ○ HEC-RAS input/output used in Fermi 3 simulations\ ○ *Provide the calculation package of the 100-year lake level of Lake Erie.* ○ Provide the calculation package of the wind stress, and wind setup/storm surge. ○ STWAVE input/output used in Fermi 3 simulations ○ Input/output for various modules used in ACES used in Fermi 3 simulations *Calculations will be made available for staff review in Reading Rooms in Chicago and Washington, DC.* **UNRESOLVED** Staff will issue a RAI requesting the following: 1. Map for drainage system for Fermi 3 overlay to topo and site features. Figure 2.4-214 and Figure 2.4-215 – superimposed on each other. Also, a map identifying the elevations of significant features and identifying the datum. 2. Information on resolution for Swan Creek watershed delineation maps. 3. Topographic map with Swan Creek HEC-RAS cross-sections identified. Figure 2.4-218- explain how the boundary of the stream was developed. 4. Large scale topographic maps (site survey data map provided at audit) 5. Topographic maps for Fermi 2. 6. 1:24,000 electronic map of Swan Creek watershed 7. STWAVE input/output files 8. HEC-RAS input/output files 9. ACES input/output files
4	**References**	Provide a hardcopy or an electronic copy of the references used in Chapter 2.4 • Enrico Fermi, Unit 2 Updated Final Safety Analysis Report, Amendment 14 (2.4-258) • Bugliosi, E. F., 1999, The Midwestern Basins and Arches regional aquifer system in parts of Indiana, Ohio, Michigan, and Illinois-summary: U.S. Geological Survey Professional Paper 1423-A, 46 p. (2.4-265) • Casey, G. D., 1996, Hydrogeologic framework of the Midwestern Basins and Arches region in parts of Indiana, Ohio, Michigan, and Illinois: U.S. Geological Survey Professional Paper 1423-B, 46 p., 2 pl. (2.4-266) • Nicholas, J.R.; G.L. Rowe, and J.R. Brannen, 1996, Hydrology, water quality, and effects of drought in Monroe County, Michigan: Water –Resources Investigations Report 94-4161 (2.4-277) *Discussion:*

		Staff also requested the following references be provided: *US Army Corps of Engineers, 1984, "Shore Protection Manual." Coastal Engineering Research Center, Waterways Experiment Station, Vicksburg, Mississippi, Fourth Edition* *The FSAR incorrectly references Amendment 14. It should read as Revision 14 instead.* *The applicant stated that all the references where provided with the initial application.* **UNRESOLVED** Staff will verify that the references are available on the docket for use in its review. The staff will issue an RAI requesting the applicant provide pertinent reference pages for Shore Protection Manual because this publication is currently out of print
5	**General**	Provide the grade levels of all proposed safety-related components and structures of Fermi 3. **RESOLVED** See item no. 2
6	**2.4.2**	Provide a knowledgeable expert to discuss and make available information on historical flood and storm events associated with Lake Erie and Swan Creek. *Discussion:* *What data was used to establish design criteria?* *For Lake Erie - The lake flooding, the 100 mph wind was used in the calculation. The length of data was not considered closely because the historical data is significantly lower then the 100 mph requirement.* *For Swan Creek- No gauge data was available so applicant used a synthetic unit hydrograph for determination of PMF. The smaller frequency floods were based on a basin north of the area.* **UNRESOLVED** Staff will provide an RAI requesting that if the 25- and 100-year flood calculations are revised, any impacts to others area of the FSAR are updated.

