PMFermiCOLPEm Resource

From: Berrios, Ilka
Sent: Wednesday, October 28, 2009 3:24 PM
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Subject: DRAFT RAIs Chapter 2
Attachments: RAI 3935.doc; RAI 3938.doc; RAI 3940.doc; RAI 3913.doc; RAI 3917.doc; RAI 3918.doc

All,

Attached files are DRAFT RAIs related to FSAR sections 2.5.1, 2.5.2, 2.5.3 and 2.5.5. Please review them and let me know if a call is needed to clarify any of these questions. If we don't hear from you by Monday, we'll assume that a call is not needed and the RAI letter will be issued.

Any questions, please let me know.

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MESSAGE	499	10/28/2009 3:24:27 PM
RAI 3935.doc	30714	
RAI 3938.doc	30202	
RAI 3940.doc	30714	
RAI 3913.doc	48634	
RAI 3917.doc	36858	
RAI 3918.doc	35322	

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Request for Additional Information No. 3935 Revision 1

Fermi Unit 3
Detroit Edison
Docket No. 52-033
SRP Section: 02.05.01 - Basic Geologic and Seismic Information
Application Section: 2.5.1

QUESTIONS for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

02.05.01-***

FSAR Section 2.5.1.1.4.3.3.1 states that a series of earthquakes occurred between 1987 and 2001 near Ashtabula County, Ohio and that a July 1987 mainshock was followed by a January 2001 event making it seem that there were no earthquakes between these events. The FSAR goes on to state that the 1987 event, and its aftershocks, were within 1 km of an injection well. The FSAR states that the series of earthquakes in 2001 were precisely recorded by the Ohio seismic network but the FSAR does not provide any additional details of the larger 2001 event (or associated smaller events) including their location or the basis for linking the 1987 and 2001 events. In addition, FSAR Figure 2.5.1-207 does not differentiate the 1987 from the 2001 events. Please provide additional information regarding the 2001 series of earthquakes in the Northeast Ohio seismic zone including how they are clearly linked to the 1987 event and if they are related to fluid injection or the regional tectonics. In addition, please update FSAR Figure 2.5.1-207 to distinguish between the 1987 and 2001 events.

Request for Additional Information No. 3938 Revision 1

Fermi Unit 3
Detroit Edison
Docket No. 52-033
SRP Section: 02.05.02 - Vibratory Ground Motion
Application Section: 2.5.2

QUESTIONS for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

02.05.02-***

In order for the staff to verify the adequacy of the Fermi 3 PSHA relative to the seismicity in the Anna, Ohio and Northeast Ohio areas, please provide the input source parameters (e.g. activity rates) as well as the specific source geometries used by each of the EPRI Teams to model these two potential sources. In addition, provide the corresponding PSHA hazard curves for these two sources.

Request for Additional Information No. 3940 Revision 0

Fermi Unit 3
Detroit Edison
Docket No. 52-033
SRP Section: 02.05.05 - Stability of Slopes
Application Section: 2.5.5

QUESTIONS for Geosciences and Geotechnical Engineering Branch 1 (RGS1)

02.05.05-***

FSAR Section 2.5.5.2 states the following:

> "The maximum slope angle of any permanent slope angle for Fermi 3 in the power block area or elsewhere is 8 percent (4.6 degrees). The slope angle is 6.5 times less than the minimum required effective angle of internal friction of the engineered fill or existing fill; therefore, 8 percent slopes are considered stable. Therefore, the finished grade has no impact on Fermi 3 safety related systems, structures, or components."

a) Please provide information on the seismically induced lateral spreading, including any potential effect on intake piping or other important utilities buried underground. Please discuss whether or not such lateral spreading is a significant issue for the 8 percent slopes at the Fermi 3 site.

b) Please discuss the plans for monitoring during and after construction to detect occurrences that could detrimentally affect the facility. Such monitoring includes periodic examination of slopes, survey of settlement monuments, and measurements of local wells and piezometers as well as any evidence of seepage.

Request for Additional Information No. 3913 Revision 1

Fermi Unit 3
Detroit Edison
Docket No. 52-033
SRP Section: 02.05.01 - Basic Geologic and Seismic Information
Application Section: 2.5.1

QUESTIONS for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

02.05.01-***

FSAR Section 2.5.1.1.1.2 states that the local relief of the Southern New York section is up to 320 m (200 ft). The same paragraph states that the Southern New York section has a lower local relief than the Kanawha section, which has local relief up to 244 m (800 ft). Please clarify these statements given that 320 meters is not equivalent to 200 feet as suggested in regards to the Southern New York section.

