PMFermiCOLPEm Resource

From: Nicholas A Latzy [latzyn@dteenergy.com]
Sent: Wednesday, March 30, 2011 8:23 AM
To: Muniz, Adrian
Subject: RAI Letter 52
Attachments: NRC3-11-0010.pdf

Mr. Muniz,

Here is a courtesy copy of RAI Letter 52. If you have any questions, please feel free to contact me.

Thank you
Nicholas A. Latzy
Supervisor - Engineering
Nuclear Development - DTE Energy
(313)-235-3370

Hearing Identifier: Fermi_COL_Public
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Recipients:
"Muniz, Adrian" <Adrian.Muniz@nrc.gov>
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The Detroit Edison Company
One Energy Plaza, Detroit, MI 48226-1279

DTE Energy
Detroit Edison

10 CFR 52.79

March 29, 2011
NRC3-11-0010

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

References: 1) Fermi 3
Docket No. 52-033
2) Letter from Jerry Hale (USNRC) to Jack M. Davis (Detroit Edison), "Request for Additional Information Letter No. 52 Related to the SRP Sections 13.3, 12.3-4, and 2.5.4 for the Fermi 3 Combined License Application," dated February 28, 2011

Subject: Detroit Edison Company Response to NRC Request for Additional Information Letter No. 52

In Reference 2, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combined License Application (COLA). The responses to the Requests for Additional Information (RAIs) associated with Reference 2 are provided as Attachments 1 through 10 of this letter. Information contained in this response will be incorporated into a future COLA submission as described in the attachments.

If you have any questions, or need additional information, please contact me at (313) 235-3341.

I state under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of March 2011.

Sincerely,

Peter W. Smith, Director
Nuclear Development – Licensing & Engineering
Detroit Edison Company

Attachments:
1) Response to RAI Letter No. 52, RAI Question No. 13.03-57
2) Response to RAI Letter No. 52, RAI Question No. 13.03-58
3) Response to RAI Letter No. 52, RAI Question No. 13.03-59
4) Response to RAI Letter No. 52, RAI Question No. 13.03-60
5) Response to RAI Letter No. 52, RAI Question No. 13.03-61
6) Response to RAI Letter No. 52, RAI Question No. 12.03-12.04-9
7) Response to RAI Letter No. 52, RAI Question No. 13.03-62
8) Response to RAI Letter No. 52, RAI Question No. 13.03-63
9) Response to RAI Letter No. 52, RAI Question No. 13.03-64
10) Response to RAI Letter No. 52, RAI Question No. 02.05.04-36

cc: Adrian Muniz, NRC Fermi 3 Project Manager
Jerry Hale, NRC Fermi 3 Project Manager
Bruce Olson, NRC Fermi 3 Environmental Project Manager
Fermi 2 Resident Inspector (w/o attachments)
NRC Region III Regional Administrator (w/o attachments)
NRC Region II Regional Administrator (w/o attachments)
Supervisor, Electric Operators, Michigan Public Service Commission (w/o attachments)
Michigan Department of Natural Resources & Environment, Radiological Protection Section (w/o attachments)

Attachment 1
NRC3-11-0010
(5 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5383)

RAI Question No. 13.03-57

NRC RAI 13.03-57

Supplemental RAI 13.03-59 asked the applicant to revise Table 2.3-1 "Inspection, Test and Analyses" (ITA) section method and Acceptance Criterion (AC) for program element 5.3 to be consistent with RG 1.206, Table C.ILJ-B1. In response the applicant revised the ITA for program element 5.3 with a note that states "Note: The requirement for a test is included in Inspections Tests, Analyses 14.1." The ITA for 14.1 leads to the AC for 14.1.1 .B.4 which states demonstrate the capability of the Alert and Notification System (ANS) to operate properly when required, 90 percent or greater of the sirens operate properly as indicated by the feedback system. Unless Fermi 3 intends to install its own siren system, separate from the existing Fermi 2 siren system, the existing siren system is already being inspected by the Reactor Oversight Program and may be presumed adequate for the purposes of this COL; therefore need not be described. Provide a basis for including ITAAC 5.3 and Acceptance Criterion 14.1.1.B.4, or revise Table 2.3-1 "ITAAC for Emergency Planning" to remove these two ITAAC items.

Response

Detroit Edison agrees that the capability of the Alert and Notification System (ANS) to operate properly is already inspected by the Fermi 2 Reactor Oversight Program, and may be presumed adequate for the purposes of the Fermi 3 COL. Acceptance Criterion 14.1.1.B.4 will be removed. In order to remain consistent with 10 CFR 50.47(b)(5) and RG 1.206 Table C.II.1-B1, the Fermi 3 COLA ITAAC 5.3 will not be removed, but will be revised to state "The capability of the Alert and Notification System (ANS) to operate properly is tested monthly by the Fermi 2 Reactor Oversight Program and may be presumed adequate for the purposes of the Fermi 3 EP as identified in NRC RAI Letter 52, ML1105906350 (RAI 13.03-57)."

Proposed COLA Revision

A proposed markup to the Fermi 3 Part 10 Table 2.3-1, Acceptance Criterion 14.1.1.B.4, and ITAAC 5.3 is attached.

Markup of Detroit Edison COLA
(following 2 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in a future submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

Table 2.3-1
ITAAC For Emergency Planning

Planning Standard	EP Program Elements	Inspections, Tests, Analyses	Acceptance Criteria
5.0 Notification Methods and Procedures			
10 CFR 50.47(b)(5) – Procedures have been established for notification, by the licensee, of State and local response organizations and for notification of emergency personnel by all organizations; the content of initial and follow-up messages to response organizations and the public has been established; and means to provide early notification and clear instruction to the populace within the plume exposure pathway Emergency Planning Zone have been established.	5.1 The means exist to notify responsible State and local organizations within 15 minutes after the licensee declares an emergency. [E.1] ITAAC Element addressed in: COL EP II.E.1	5.1 A test will be performed of the capabilities.	5.1 Communications have been established via Ringdown Phone System among the control room, the State of Michigan, Monroe County, and Wayne County within 15 minutes after an emergency has been declared.
	5.2 The means exist to notify emergency response personnel. [E.2] ITAAC Element addressed in: COL EP II.E.1	5.2 A test will be performed of the capabilities.	5.2 Notification to the Fermi 3 emergency response organization has been performed. NOTE: Confirmation of the ability to alert, notify and mobilize the Fermi 3 emergency response personnel is addressed in Acceptance Criterion 14.1.1.B.1.
	5.3 The means exists to notify and provide instructions to the populace within the plume exposure EPZ. [E.6] ITAAC Element addressed in: COL EP II.E.2 & E.5	5.3 ~~Note: The requirement for a test is included in Inspections, Tests, Analyses 14.1.~~ See 5.3 Acceptence Criteria	5.3 ~~Note: The means for notifying and providing instructions to the public in the plume exposure EPZ that meet the alert and notification system design objectives are addressed by Acceptance Criterion 14.1.1.B.4.~~

The capability of the Alert and Notification System (ANS) to operate properly is tested monthly by the Fermi 2 Reactor Oversight Program and may be presumed adequate for the purposes of the Fermi 3 EP as identified in NRC RAI Letter 52, ML1105906350 (RAI 13.03-57).

Table 2.3-1 ITAAC For Emergency Planning			
Planning Standard	**EP Program Elements**	**Inspections, Tests, Analyses**	**Acceptance Criteria**
			~~4. Demonstrate the capability of the Alert and Notification System (ANS), for the public, to operate properly when required.~~ ~~Performance Criterion:~~ ~~a. 90% of the sirens operate properly, as indicated by the feedback system.~~ *C. Emergency Response* 1. Demonstrate the capability to direct and control emergency operations. Performance Criterion: a. Command and control is demonstrated by the control room in the early phase of the emergency, and the technical support center (TSC) within 60 minutes of declaration of an Alert or higher emergency classification. 2. Demonstrate the ability to transfer emergency direction from the control room (simulator) to the TSC upon activation. Performance Criteria: a. Turnover briefings are conducted in accordance with emergency plan implementing procedures. b. Documentation of transfer of duties is completed in accordance with emergency plan implementing procedures. 3. Demonstrate the ability to prepare for 24-hour staffing requirements. Performance Criterion: a. Complete 24-hour staff assignments. 4. Demonstrate the ability to perform assembly and accountability for all onsite individuals within 30 minutes of an emergency requiring protected area assembly and accountability. Performance Criterion: a. Protected area (PA) personnel assembly and accountability completed within 30 minutes of an emergency requiring PA assembly and accountability.