7	**2.4.2**	Provide a knowledgeable expert to discuss the assumptions and approaches used in calculating local runoff and flood, including topics as: - Local PMP - Proposed onsite drainage system for Fermi 3 - Peak runoff during the local intense precipitation - Time of concentration - On-site water surface elevations during the local intense precipitation *Audit questions from staff:* • *The FSAR states that "Storm water runoff from the Fermi 3 final grade will possibly flow …". Has the drainage design finalized (p. 2-439 Section 2.4.2.3)?* • *Provide information on the drainage system at Fermi 3 and the characteristics and extent of the boundary channel surrounding Fermi 3.* • *Verify that in Table 2.4-211, HMR 52 (Figure 24) is used to estimate the 1-hr 1-square miles PMP (17.3 in).* • *In HMR52, the multiplying factors are 0.337, 0.531, and 0.767 for 5, 15, and 30 minute duration PMP (Figs. 36-38). Table 2.4-211 of the FSAR shows the different 1-hr multipliers (0.333, 0.522, and 0.749). What is the source of the multipliers in the FSAR?* • *Provide information on the equation used in calculationulating the time of concentration for each subarea in Table 2.4-213.* • *On figure 2.4-214, the size of the existing outfall pit is 96". Such pipe was not observed in previous environmental audit. On p. 2-441, the FSAR states that "the additional runoff from the typical storm events will have a minimal impact on the site due to the size and slope of the outfall pipe …" Is the statement based on the pipe size of 96 inches? If not, what is the correct size and slope of the outfall pipe?* • *Provide the source of the rain intensities for 10-, 25-, 50-, and 100-year storms.* • *For using NRCS method to estimate local runoff, what is the peaking factor used in the unit hydrograph of Fig. 2.4-216?* • *Explain the basis that a PMP depth at 5 minutes duration is used to estimate local runoff (p. 2-441) when NRCS method is used? Time of concentration?* • *Where are the safety related area, N3 subarea, and the boundary channel in Figure 2.4-215? Provide a drawing that includes information on these areas (e.g. main features, elevations, etc.).* • *What are the assumptions used to calculate the local PMP runoff flood level?* • *Provide information on the possibility of ice/snow blockage along the surrounding channels of Fermi 3 or drainage channels down gradient of N3 area.*

		Discussion: *Additional details concerning the drainage system are included in the calculation package. However, staff will need the FSAR to reflect these details.* *Figure 2.4-215 – does not show the details for the surrounding channel. N3 description discusses some channels but the details are not provided. A figure and the channel details are still needed in the FSAR.* *Staff reviewed the PMP and determined that the precipitation for the PMP is greater than that in the FSAR.* *The staff looked at the HMR 52 for the multiplying factors and determined that the FSAR is not as conservative as staffs. The staff verified that the source is the same. Staff will check the HMR factors in the calculation. The staff asked details about time of concentration. Two time of concentration (tc) were used for local drainage and for Swan Creek. Kirpich equation was used in the calculation.* *Staff requested the source of rain intensities.* *The peaking factor is the average -484.* *The applicant was not clear about why the 5 minute duration was selected. Staff or applicant should verify this in the calculation.* **UNRESOLVED** Staff will issue an requesting the following • Source of rain intensities listed. (TP-25) • Table 2.4-213 is checked for accuracy and that the FSAR is updated to reflect the method of evaluation • A PMP analysis that includes the impact of rain on snow to the flood elevation. • The terminology and elevation data for the existing plant grade are consistent through out the section and the chapter.
8	**2.4.3**	Provide a knowledgeable expert to discuss the development of PMP estimation and the calculation of PMP for the Swan Creek watershed. *Audit questions and discussion:* • *What is the source of the Swan Creek watershed boundary?* • *Are the defaults of storm orientation, size, centering, and timing of the HMR52 program being used to derive the maximum basin average precipitation?* • *Provide detailed information on the development of PMP and the derivation of Table 2.4-216* • *Have you evaluated a single rain-on-snow event and the possibility of such occurrence?* *The calculation package should show the assumptions for the PMP orientation*.