Attachment 2
NRC3-11-0010
(2 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5383)

RAI Question No. 13.03-58

NRC RAI 13.03-58

COL application, Part 10 ITAAC, Table 2.3-1 program element 10.4 states "The means exists to register and monitor evacuees at relocation centers" and refers to NUREG-0654 evaluation criteria II.J.12. Evaluation criteria II.J.12 is not applicable to licensees and therefore should not be included in a COL application. Please revise Table 2.3-1 "ITAAC for Emergency Planning" to remove this ITAAC item.

Response

Detroit Edison agrees that Evaluation Criteria II.J.12 of NUREG-0654/FEMA-REP-1, Rev. 1 is not applicable to licensees. Table 2.3-1 will be revised to remove EP Program Element 10.4 and Inspections, Tests, Analyses and Acceptance Criterion 10.4.

Proposed COLA Revision

A proposed markup to remove EP program element 10.4 of Table 2.3-1 in Part 10 is included in Attachment 4 of this letter.

Attachment 3
NRC3-11-0010
(4 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5383)

RAI Question No. 13.03-59

NRC RAI 13.03-59

Supplemental RAI 13.03-79 was asked, in part, to address the success criteria for declaring an emergency action level (EAL) as being from the time the information is available to the control room decision maker and not from when the information was noticed by the decision maker. The response to the RAI stated that the Acceptance Criterion for ITAAC 14.1 .1.A.1 appropriately refers to the time the initiating condition or emergency action level (EAL) is identified, rather than the time when the information that an initiating condition is met or an EAL is exceeded is available to the decision maker, and that EALs are addressed in Appendix 1 to NUREG-0654/FEMA-REP-1, Rev. 1. Appendix 1 specifically addresses the timeliness of EAL recognition by stating the following:

Prompt notification of offsite authorities is intended to indicate within about 15 minutes for the unusual event class and sooner (consistent with the need for other emergency actions) for other classes. The time is measured from the time at which operators recognize that events have occurred which make declaration of an emergency class appropriate.

Emergency Preparedness Position (EPPOS) No. 2, "Timeliness Of Classification Of Emergency Conditions," guidance (issued after NUREG-0654/FEMA-REP-1, Rev. 1, Appendix 1) states, in part, "...provide guidance to NRC staff for evaluating the amount of time taken by a licensee to classify an event and declare an emergency once indications are available to control room operators that an emergency action level (EAL) has been reached or exceeded", not from the time the decision maker identifies the information (emphasis added). Revise the performance criteria to correctly describe the timeliness requirement to be from the time the information is available to the decision maker, or provide an acceptable justification for why this is not needed.

Response

Fermi 3 COLA Part 10, Table 2.3-1, "ITAAC for Emergency Planning," acceptance criteria 14.1.1.A.1.a will be revised to state "Determine the correct highest emergency classification level based on events which were in progress, considering past events and their impact on the current conditions, within 15 minutes of indications for an emergency event."

Proposed COLA Revision

A proposed markup to Table 2.3-1, "ITAAC for Emergency Planning," is attached.

Markup of Detroit Edison COLA
(following 1 page)

The following markup represents how Detroit Edison intends to reflect this RAI response in a future submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

Table 2.3-1
ITAAC For Emergency Planning

Planning Standard	EP Program Elements	Inspections, Tests, Analyses	Acceptance Criteria
14.0 Exercises and Drills			
10 CFR 50.47(b)(14) – Periodic exercises are (will be) conducted to evaluate major portions of emergency response capabilities, periodic drills are (will be) conducted to develop and maintain key skills, and deficiencies identified as a result of exercises or drills are (will be) corrected.	14.1 Licensee conducts a full participation exercise to evaluate major portions of emergency response capabilities, which includes participation by each State, local and provincial agency within the plume exposure EPZ, and each State and provincial agency within the ingestion exposure EPZ. [N.1] ITAAC Element addressed in: COL EP II.N.1.	14.1 A full participation exercise (test) will be conducted within the specified time periods of Appendix E to 10 CFR Part 50.	14.1.1 The exercise is completed within the specified time periods of Appendix E to 10 CFR Part 50, onsite exercise objectives listed below have been met, and there are no uncorrected onsite exercise deficiencies. *A. Accident Assessment and Classification* 1. Demonstrate the ability to identify initiating conditions, determine emergency action level (EAL) parameters, and correctly classify the emergency throughout the exercise. Performance Criterion: a. Determine the correct highest emergency classification level based on events which were in progress, considering past events and their impact on the current conditions, within 15 minutes ~~from the time the initiating condition(s) or EAL is identified.~~

of indications for an emergency event.

Attachment 4
NRC3-11-0010
(4 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5383)

RAI Question No. 13.03-60

NRC RAI 13.03-60

The applicant's description in letter "b" (under the "Response" section to supplementary RAI 13.03-72 on Attachment 18 of letter #41) does not match the corresponding change made to Table 2.3-1 "ITAAC for Emergency Planning" Acceptance Criteria 10.1.2. Revise the Table 2.3-1 change for Acceptance Criteria 10.1.2 to match Attachment 18 of letter #41, letter "b" under the "Response" heading or provide an acceptable justification for why this is not needed.

Response

Table 2.3-1 will be clarified to change objectives 1 through 5 to Acceptance Criteria 10.1.1 through 10.1.5 and to include Acceptance Criterion 10.1.6 addressing the specific capability to provide both warnings and instructions to individuals outside the protected area, but within the Owner Controlled Area. The revised Acceptance Criteria addresses the guidance provided in Reg. Guide 1.206, Appendix B, Table C.II.1-B1, "Emergency Planning - Generic Inspections, Test, Analysis, and Acceptance Criteria (EP-ITAAC)," Acceptance Criterion 10.1.

Proposed COLA Revision

A proposed markup to clarify COLA Part 10 Table 2.3-1 Acceptance Criteria 10.1.1 through 10.1.6 is attached. This markup also removes EP program element 10.4 as discussed in attachment 2 of this letter.

Markup of Detroit Edison COLA
(following 1 page)

The following markup represents how Detroit Edison intends to reflect this RAI response in a future submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

RAI 13.03-60

Renumber 1 thru 5 below to;
10.1.1, 10.1.2, 10.1.3, 10.1.4, and 10.1.5

Table 2.3-1
ITAAC For Emergency Planning

Planning Standard	EP Program Elements	Inspections, Tests, Analyses	Acceptance Criteria
10.0 Protective Response			
10 CFR 50.47(b)(10) – A range of protective actions has been developed for the plume exposure EPZ for emergency workers and the public. In developing this range of actions, consideration has been given to evacuation, sheltering, and, as a supplement to these, the prophylactic use of potassium iodide (KI), as appropriate. Guidelines for the choice of protective actions during an emergency, consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure EPZ appropriate to the locale have been developed.	10.1 The means exist to warn and advise onsite individuals of an emergency, including those in areas controlled by the operator, including:[J.1] 1. employees not having emergency assignments; 2. visitors; 3. contractor and construction personnel; and 4. other persons who may be in the public access areas, on or passing through the site, or within the owner controlled area. ITAAC Element addressed in: COL EP II.J.1.	10.1 A test of the onsite warning and communications capability emergency plan implementing procedures including protective action guidelines, assembly and accountability and site dismissal will be performed during a drill or exercise. RAI 13.03-60 10.1.6 Demonstrate the ability to provide warnings and instructions to individuals outside the protected area, but within the Owner Controlled Area.	~~10.1 The organization will satisfy the following objectives during the drill or exercise~~: ~~1.~~ Demonstrate the capability to direct and control emergency operations. ~~2.~~ Demonstrate the ability to transfer emergency direction from the control room (simulator) to the TSC within 30 minutes from activation. ~~3.~~ Demonstrate the ability to prepare for 24-hour staffing requirements. ~~4.~~ Demonstrate the ability to perform assembly and accountability for all onsite individuals within 30 minutes of an emergency requiring protected area assembly and accountability. ~~5.~~ Demonstrate the ability to perform site dismissal.
	10.2 The means exist to radiological monitor people evacuated from the site. [J.3]	10.2 A test of the emergency plan implementing procedures will be performed.	10.2 Demonstrate the ability to perform radiological monitoring of people evacuated from the site during a drill or exercise.
	10.3 The means exists to notify and protect all segments of the transient and resident population. [J.10]	10.3 An analysis of offsite emergency plans will be performed.	10.3 State and local plans or procedures provide methods to notify and protect all segments of the transient and resident population.
	~~10.4 The means exists to register and monitor evacuees at relocation centers. [J.12]~~	~~10.4 An analysis of offsite emergency plans will be performed.~~ RAI 13.03-58	~~10.4 State and local plans or procedures provide methods to register and monitor evacuees at relocation centers~~.

Attachment 5
NRC3-11-0010
(4 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5384)

RAI Question No. 13.03-61

NRC RAI 13.03-61

Supplemental NRC RAI 13.03-14 was asked to address why there was no description of the potential use of sheltering affected areas if conditions make evacuation dangerous, or the consideration for the use of KI consistent with 10 CFR 50.47 (b)(10), RIS 2004-13 and NUREG-0654, Supplement 3. In response the applicant prepared a revision to the Fermi 3 Emergency Plan that add the phrase "unless conditions make evacuation dangerous" to the evacuation PAR description. The applicant further stated RIS 2004-13 and Supplement 3 to NUREG-0654 are silent regarding the use of KI. This is accurate, however, 10 CFR 50.47 (b) (10) is not silent and requires, in part, the prophylactic use of potassium iodide (KI), as appropriate. Revise the Plan's description of the Emergency Directors expected PAR actions to be taken for a General Emergency declaration to include the consideration for the use of KI consistent with 10 CFR 50.47 (b)(10), or provide an acceptable justification for why this is not needed.

Response

As requested in this RAI, Detroit Edison has revised the discussion on the Emergency Director's process for developing PARs within the Emergency Plan, Section II.J.7, "Protective Action Recommendations and Bases," to identify the administration of stable iodine as a consideration.

Proposed COLA Revision

A proposed markup of subsection II.J.7 of the Fermi 3 Emergency Plan is attached.

Markup of Detroit Edison COLA
(following 1 page)

The following markup represents how Detroit Edison intends to reflect this RAI response in a future submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

Candidate protective actions that will be considered are shelter, evacuation, administration of stable iodine, etc.

If the Emergency Director declares a General Emergency, Detroit Edison will notify the State of Michigan, Monroe County, and Wayne County governmental authorities with a PAR to evacuate the Protective Action Areas (PAAs) within a two mile radius around the Fermi 3 site; evacuate five miles downwind in affected Areas and shelter in place the remainder of the Plume Exposure Pathway EPZ, unless other conditions make evacuation dangerous. The PAR is provided to offsite agencies within 15 minutes of the General Emergency declaration and within 15 minutes of a change in status of the PAR.

In addition to the EAL-based Protective Action Recommendation, Detroit Edison provides PARs based on offsite dose projections. The Radiation Protection staff is responsible for conducting offsite dose projections periodically throughout any emergency during which there is an actual or potential release of an amount of radioactive material that is likely to result in offsite consequences. Emergency plan implementing procedures establish the requirements for performing required calculations and projections consistent with Section II.I of this Plan.

The projected doses are compared to the Protective Action Guides (PAGs) shown in Table II.J-1 which are derived from EPA 400-R-92-001, "The Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" (Ref. 4) and Supplement 3 to NUREG-0654/FEMA-REP-1 (Ref. 9). PARs are then developed based on the results of these comparisons. Table II.J-2 summarizes possible protective actions to be implemented by State and local agencies during an emergency. As a further aid in determining appropriate protective actions, Table II.J-3 contains representative shielding factors provided by typical structures against direct exposure from the plume. Emergency Plan Implementing Procedure, "Protective Action Recommendations," as listed in Appendix 6, provides details regarding development of Protective Action Recommendations.

Prior to activation of the EOF, the Emergency Director is responsible for determining PARs and communicating projected offsite doses and PARs to affected Federal, State and local authorities and to the Province of Ontario, consistent with the notification protocols as discussed in Section II.E.1 of this Plan. Following activation of the EOF, the Emergency Officer assumes these responsibilities.

The Emergency Director or Emergency Officer provides projected offsite doses and Protective Action Recommendations to state and local authorities who are responsible for implementing the protective actions, using the communications systems discussed in Section II.H of this Plan, or by direct communications in the EOF.

8. Evacuation Time Estimates

Detroit Edison has conducted a Fermi 3-specific Evacuation Time Estimate (ETE) (Ref. 7) which is summarized in Appendix 5 of this Plan. The Fermi 3 ETE is consistent with the guidance provided in Appendix 4 of NUREG-0654/FEMA-REP-1 and NUREG/CR-6863, "Development of Evacuation Time Estimate Studies for Nuclear Power Plants" (Ref. 14). The ETE did not reveal the existence of any significant impediments to the development of emergency plans.

Appendix 5 of this Plan summarizes the population distribution and Evacuation Time Estimate.

Attachment 6
NRC3-11-0010
(5 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5432)

RAI Question No. 12.03-12.04-9

NRC RAI 12.03-12.04-9

In the response to RAI 12.03-12.04-7, the applicant states that several DCD figures and tables have been replaced by site-specific figures and tables in the Fermi FSAR to describe the reconfiguration of the Radwaste Building. Upon review of the equipment relocation in the Radwaste Building, the staff notes that Figures 12.3-19R and 12.3-20R indicate that the equipment for the high activity phase separator has been relocated from the ground floor at elevation -9350 (Room 6151 in Figure 12.3-19 of the ESBWR DCD) to the second floor at elevation -2350 (Room 6251 in Figure 12.2-20R of the Fermi FSAR). DCD Section 11.2.2.3.2 states that "Tank cubicles are lined with steel to preclude accidental releases to the environment." Since the room housing the high activity phase separator (Room 6251) is no longer located on the ground floor of the Radwaste Building:

1) *Explain the provisions included in this design to prevent the spread of contamination in the case of a tank leak or tank failure in this room. Regulatory Guide 8.8 states that the exposure to station personnel to radiation from pipes carrying radioactive material can be reduced by means of shielded chases.*

2) *Explain any shielding provisions incorporated for the floor drain and the drain pipe for Room 6251 which would serve to minimize the potential of increased dose rates in the adjacent areas traversed by the room drain line in the event of a tank leak or failure in Room 6251. Furthermore, review of the wall thicknesses listed in Table 1 of the applicant's response to RAI 12.03-12.04-7 identifies that, in those areas where a wall separates high activity tanks (having radiation zone levels of H or I) from a corridor, the wall has a thickness of 100 cm in the DCD. This approach is used in the reconfigured Radwaste Building except for the walls of the cubicle housing the high activity phase separator (Room 6251). This room is identified as a radiation zone H and, in the DCD Radwaste Building configuration the cubicle wall adjacent to the corridor (the southern wall of Room 6151) has a thickness of 100 cm. In the reconfigured FSAR layout drawing, the walls which are adjacent to the corridor (the western wall of Room 6251) and are adjacent to the control room (the western wall of Room 6251) on the second floor are only 90 cm. thick.*

3) *Please explain why the west- and east-facing walls for this radiation Zone H cubicle do not have a thickness of 100 cm to ensure that the radiation zoning of the corridor and the control room (both Zone B areas), respectively, are not exceeded due to the radiation sources in Room 6251.*

<u>Response</u>

Detroit Edison submitted Revision 3 to the Fermi 3 FSAR via Detroit Edison Letter NRC3-11-0005, dated February 14, 2011 (ML110600656). As part of Revision 3 to the Fermi 3 FSAR, Detroit Edison made the following changes that address this RAI.

- DCD Section 12.3.1.4.5 describes provisions included in the design of the Radwaste Building in order to minimize occupational exposure. FSAR Section 12.3.1.4.5 incorporates DCD Section 12.3.1.4.5 by reference with supplemental item EF3 SUP 12.3-1 in FSAR Section 12.3.1.4.5. Supplemental item EF3 SUP 12.3-1 of FSAR Section 12.3.1.4.5 adds the following provisions to those identified in the DCD:

  Provision for control of fluids exiting high activity rooms, including provision to isolate floor drains, and remote operation of control valves from the Radwaste Building control room.