		UNRESOLVED Staff reviewed the calculation package concerning application of HMR52 and the results listed on Table 2.4-211. Staff will issue an RAI requesting the multiplier factors are corrected and PMP storm area and orientation are confirmed and updated in the FSAR.
9	**2.4.3**	Provide a knowledgeable expert to discuss the estimation of precipitation losses used for PMF determination for the Swan Creek watershed. *Audit discussion:* • *Spring flooding is common in this region and in Swan Creek, as evidenced in Table 2.4-215. When the NRCS method was used to calculate the excess rainfall, was frozen ground considered?* • *What types of soils are used in calculating the excess rainfall?* • *Provide information on the sources in estimating initial losses and constant rate losses.* • *Is the above information available from a gauged watershed near Fermi 3?* *Although losses were calculated, they were not applied to calculation. Infiltration was not applied to hydrograph.* *Calculation package did discuss the determination of the composite CN for the watershed.* **UNRESOLVED** Staff will issue a RAI requesting the FSAR be updated to include details of the PMF analysis for Swan Creek and should include a discussion on how, or if, losses were applied to determine the final PMF.
10	**2.4.3**	Provide a knowledgeable expert to discuss the approach, methods, and inputs in determining the PMF flow for the Swan Creek watershed and to discuss the verification process of the runoff model used for the PMF flow estimation. *Audit discussion:* *In Table 2.4-218, what is the peak rate factor (C) used in estimating the peak discharge for the NRCS unit hydrograph? Is the factor representing an average, flat area, or steep terrain?* *The applicant stated that the hydrograph peaking factor 484.* **RESOLVED**
11	**2.4.3**	Provide a knowledgeable expert to discuss the input data for HEC-RAS and output results in determining the water levels along the Swan Creek under 3 alternative scenarios. *Audit discussion:* • *What are the source and resolution of the DEM data?*

		• *Discuss the input for the main parameters and model setup of HEC-RAS.* • *Under the Alternative III (25-year flood, maximum surge, and seiche plus 100-yr lake level), the Swan Creek would reach a flood level of 585.4 ft, NAVD 88 (p.2-446), have you evaluated any potential impact of that level on the drainage system at and near Fermi 3?* • *Is the flood level above the elevation at the N3 drainage area?* • *What is the potential effect to the local PMP runoff at the site if it occurs at the same time as the PMF runoff?* *Staff reviewed calculation package for input parameters.* *Alternative III and area N3 issues addressed in previous question.* **RESOLVED** The RAI associated with item no. 3 will address these questions.
12	**2.4.3**	Provide a knowledgeable expert to discuss the impacts of uncertainty in un-gauged Swan Creek data, ice jam conditions (if any), and snowmelt on the results of PMF runoff and stream course models. *Audit discussion* • *What are main uncertainties for PMF analysis due to un-gauged watershed?* • *Is there any historical ice jam along Swan Creek or/and lake ice blockage near the creek's outlet to Lake Erie? What are their effects on PMF if any?* *Staff will review calculation for additional details associated with uncertainties of the un-gauged watershed.* **UNRESOLVED** Staff will issue an RAI requesting justification for ice jam determination for local area and lake.
13	**2.4.4**	Provide the sources of information to confirm the absence of dam or water control structures in the Swan Creek watershed. *Audit discussion:* • *In Section 2.4.3.4, the second paragraph states that "There are no dams existing within the Swan Creek watershed ..", what is the source of the information?* • *On pages 2-442 and 2-443, the Plum Brook watershed near Utica was used to estimate the 10%, 2%, 1%, 0.5% and 0.2% peak flows of Swan Creek. The Plum Brook watershed is more than 20 miles north of Detroit and has a drainage area (23.8 square miles) much smaller than the Swan Creek watershed (100.6 square miles). Please justify the use of Plum Brook to make the estimation.* *Staff addressed the Plum Brook watershed in an earlier question.*