  Piping from high activity rooms are arranged to minimize exposure to normally occupied areas, and are designed to maintain radiation levels in the Radwaste Building process system area as shown in Figure 12.3-19R through Figure 12.3-22R.

  The purpose of the first supplemental provision is to provide isolation capability to prevent the spread of contamination to undesired areas. Remote isolation capability is provided to minimize occupational exposure in the event such isolation is necessary.

  The purpose of the second provision is to minimize occupational exposure from radioactive fluids in the piping. As stated in the Fermi 3 FSAR Section 12.3.1.4.5, the design provisions maintain radiation levels in the Radwaste Building areas to the levels as shown in FSAR Figures 12.3-19R and 12.3-22R. This provision will be revised to indicate applicability to process as well as drain piping.

  In addition, as shown in FSAR Table 1.9-202, Fermi 3 conforms to Regulatory Guide 8.8. Conformance with RG 8.8 encompasses conformance with the guidelines pertaining to facility and equipment design features associated with minimizing occupational exposure including pipe routing and shielding.

- As shown in FSAR, Revision 3, Table 12.3-8R, Sheet 2, the wall thicknesses for Room 6251 has been increased to 100 cm for the walls between Room 6251 and the corridors and the control room. Increasing these wall thicknesses from 90 cm to 100 cm is consistent with the DCD for similar configurations.

The above described changes, included in the Fermi 3 FSAR Revision 3 and the proposed markups to FSAR Section 12.3.1.4.5, address this RAI.

Proposed COLA Revision

A proposed markup to FSAR Section 12.3.1.4.5 to clarify design provisions is attached.

Markup of Detroit Edison COLA
(following 1 page)

The following markup represents how Detroit Edison intends to reflect this RAI response in a future submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

wall was identified and the thickness was compared to the corresponding function in the DCD, the departure wall thickness was updated as needed. In this manner, the radiation zones in the departure were maintained the same as those in the DCD.

12.3.1.4.5 Radwaste Building

Add the following two bullet items at the end of the bulleted list of the first paragraph.

EF3 SUP 12.3-1

- Provision for control of fluids exiting high activity rooms, including provision to isolate floor drains, and remote operation of control valves from the RW control room.
- Piping from high activity rooms (process and drain piping) are arranged to minimize exposure to normally occupied areas, and are designed to maintain radiation levels in the RWB process system area as shown in Figure 12.3-19R through Figure 12.3-22R.

12.3.1.5 Minimization of Contamination and Radioactive Waste Generation

STD COL 12.3-4-A

Replace the second sentence in the second paragraph with the following.

Subsection 12.3.1.5.2 describes operational procedures and program concepts associated with the Regulatory Position.

12.3.1.5.1 Design Considerations

Add the following after the bullets in the third paragraph:

There are no other underground piping segments at Fermi 3 that require features to minimize contamination or monitoring to ensure that the potential for unmonitored, uncontrolled releases of radioactivity to the environment is minimized.

12.3.1.5.2 Operational/Programmatic Considerations

Replace this section with the following.

Attachment 7
NRC3-11-0010
(6 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5499)

RAI Question No. 13.03-62

NRC RAI 13.03-62

In accordance with 10 CFR 30.32(i)(1), does the request for a Part 30 license involve authorization to receive or possess byproduct material(s) "in unsealed form, on foils, plated sources, or sealed in glass," in excess of the quantities in Schedule C of 10 CFR 30.72? If the physical form of the byproduct material(s) to be received, possessed, or used will be in the above described forms or the quantities exceed Schedule C, provide either an evaluation showing the maximum dose to a person offsite would be less than 1 rem dose equivalent or 5 rems to the thyroid [10 CFR 30.32(i)(2)], or an emergency plan that meets the requirements of 10 CFR 30.32(i)(3). If compliance through the requirements of 10 CFR 30.32(i)(3) is chosen, address how the implementation of the emergency plan prior to the receipt of byproduct material will be accomplished and reflect the implementation in FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations." Revise Table 13.4-201 accordingly.

Response

Byproduct material that is in unsealed form, on foils or plated sources, or sealed in glass, that exceeds the quantities in Schedule C of 10 CFR 30.72, will not be received, possessed, or used at the Fermi 3 site. Since the quantities do not exceed Schedule C, an emergency plan that meets the requirements of 10 CFR 30.32(i)(3) is not required. As such, the implementation of the Emergency Plan prior to the receipt of byproduct material will be removed from FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations."

Chapter 12 of the FSAR will be revised to include a requirement addressing these limitations during the period prior to the implementation of the Emergency Plan (prior to the initial fuel loading following the finding that the acceptance criteria in the combined license has been met as provided in 10 CFR 52.103(g)).

Proposed COLA Revision

A proposed markup to FSAR Table 13.4-201 and FSAR Section 12.2.1.5 is attached.

Markup of Detroit Edison COLA
(following 3 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in a future submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

The same consideration applies to solid and liquid radionuclide sources of exempt quantities or concentrations which are used to calibrate or check the portable and laboratory radiation measurement instruments.

Instrument calibrators are normally used for calibrating gamma dose rate instrumentation. These may be self-contained, heavily shielded, multiple source calibrators. Beta and alpha radiation sources are also available for instrument calibration. Calibration sources are traceable to the National Institute of Standards and Technology, or equivalent.

Radiography sources are surveyed upon entry to the site. Radiation protection personnel maintain copies of the most recent leak test records for owner-controlled sources. Contractor radiography personnel provide copies of the most recent leak test records upon radiation protection personnel request. Radiography is conducted in accordance with approved procedures.

Insert A

The Condensate Storage Tank (CST) potentially contains radioactive fluids. Estimated conservative radionuclide inventories in the CST are provided in Table 12.2-207. Using conservative assumed parameters for the CST, the exposure rate is less than 5 mrem/hr at 30 cm from the CST and would not be considered a radiation area per 10 CFR 20.1003.

12.2.2.1 Airborne Releases Offsite

Replace this section with the following.

EF3 COL 12.2-2-A

Airborne sources are calculated using the source terms given in Section 11.1.

The bases for these calculations are shown in Table 12.2-15R.

The ESBWR standard design employs three ventilation stacks (airborne release points). Individual stacks service the ventilation flows from the Reactor/Fuel Buildings (RB/FB), the Turbine Building (TB) and the Radwaste Building (RWB). The offsite airborne release analysis of the ESBWR ventilation stack design employs conservative long term atmospheric dispersion (X/Q) and deposition (D/Q) parameter values for each release location. Fermi site-specific values for these parameters are shown in Table 12.2-15R.

The subject X/Q and D/Q values in Table 12.2-15R are used in the calculation of the gaseous effluent normal operation doses in Table

Insert A

During the period prior to the implementation of the Emergency Plan (in preparation for the initial fuel loading following the 10 CFR 52.103(g) finding), no specific by-product, source, or special nuclear material related emergency plan will be necessary because:

a) No by-product material will be received, possessed, or used in a physical form that is "in unsealed form, on foils or plated sources, or sealed in glass," that exceeds the quantities in Schedule C in 10 CFR 30.72;
b) The source material to be received, possessed, or used does not involve uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total; and
c) The special nuclear material to be received, possessed, or used does not involve enriched uranium for which a criticality accident alarm system is required, uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total, or in excess of 2 curies of plutonium in unsealed form or on foils or plated sources.

Table 13.4-201 Operational Programs Required by NRC Regulations (Sheet 5 of 9) [STD COL 13.4-1-A] [STD COL 13.4-2-A]

Item	Program Title	Program Source (Required by)	Section	Implementation	
				Milestone	Requirement
14.	Emergency Planning	10 CFR 50.47 10 CFR 50, Appendix E	13.3	Full participation exercise conducted within 2 years prior to scheduled date for initial loading of fuel	10 CFR Part 50, Appendix E, Section IV.F.2.a(ii)
				Onsite exercise conducted within 1 year prior to the schedule date for initial loading of fuel	10 CFR 50, Appendix E, Section IV.F.2.a(ii)
				Licensee's detailed implementing procedures for its emergency plan submitted at least 180 days prior to scheduled date for initial loading of fuel	10 CFR 50, Appendix E, Section V
				The licensee shall submit a fully developed set of site-specific Emergency Action Levels (EALs) to the NRC in accordance with the NRC-endorsed version of NEI 07-01, Rev. 0, with no deviations. The fully developed site-specific EAL scheme shall be submitted to the NRC for confirmation at least 180 days prior to initial fuel load.	License Condition **[COM 13.4-031]**
	~~(portions applicable to radioactive material)~~	~~10 CFR 30.32(i)(3)~~ ~~10 CFR 40.31(j)(3)~~ ~~10 CFR 70.22(i)(3)~~		~~Prior to initial receipt of byproduct source, or special nuclear materials (excluding Exempt Quantities as described in 10 CFR 30.18)~~	~~10 CFR 30.32(i)(1)~~ ~~10 CFR 40.31(j)(1)~~ ~~10 CFR 70.22(i)(1)~~ ~~**[COM 13.4-029]**~~
15.	Security Program:	10 CFR 52.79(a)(35) 10 CFR 52.79(a)(36)	13.6		

Attachment 8
NRC3-11-0010
(2 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5499)

RAI Question No. 13.03-63

NRC RAI 13.03-63

In accordance with 10 CFR 40.31(j)(1), does the request for a Part 40 license involve authorization to receive, possess, or use uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total? If so, provide either an evaluation showing that the maximum intake of uranium by a member of the public due to a release would not exceed 2 milligrams [see 10 CFR 40.31(j)(2)] or an emergency plan for responding to the radiological hazards of an accidental release of source material and to any associated chemical hazards related to the material [see 10 CFR 40.31(j)(3)]. Revise Table 13.4-201 accordingly.

Response

The request for a Part 40 license does not involve authorization to receive, possess, or use uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total. Because the above quantities are not exceeded, an emergency plan for responding to the radiological hazards of an accidental release of source material and to any associated chemical hazards related to the material is not required. As such, the implementation of the Emergency Plan prior to the receipt of source material will be removed from FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations."

Chapter 12 of the FSAR will be revised to include a requirement addressing these limitations during the period prior to the implementation of the Emergency Plan (prior to the initial fuel loading following the finding that the acceptance criteria in the combined license has been met as provided in 10 CFR 52.103(g)).

Proposed COLA Revision

A proposed markup to FSAR Table 13.4-201 and FSAR Section 12.2.1.5 is included in Attachment 7 of this letter.

Attachment 9
NRC3-11-0010
(2 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5499)

RAI Question No. 13.03-64

NRC RAI 13.03-64

In accordance with 10 CFR 70.22(i)(1), does the request for a Part 70 license involve authorization to possess enriched uranium for which a criticality accident alarm system is required? If so, is an exemption from 10 CFR 70.24 through compliance with the requirements of 10 CFR 50.68 being sought based on sections 9.1.1.7 and 9.1.2.8 of the proposed ESBWR DCD that addresses meeting the requirements of 10 CFR 50.68 instead of installing a criticality accident alarm system? If not, provide an evaluation showing that a release of radioactive material would not cause a person offsite to exceed the maximum dose of 1 rem effective dose equivalent or be subject to an intake of 2 milligrams of soluble uranium, or provide an emergency plan that meets 10 CFR 70.22(i)(3). Discuss whether or not a criticality accident alarm system will be installed in Fermi 3. Revise Table 13.4-201 accordingly.

Response

The request for a Part 70 license does not involve authorization to possess enriched uranium for which a criticality accident alarm system is required, uranium hexafluoride in excess of 50 kilograms in a single container or 1000 kilograms total, or in excess of 2 curies of plutonium in unsealed form or on foils or plated sources. Because the above quantities are not exceeded, an emergency plan that meets 10 CFR 70.22(i)(3) is not required. As such, the implementation of the Emergency Plan prior to the receipt of special nuclear materials will be removed from FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations."

Chapter 12 of the FSAR will be revised to include a requirement addressing these limitations during the period prior to the implementation of the Emergency Plan (prior to the initial fuel loading following the finding that the acceptance criteria in the combined license has been met as provided in 10 CFR 52.103(g)).

Proposed COLA Revision

A proposed markup to FSAR Table 13.4-201 and FSAR Section 12.2.1.5 is included in Attachment 7 of this letter.

Attachment 10
NRC3-11-0010
(16 pages)

Response to RAI Letter No. 52
(eRAI Tracking No. 5537)

RAI Question No. 02.05.04-36

NRC RAI 02.05.04-36

In a letter to the NRC dated December 9, 2010 (NRC3-10-0056), you provided markups and additional ITAACs for the Fermi 3 FSAR. These changes reflect the incorporation of soil property requirements associated with DCD Revisions 7 and 8. To assist the staff with reviewing these markups and additional TAACs, please provide the information described in the list below. This request is in accordance with 10 CFR 100.23 and 10 CFR Part 50, and includes information necessary for the staff to follow guidance outlined in SRP Section 2.5.4 (NUREG-0800):

1. *Provide information on the extent of seismic Category 1 side backfill, and justify why the extent is sufficient and adequate.*

2. *Describe the test methods, and the frequency, location, and elevation of testing associated with ITAACs on the Category 1 side backfill.*

3. *Discuss how the 1000 ft/s minimum shear wave velocity will be maintained at the top and near-top surface layer of the Category 1 side backfill.*

4. *Provide information on the quantity of backfill material required from both on-site (e.g., excavated material that will be demonstrated to meet gradation requirements) and offsite sources. For off-site sources of backfill, specify the backfill source location(s) and describe the field and laboratory test methods performed, including material property and strength (dynamic and static) testing.*

<u>Response</u>

1. *Provide information on the extent of seismic Category 1 side backfill, and justify why the extent is sufficient and adequate.*

FSAR Reference 2.5.4-232, Chapter 11 (Kramer, S.L., "Geotechnical Earthquake Engineering," Prentice Hall, 1996) states the following:

> "Static earth pressures on retaining structures are strongly influenced by wall and soil movements. *Active earth pressures* develop as a retaining wall moves away from the soil behind it, inducing extensional lateral strain in the soil. When the wall movement is sufficient to fully mobilize the strength of the soil behind the wall, *minimum active earth pressures* act on the wall….. *Passive earth pressures* develop as a retaining wall moves toward the soil, thereby producing compressive lateral strain in the soil. When the strength of the soil is fully mobilized, *maximum passive earth pressures* act on the wall….." (Page 469)

American Society of Civil Engineers (2000), "Seismic Analysis of Safety-Related Nuclear Structures and Commentary," ASCE 4-98, Section 3.5.3.1, part (c) states the following:

> "The summation of the calculated dynamic seismic soil pressure and the static earth pressure shall not exceed the soil static passive earth pressure."

Table 2.0-1 of the referenced DCD does not include a requirement for the extent of Seismic Category I side backfill. However, based on the references presented above, the Fermi 3 side backfill is extended the distance from the Seismic Category I structures required to fully develop the passive failure wedge. This distance is considered sufficient because the maximum soil resistance that can be developed is the maximum passive earth pressure.

Figure 1 shows the configuration of the passive failure wedge based on Rankine passive earth pressure theory. Figure 1 shows that the horizontal extent of the passive failure wedge is dependent upon the angle of internal friction, ϕ', of granular backfill material. Therefore, the minimum horizontal extent of Seismic Category I side backfill, $L_{\min}$, is:

$$L_{\min} = \frac{H}{\tan(45^o - \phi'/2)}$$

Where H is the height of the Seismic Category I side backfill, and ϕ' is the angle of internal friction of the Seismic Category I side backfill.

FSAR Section 2.5.4.5.2 text will be updated to include the minimum horizontal extent of Seismic Category I side backfill presented in this response.