		UNRESOLVED Staff will issue an RAI requesting justification for the statement regarding dams in the watershed.
14	**2.4.5**	Provide a knowledgeable expert to describe and make available information on historic storm surges, their characteristics, probable maximum winds, and associated meteorological parameters in Lake Erie. *Audit discussion:* • *What are the maximum wind set-up and set-down during the maximum historical surge in Lake Erie and what are their durations?* • *How are the set-up compared to the calculated storm surge (10.3 ft) on page 2-453 of the FSAR?* • *How would the water intake of the proposed Fermi 3 be affected under such maximum set-down and how long the cooling system can be run without fresh makeup water?* • *Provide the calculation package of the surge simulation.* • *Staff discussed back ground for wind set-up and set-down. See section 2.4.2 – page 2-437* *See also Table 2.4-210 – lists maximum and minimum lake level.* *Applicant states that the maximum recorded lake level is approximately 1 ft higher than the calculated 100 year lake level.* *Staff discussed methodology and approach. Page 2-453 was referenced to address staff's question.* *Staff asked about the Lake slope or trend and the impact on the surge calculation. Is there a lake trend that could be more conservative?* *Applicant will provide additional justification by verifying with the Corps value.* *Calculation package associated with surge - 51.1002* **UNRESOLVED** Staff will issue an RAI requesting that the FSAR (Section 2.4.2.1) is updated to include max hourly elevation and revise title for Table 2.4-210 to clarify the nature of the data.

15	**2.4.5**	Provide a knowledgeable expert to discuss the method, data availability, and assumptions used to derive the 100-year lake level of Lake Erie. *Audit discussion:* • *What is the weighting factors used in calculating the 100-year lake level (p. 2-451)?* • *If maximum monthly lake level data is used to derive the 100-year lake level of Lake Erie, how would the result compare to the calculated lake level presented in the FSAR?* *The applicant explained that there are 14 gauging stations along the lake but that they were not distributed evenly. Figure 2.4-225, pg 2-474 identifies locations of the gauges. Applicant applied a weighting factor for area of shoreline represented - based on the percentage of shoreline that each represented and based on hourly data.* **RESOLVED**
16	**2.4.5**	Provide a knowledgeable expert to discuss the methodology and processes used to simulate storm surge in Lake Erie and the inputs and outputs of STWAVE model. *Audit discussion:* • *What is the boundary input for the model?* • *Provide the calculation package of the STWAVE model.* *The applicant did not model the western basin exclusively because there were no boundary conditions that allowed for the only the western basin to be modeled. Therefore the entire lake was modeled.* **RESOLVED** Resolved under item no. 3
17	**2.4.5**	Provide a knowledgeable expert to discuss the approach, assumptions, input data, and output results of ACES model. *Audit discussion* • *Provide the calculation package of the wave run-up and overtopping rate* **RESOLVED** Resolved under item no. 3

18	**2.4.7**	Provide a knowledgeable expert to discuss an assessment of ice effects and snow melts on floods along Swan Creek. *Audit discussion* • *Spring melt could enhance flows of Swan Creek, especially with rains. When the PMF is estimated, did melting of snow packs was considered?* • *What is the effect if PMF is analyzed using a single rain-on-snow event for the entire Swan Creek watershed?* **RESOLVED** This was addressed site audit needs item no. 9.
19	**2.4.9**	Provide a knowledgeable expert to discuss the possibility of channel diversion on Swan Creek **UNRESOLVED** Staff will issue an RAI requesting additional discussion concerning the possibility of diversions along the Swan Creek.
20	**2.4.11**	What is the minimum intake design basis water level (or the water depth above the elevation of the base of the intake bay at the location of the pump suction) for the cooling water pumps to supply sufficient water for Fermi 3 to operate? **RESOLVED** The intake is not a safety related structure.
21	**2.4.11**	Provide a knowledgeable expert to discuss the ice conditions near the entrance of the intake canal that could affect water flow into the canal. **RESOLVED** The intake is not a safety related structure.
22	**2.4.12**	Provide a knowledgeable expert to discuss the regional and local hydrogeology conditions. *Audit discussion:* *The definition of the surficial aquifer is not clearly defined. The applicant stated that the surficial aquifer system is based on a definition for regional USGS reports.* *Due to the difference in material in this area, the applicant uses the term "overburden"* *Site specific – overburden is the native and quarry rock fill.* *Regionally – surficial aquifer is the term used.* *Both cases refer to unconsolidated and unconfined material.* *The bedrock aquifer is not "confined" throughout the site.*