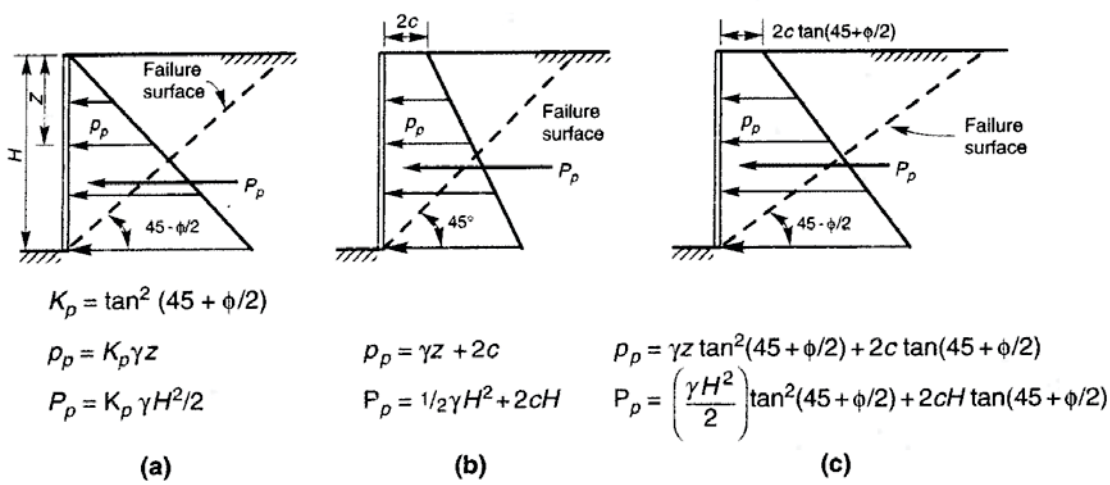

Figure 11.6 Maximum Rankine passive earth pressure distributions for backfills with various combinations of frictional and cohesive strength: (a) frictional resistance, no cohesion; (b) cohesive soil, no frictional resistance; (c) combined cohesion and friction. (After NAVFAC, 1982.)

Figure 1 – Passive Failure Wedge Configuration Based on Rankine Passive Earth Pressure Theory (Excerpt from FSAR Reference 2.5.4-232, Figure 11.6)

2. *Describe the test methods, and the frequency, location, and elevation of testing associated with ITAACs on the Category 1 side backfill.*

Test methods for index and static engineering properties of the Seismic Category I side backfill are provided in FSAR Section 2.5.4.5.1. Acceptable test methods for the dynamic property of in-situ shear wave velocity of the Seismic Category I side backfill are as follows:

- P-S Suspension logging.
- Downhole seismic testing (ASTM D 7400).
- Crosshole seismic testing (ASTM D 4428).
- Spectra analysis of surface waves (SASW) method.

Tables 1 and 2 provide a summary of the test methods, frequency, location, and elevation of testing associated with ITAACs on the Seismic Category I side backfill.

Table 1
Summary of Test Frequency for Laboratory Testing Methods

Test Method	Standard	Number of Test
Direct Shear Test	ASTM D 3080	Minimum of 3 tests per material type per borrow source
Maximum and Minimum Relative Density Test	ASTM D 4253, ASTM D 4254	Minimum of 3 tests per material type per borrow source
Modified Proctor Test	ASTM D 1557	Minimum of 3 tests per material type per borrow source
Sieve Analysis	ASTM D 422	Minimum of 10 tests per material type per borrow source
Moisture Content	ASTM D 2216	Minimum of 10 tests per material type per borrow source
Unconfined Compression Test	ASTM C 39/C 39M	Determine during detailed design and provided in construction specifications

Table 2
Summary of Test Frequency, Location, and Elevation for Field Testing Methods

Test Method	Standard	Number of Test	Location and Elevation of Testing
Shear Wave Velocity Measurement	Standard associated with test method selected	Total of 2 locations within backfill	• Within 50 feet of the Seismic Category I structures • From final grade to the top of Bass Islands Unit bedrock
Standard Penetration Testing in Borings	ASTM D 1586	Total of 4 borings within backfill	• Within 50 feet of the Seismic Category I structures • From final grade to the top of Bass Islands Unit bedrock
In-Place Density Tests	ASTM D 6938	Determine during detailed design and provided in construction specifications	Determine during detailed design and provided in construction specifications.

FSAR Section 2.5.4.5.4.2 text will be updated to include the testing presented in this response.

3. *Discuss how the 1000 ft/s minimum shear wave velocity will be maintained at the top and near-top surface layer of the Category 1 side backfill.*

To maintain the 300 m/s (1,000 ft/s) shear wave velocity near the ground surface in the side backfill for Seismic Category I structures, the near surface engineered granular backfill can be improved by adding cement to make roller-compacted concrete or a similar product. Improvement of the granular backfill will be implemented from the final plant grade to a depth established during detailed design.

The design of improved engineered granular backfill is addressed during detailed design, where the option(s) for improvement is finalized, and the mix design, placement methodology, and construction testing specification are developed. Testing to develop the mix design includes unconfined compression testing with samples prepared in accordance with ASTM C 1435/C 1435M, Standard Practice for Molding Roller-Compacted Concrete Cylinder Molds Using a Vibrating Hammer. The unconfined compressive strength will be used to calculate the shear wave velocity to ensure a shear wave velocity of 300 m/s (1,000 ft/s) per the referenced DCD. During construction, observation will verify that the approved mixes are used and test specimens are obtained to verify the design parameters are achieved. Testing during construction to verify the properties of the improved engineered granular backfill includes in-place density testing, unconfined compression testing of core samples obtained from in-place backfill, and in-place shear wave velocity testing. The improved engineered granular backfill will be designed in accordance with ACI 318 for plain concrete and ACI 207.5R for roller-compacted concrete. ACI 349 does not address plain concrete design; however, the ACI 349

requirements for concrete exposed to sulfate-containing solutions will be implemented to select the cement type. The response to RAI 02.05.04-31 (Detroit Edison letter NRC3-10-0035 [ML102210351]) addressed long term quality of lean concrete, which has been incorporated into FSAR Section 2.5.4.5.4.2. The mix design developed for improved granular backfill will control cement erosion and leaching due to contact with groundwater.

FSAR Section 2.5.4.5.4.2 text will be updated to reflect use of improved granular backfill.

4. *Provide information on the quantity of backfill material required from both on-site (e.g., excavated material that will be demonstrated to meet gradation requirements) and offsite sources. For off-site sources of backfill, specify the backfill source location(s) and describe the field and laboratory test methods performed, including material property and strength (dynamic and static) testing.*

The volume of granular backfill available from on-site sources is estimated to be 235,000 cubic yards and the additional volume of granular backfill required from offsite sources is estimated to be 175,000 cubic yards. The remainder of the planned backfill is lean concrete below the Turbine Building and Fire Water Service Complex. These estimates will be included in FSAR Section 2.5.4.5.1 as identified below.

FSAR Section 2.5.4.5.1 provides the following additional text:

> "The excavated fill and bedrock may be processed to meet the required grading in accordance with Subsection 2.5.4.5.4. As an alternative or supplement to the onsite crushed rock, dense-graded aggregate from an off-site source may be used as engineered granular backfill material. Dense graded aggregate such as Size 21A or 21AA as specified by the Michigan Department of Transportation (Reference 2.5.4-233) is suitable material. These types of materials are available from local and regional quarry sources."

The source of on-site engineered granular backfill is from the existing rock fill and the Bass Islands Unit dolomite bedrock excavated during construction. The existing rock fill is bedrock that was excavated from the on-site quarry during construction of Fermi 2; therefore, the source of the existing rock fill is the Bass Islands Unit dolomite. Quarries near the site obtain borrow from hard bedrock, with some quarries in similar Bass Islands Unit dolomite. The quarry to be used as the offsite borrow source will be identified during design as stated in Fermi 3 FSAR, Revision 1, Section 2.5.4.5.1:

> "Once the imported source material is identified, the material(s) are sampled and tested to verify adherence to the required specifications for engineered granular backfill….."

The gradation of the granular backfill material will be specified during the detailed design phase, and all material used as backfill will meet the specified gradation. As required, on-site and

offsite borrow material will be processed to meet the specified gradation; therefore, the source of the material will not impact the gradation used for the granular backfill.

Test methods for index and static engineering properties of the Seismic Category I side backfill are provided in FSAR Section 2.5.4.5.1 as repeated here:

> "Laboratory tests including moisture content per ASTM D2216 (Reference 2.5.4-213), sieve analysis per ASTM D422, (Reference 2.5.4-216), standard Proctor per ASTM D698 (Reference 2.5.4-234), modified Proctor tests per ASTM D1557 (Reference 2.5.4-235), Relative Density test per ASTM D 4253 and 4254 (Reference 2.5.4-236, Reference 2.5.4-237) and Direct Shear Test per ASTM D3080 (Reference 2.5.4-223) are performed to verify design requirement compliance for engineered granular backfill. The soundness of aggregate is confirmed using sulfate soundness per ASTM C88 (Reference 2.5.4-238) and Los Angeles abrasion tests per ASTM C131 and ASTM C535 (Reference 2.5.4-239, Reference 2.5.4-240)."
>
> "Testing for chemical, static and dynamic properties are performed on all proposed engineering backfill material(s)."

Additional detail regarding the field and laboratory test methods, including material property and strength (dynamic and static) testing are described in Tables 1 and 2 included in the response to Question 2 of this response.

<u>Proposed COLA Revision</u>

Proposed revision to FSAR Sections 2.5.4.5.1, 2.5.4.5.2 and 2.5.4.5.4.2 is shown in the attached markup.

Markup of Detroit Edison COLA
(following 8 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in a future submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

2.5.4.2. Details of engineered granular backfill requirements at the site are provided in Subsection 2.5.4.5.4.2.

The finished Fermi 3 site surface grade elevation is approximately elevation 179.6 m (589.3 ft) NAVD 88. Foundation elevations range from 177.3 m (581.6 ft) to 159.6 m (523.7 ft) NAVD 88. A list of the major structures in the power block area and their foundation levels are presented in Table 2.5.4-224. All excavation activities for the power block structures will commence from the existing ground surface elevation of approximately 177.1 m (581.0 ft) NAVD 88.

Excavated soil and/or rock may be used to fill some open water areas and to fill areas associated with temporary parking and construction laydown. Excavated material that meets requirements for use as engineered backfill will be segregated.

2.5.4.5.1 Source and Quantities of Backfill and Borrow Materials

The Fermi 3 project excavation generates approximately 313,468 m^3 (410,000 cubic yards) of excavated material. Excavated material that meets gradation requirements may be used as engineered granular backfill as defined in Subsection 2.5.4.5.4.2. Backfill surrounding Seismic Category I or II structures is well-graded granular material. Backfill underneath the FWSC and TB is lean concrete. The anticipated extent of granular backfill and lean concrete is shown on the foundation cross-sections on Figure 2.5.4-202 through Figure 2.5.4-204.

The excavated fill and bedrock may be processed to meet the required grading in accordance with Subsection 2.5.4.5.4. As an alternative or supplement to the onsite crushed rock, dense-graded aggregate from an off-site source may be used as engineered granular backfill material. Dense graded aggregate such as Size 21A or 21AA as specified by the Michigan Department of Transportation (Reference 2.5.4-233) is suitable material. These types of materials are available from local and regional quarry sources.

Once the imported source material is identified, the material(s) are sampled and tested to verify adherence to the required specifications for engineered granular backfill. Laboratory tests including moisture content per ASTM D2216 (Reference 2.5.4-213), sieve analysis per ASTM D422, (Reference 2.5.4-216), standard Proctor per ASTM D698 (Reference 2.5.4-234), modified Proctor tests per ASTM D1557 (Reference

2.5.4-235), Relative Density test per ASTM D 4253 and 4254 (Reference 2.5.4-236, Reference 2.5.4-237) and Direct Shear Test per ASTM D3080 (Reference 2.5.4-223) are performed to verify design requirement compliance for engineered granular backfill. The soundness of aggregate is confirmed using sulfate soundness per ASTM C88 (Reference 2.5.4-238) and Los Angeles abrasion tests per ASTM C131 and ASTM C535 (Reference 2.5.4-239, Reference 2.5.4-240).

Testing for chemical, static and dynamic properties are performed on all proposed engineering backfill material(s).

Completing the Fermi 3 excavation using vertical sidewall excavation in soils and bedrock results in a total estimated cut volume (in-place volume) of about 313,468 m^3 (410,000 cubic yards). The total estimated backfill volume (in-place volume) is 344,050 m^3 (450,000 cubic yards). The total estimated soil excavation (in-place volume) is about 256,126 m^3 (335,000 cubic yards). The total estimated bedrock excavation (in-place volume) is about 57,342 m^3 (75,000 cubic yards). Bulking and shrinkage factors have not been applied to the estimated excavation and backfill material volumes. Bulking and shrinkage factors are applied during the final design phase and are determined by specific material testing.

Insert 1 here

2.5.4.5.2 Extent of Excavations, Fills and Slopes

Vertical excavation faces within soil and bedrock could be achieved by using an excavation system consisting of a vertical cut-off, such as reinforced concrete diaphragm wall system around the entire excavation. In such a case, overburden soils would be excavated from ground surface to the estimated top of the bedrock surface at elevation 168.2 m (552 ft) NAVD 88. Bedrock would be excavated to reach the required foundation design elevations as shown in Table 2.5.4-224.

If the vertical cut-off wall were utilized, it would likely be installed from existing ground surface at elevation 177.1 m (581.0 ft) NAVD 88 to a depth determined during design to control seepage into the excavation, followed by excavation to the required foundation design elevations inside the cut-off walls through soil and bedrock. For this discussion, the Fermi 3 cut-off walls are assumed to be approximately 24.4 m (80 ft) deep with an embedment depth of approximately 15.2 m (50 ft) into bedrock, between elevations 168.2 and 153.5 m (552.0 and 503.7 ft) NAVD 88. Soil nails or rock bolts may be used to provide additional

lateral support, as necessary, based upon analysis during the detailed design phase if such an excavation system were used.

The reinforced concrete diaphragm wall will act as the perimeter of the soil excavation and will provide vertical support for the portion of the excavation within the soil. Structural design of the concrete diaphragm wall will be in accordance with ACI 318. The reinforced concrete diaphragm wall will be reinforced to resist lateral forces applied by the soils.

A plan view of the excavation for Fermi 3 using the vertical cut-off wall option in soil and bedrock is shown on Figure 2.5.4-201. Cross-sections of the excavation plan are shown on Figure 2.5.4-202, Figure 2.5.4-203, and Figure 2.5.4-204. These figures are intended to indicate the presence of the wall, but are not intended to establish distances between the wall and Seismic Category I structures. Considerations that will be taken into account regarding the distance between the wall and the Seismic Category I structures include the following:

- During design, the deflection of the concrete diaphragm wall will be estimated. The wall will be aligned to prevent the deflected wall from encroaching on the limits of Seismic Category I structures plus any construction limits.
- The wall will be aligned to allow sufficient space for placement of backfill outside the Seismic Category I structures.
- The wall will be aligned to allow sufficient space for performing inspections of the outside of the structures, as required, during construction.
- The distance from the Seismic Category I structures to the diaphragm wall will be established to provide sufficient space to facilitate erection of structures. Considerations for construction would include providing sufficient space for personnel and equipment.

Insert 2 Here

Seismic Category I structures are designed to resist all static and dynamic soil and bedrock loads assuming the concrete diaphragm wall is not present. There are no impacts to the completed Seismic Category I structures due to the presence of the concrete diaphragm wall as the wall will not impact the foundation input response spectra (FIRS) and the diaphragm wall will be supported on both sides when structures are completed, as backfill will be placed in the gap between the structure and

geologic mapping program includes photographic documentation of the exposed surface and documentation for significant geologic features.

The details of the quality control and quality assurance programs for foundation bedrock are addressed in the design specifications prepared during the detailed design phase of the project.

2.5.4.5.4.2 Backfill Materials and Quality Control

engineered

Backfill for the Fermi 3 may consist of concrete fill or a sound, well graded granular backfill. Engineered granular backfill to be used will have a ϕ' equal to or greater than 35 degrees when properly placed and compacted. In addition, the engineered backfill is required to meet the following criteria:

i. Product of peak ground acceleration α (in g), Poisson's ratio ν and density γ

$\alpha(0.95v + 0.65)\gamma$: 1220 kg/m^3 (76 lbf/ft^3) maximum

ii. Product of at-rest pressure coefficient κ_0 and density:

$\kappa_0\gamma$:750 kg/m^3 (47 lbf/ft^3) minimum

iii. Soil density

γ: 2000 kg/m^3 (125 lbf/ft^3) minimum

iv. Minimum shear wave velocity v_s associated with seismic strains for lower bound soil properties at minus one sigma from the mean v_s: 300 m/s (1000 ft/s)

Insert 3 Here

engineered

The anticipated extent of lean concrete fill and granular backfill is shown on Figure 2.5.4-202, Figure 2.5.4-203, and Figure 2.5.4-204.