		RESOLVED Staff reviewed data on gw table. Based on review, the issue is resolved.
23	**2.4.12**	Provide a knowledgeable expert to discuss the assumed source and location, and the groundwater transport pathways of potential contaminants and existing and proposed monitoring programs. *Audit discussion:* • *Where is the source from which the distances to the surface water and the groundwater receptors are measured? (p. 2-488)* • *When a pathway across different materials (fills, dike, and native lake clay and tills) in the overburden, how is the hydraulic conductivity of the overburden calculated? (p.2-490)* • *The upper part of the dolomite aquifer is more weathered or fractured (Figure 2.5.1-238) and sometimes is overlain by sand and gravels of glacial fluvial origin, as shown in the higher hydraulic conductivity data (Table 2.4-233) and well log (P-385D, Figure 2.5.1-240). Therefore, horizontal groundwater movement in the bedrock aquifer is more likely to flow near the upper part of the aquifer. Why higher K value (e.g. 33.88 or 40 ft/day) than 17.57 ft/day is not used to calculate groundwater flows? (p. 2-490)* • *For the same reason, why the porosity of 1% is assumed? (p. 2-490)* • *Provide tritium data from Fermi 1 monitoring program (p. 2-491).* • *Is there any monitoring programs developed or updated for Fermi 3?* *Bedrock data for Section 2.5 is available for review. The applicant used the center of the reactor building as the source.* *The applicant used the more conservative hydraulic conductivity when completing its analysis.* *Applicant selected 1 percent for the porosity to make the calculation more conservative.* *The applicant is current collecting ground water data for the NEI tritium initiative. This program is referenced on pg 2-491.* *There are no monitoring programs currently developed for Fermi 3. Construction and operational monitoring are still general. The specific details will be finalized in the future.* *2008 REMP report available on Fermi 2 docket (quarterly ground water monitoring)*

		UNRESOLVED Staff will issue an RAI requesting additional clarification regarding the selection of the source – consistency for the release point. Staff will issue an RAI requesting additional justification (literature search) regarding the porosity used in the calculations.
24	**2.4.13**	Provide a knowledgeable expert to discuss radionuclides screening, and their transport analysis in the event of accidental releases of radionuclides. *Audit discussion:* • *Table 12.2-13a of the ESBWR DCD has 51 radionuclides [5 in Class 2, 6 in Class 3, 1 in Class 5 and 39 in Class 6]. The supplemental information for 2.4.13 has shown 38 radionuclides. Explain the screening process that is used to reduce the 51 radionuclides to the 38 radionuclide in the transport analysis.* • *Is there any other chemical agents besides chelating agents that could modify the transport characteristics of radionuclides at the site?* • *Why is porosity data from literature used in the analysis.* *The supplemental information was provided in a letter dated February 16, 2009.* *DTE provided initial response to this on November 11, 2008.* *The screening process will be discussed by Steve Thomas via telecom.* *Discussion with Steve:* *All 51 radionuclides were addressed* *In Nov. 2008 response, the Table 2 - 38 in radionuclide column plus the 13 progeny account for all 51. There were 13 radionuclides with an initial concentration. LA-140 is in progeny column based on Barium 140.* *This is the initial source term.* *In the assumption in supplemental the release point and the FSAR was not the same. One assumed the liquid rad waste building and the other was the reactor. This should be corrected for consistency especially for 2.4.13.* *Why were three members of the decay chain limited? The assumption (pg 4 of the supplemental document – last three lines of the page) – this is explained in the calculation package.* *Will concentration be reanalyzed once new kd value provided in response to initial RAIs? Applicant will revise these to address RAI – this is the expected September response.* *Staff awaiting RESRAD results and may have additional questions at that time.*

		The literature values were used because there was no porosity data for the bedrock available for the fractured bedrock at the site. **RESOLVED**
	2.4.2	Staff will issue a RAI requesting information for the run-off and erosion protection for the slopes along the elevated area containing the safety related structures.
	General	Note: The staff may have additional questions once the models have been accessed.

Fermi - Mailing List (Revised 06/18/2009)

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