Concrete fill mix designs are addressed in a design specification prepared during the detailed design phase of the project. Field observation is performed to verify that approved mixes are used and test specimens are obtained that verify that specified design parameters are reached. The foundation bedrock and concrete fill provide adequately high factors of safety against bearing capacity failure under both static and seismic structural loading. Quality Control testing requirements for bedrock include visual inspection and geologic mapping.

Engineered granular backfill sources are identified and tested for engineering properties, in accordance with recommendations from Subsection 2.5.4.5.1 and other testing as required by design specifications. During detailed design, the laboratory testing in

Subsection 2.5.4.5.1 is implemented to establish the required density to meet design requirements of the engineered granular backfill adjacent to Category I structures. To further confirm the density selected based on the laboratory testing results meets the design requirements, a program will be implemented to test the in-place engineered granular backfill, which could consist of construction of a test pad(s). Also during ~~detailed design~~, a testing program will be implemented to confirm the engineered granular backfill placed ~~during construction~~ meets the design requirements. For liquefaction, the program could consist of performing standard penetration tests to confirm the fill has the minimum N_{60} in Subsection 2.5.4.8.

construction

a

Engineered granular backfill is compacted to achieve density that results in the backfill having a minimum ϕ' of 35 degrees. Based on correlations of strength characteristics for granular soils (Reference 2.5.4-242), the ϕ' of compacted granular soils can achieve 35 degree. Engineered granular backfill materials are placed in controlled lifts and compacted. Within confined areas or close to foundation walls, smaller compactors are used to prevent excessive lateral pressures against the walls from stress caused by heavy compactors.

Insert pagagraph

Insert paragraph and then Insert 4 Here

with and without improvement

Evaluation and discussion of liquefaction issues related to soil backfill materials is provided in Subsection 2.5.4.8. Lateral pressures applied against foundation walls are evaluated and discussed in Subsection 2.5.4.10.

engineered

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A quality control sampling and testing program is developed to verify that concrete fill and granular backfill ~~material properties~~ conform to the specified design parameters. Sufficient laboratory compaction and grain size distribution tests are performed to account for variations in fill material. A test fill program may be included for the purposes of determining an optimum size of compaction equipment, number of passes, lift thickness, and other relevant data for achievement of the specified compaction.

the properties of

Lean concrete used as fill under the FWSC will be proportioned, tested and the placement controlled in accordance with Regulatory Guide 1.142. Additionally, ACI 349 requirements for concrete exposed to sulfate-containing solutions will be implemented. The lean concrete fill will have a mean 28-day compressive strength of equal to, or greater than, 13.8 MPa (2000 psi) with a mean shear wave velocity of equal to, or greater than, 1,100 m/s (3600 ft/s). Compressive strength of the lean

concrete will be tested in accordance with Regulatory Guide 1.142. The compressive strength of the concrete will be used to calculate shear wave velocity to ensure that the shear wave velocity of 1,100 m/s (3600 ft/s) is met. The mix design developed for the lean concrete will control erosion and leaching due to contact with site groundwater and limit settlement to specified tolerances (Table 2.0-201), including creep and shrinkage.

The quality control program for fill concrete includes requirements for compressive strength testing. Verification will be performed to confirm that compressive strength testing results comply with mix design, minimum strengths, and placement requirements. The details of the quality control program will be addressed in a design specification prepared during the detailed design phase of the project.

engineered

with and without improvement

The quality control program for granular backfill includes requirements for field in place density tests, shear wave velocity measurements, and index tests to confirm material classification and compaction characteristics are within the compliance range of materials specified and used for design. The ITAAC for backfill surrounding the embedded walls of Seismic Category I structures are provided in Part 10, Section 2.4.2. Granular backfill placement and compaction methods will be addressed in design specifications prepared in the detailed design stage of the project.

Insert 5 Here

The details of the quality control and quality assurance programs for concrete fill and granular backfill are addressed in the specifications prepared during the detailed design phase of the project.

2.5.4.5.5 Control of Groundwater during Excavation

Control of groundwater and dewatering during excavation is presented in Subsection 2.5.4.6.2.

2.5.4.5.6 Geotechnical Instrumentation

The Fermi 3 excavation support and seepage control system will be continually monitored during excavation activities for movement and/or deflection. Real time data acquisition techniques may be used for collection and graphical representation of the data. An instrumentation and monitoring program developed during the project detailed design phase may include inclinometers, piezometers, seismographs, survey points, and construction inspection documentation.

Insert 1

The volume of granular backfill from on-site is estimated to be 179,700 m^3 (235,000 cubic yards) and the volume of granular backfill from offsite sources is estimated to be 133,800 m^3 (175,000 cubic yards). The remainder of the planned backfill is lean concrete below the FWSC and TB.

Insert 2

- The minimum horizontal extent of backfill adjacent to Seismic Category I structures, $L_{\min}$, will be calculated using the following equation:

$$L_{\min} = \frac{H}{\tan(45^o - \phi'/2)}$$

where H is the height of backfill adjacent to the Seismic Category I structures, and ϕ' is the angle of internal friction of the backfill.

Insert 3

To meet the minimum shear wave velocity requirement near the ground surface in the backfill adjacent to Seismic Category I structures, the near surface engineered granular backfill can be improved by adding cement to make roller-compacted concrete or a similar product. Improvement of the granular backfill will be implemented from the final plant grade to a depth established during detailed design.

Insert 4

The design of improved engineered granular backfill is addressed during detailed design, where the option(s) for improvement is finalized, and the mix design, placement methodology, and construction testing specification are developed. Testing to develop the mix design includes unconfined compression testing with samples prepared in accordance with ASTM C 1435/C 1435M, Standard Practice for Molding Roller-Compacted Concrete Cylinder Molds Using a Vibrating Hammer. The mix unconfined compressive strength will be used to calculate the shear wave velocity to ensure a shear wave velocity of 300 m/s (1,000 ft/s) per the Referenced DCD. During construction, observation will verify that the approved mixes are used and test specimens are obtained to verify the design parameters are achieved. Testing during construction to verify the properties of the improved engineered granular backfill includes in-place density testing, unconfined compression testing of core samples obtained from in-place backfill, and in-place shear wave velocity testing. The improved engineered granular backfill will be designed in accordance with ACI 318 for plain concrete and ACI 207.5R for roller-compacted concrete. ACI 349 requirements for concrete exposed to sulfate-containing solutions will be implemented to select the cement type.

Insert 5

Test methods for index and static engineering properties of the Seismic Category I side backfill are provided in Section 2.5.4.5.1. Acceptable test methods for the dynamic property of in situ shear wave velocity of the backfill adjacent to Seismic Category I structures are as follows:

- P-S Suspension logging
- Downhole seismic testing (ASTM D 7400)
- Crosshole seismic testing (ASTM D 4428)
- Spectra analysis of surface waves (SASW) method

The test methods, frequency, location, and elevation of testing associated with ITAACs on the backfill adjacent to Seismic Category I structures are provided in the following:

- Direct Shear Test (ASTM D 3080) - Minimum of 3 tests per material type per borrow source.
- Maximum and Minimum Relative Density Test (ASTM D 4253, ASTM D 4254) - Minimum of 3 tests per material type per borrow source.
- Modified Proctor Test (ASTM D 1557) - Minimum of 3 tests per material type per borrow source.
- Sieve Analysis (ASTM D 422) - Minimum of 10 tests per material type per borrow source.
- Moisture Content (ASTM D 2216) - Minimum of 10 tests per material type per borrow source.
- Unconfined Compression Test (ASTM C 39/C 39M) - test frequency and location determined during detailed design and provided in construction specifications.
- Shear Wave Velocity Measurement - Minimum of 2 test locations within 50 feet of the Seismic Category I structures, with measurements performed from the ground surface to the top of Bass Islands Unit bedrock.
- Standard Penetration Testing in Borings - Minimum of 4 borings performed within 50 feet of the Seismic Category I structures, and from the ground surface to the top of Bass Islands Unit bedrock.
- In-Place Density Tests (ASTM D 6938) – test frequency and location determined during detailed design and provided in construction specifications.