02.05.01-***

FSAR Section 2.5.1.1.4.1 discusses the contemporary stress environment in the Fermi site region and cites FSAR Figure 2.5.1–219. FSAR Figure 2.5.1-219 contains symbols of differing sizes. Please modify the figure to provide an explanation of the differing symbol sizes.

02.05.01-***

FSAR Sections 2.5.1.1.4.1.1 and 2.5.3.2.2 provide limited discussions on the effects of glacial isostatic adjustments (GIA). FSAR Section 2.5.1.1.4.1.1 states that GIA is "suspected to be a cause of deformation within continental plates and may be a trigger of seismicity in eastern North America and other formerly glaciated regions." Please provide additional discussion of the following:

(a) The potential GIA effects that might impact the seismic hazard in the Fermi site region
(b) The geodetic strain rates that are currently measured in the site region
(c) Any unusual strain gradients in the region and if there is any indication of localized strain on or near potential seismogenic structures
(d) Any deformed glacial shorelines and whether or not the shoreline deformation can be explained solely by GIA processes

02.05.01-***

FSAR Section 2.5.1.1.4.1.1 describes (1) substantial deformation of the Port Huron shoreline (60 meters of uplift between 11,000 and 7,000 years BP), (2) upwarping of shorelines as young as 4,700 years, and (3) recognition of widespread uplift and rebound through the Holocene.

(a) As noted in FSAR Section 2.5.1.1.4.1.1, "rebound information is most easily conveyed in plots of the elevation of a given shoreline across a distance." Therefore, please provide maps and/or profiles to illustrate the extent of this deformation and its relation to the Fermi site. In addition, discuss the implications of regional deformation data for assessing potential uplift or subsidence at the Fermi site.

(b) FSAR Section 2.5.1.1.4.1.1 also describes regions of recent uplift and subsidence in relation to the site, as indicated by the GPS velocity field. Please include one or more figures illustrating this deformation.

02.05.01-***

FSAR Section 2.5.1.1.4.1.1 states that the elevation of the Onondaga Limestone at Buffalo New York is now the main control on the level of Lake Erie. The FSAR states that that the elevation of the Onondaga is 25 km (8200 feet) upriver from Niagara Falls. Please clarify the elevation given that 25 km is not equivalent to 8200 feet.

02.05.01-***

FSAR Section 2.5.1.1.4.3 systematically discusses significant structures in the site region (320-km radius). For many structures, the FSAR describes the observations and relations that establish limits on the times of most recent deformation on specific structures. This important information is not included for all structures. Please summarize the observations that define limits on the times of the most recent deformation for the following structures in the Fermi site region:

a. Peck fault (FSAR Section 2.5.1.1.4.3.2.11)

b. Sharpsville fault (FSAR Section 2.5.1.1.4.3.2.13)

c. Transylvania fault extension (FSAR Section 2.5.1.1.4.3.2.14)

02.05.01-***

FSAR Table 2.5.1–201 summarizes information about faults and folds in the Fermi site region. The table includes a column entitled "Unit/Age/Amount of Youngest Deformation/Offset" that lists the youngest faulted or deformed unit for most structures. However, the table (and the FSAR in general) does not provide explicit discussion of the oldest unfaulted unit associated with each fault or fold. For the faults and folds in Table 2.5.1–201, please summarize observations that place limits on the cessation of faulting (i.e., describe the oldest unfaulted or undeformed units for the structures included in the table).

02.05.01-***

In FSAR Section 2.5.1.1.4.3.2.12, the Royal Center fault is described as "a steeply southeast-dipping, down-to-the-southwest normal fault on the north flank of the Kankakee arch." It is unclear how the fault can be dipping to the southeast with a down-to-the-southwest sense of slip. Please correct, or clarify, this statement.

02.05.01-***

FSAR Section 2.5.1.1.4.3.3 states that “no faults in the site region exhibit evidence of movement since the Paleozoic (Reference 2.5.1–344).” Similarly, FSAR Section 2.5.1.1.4.3 states, “There is no evidence to indicate that reactivation of structures in the Mesozoic…occurred in the region.” However, FSAR Section 2.5.1.1.4.3.2.14, which discusses the Transylvania fault extension, states that the Middleburg fault was reactivated “during the Early Jurassic faulting of the rift basins along the margin of the continent (Reference 2.5.1–342).” Please resolve these statements.

02.05.01-***

FSAR Section 2.5.1.1.4.3.3.1 does not discuss liquefaction studies within the Northeast Ohio seismic zone. However, Crone and Wheeler (FSAR Reference 2.5.1–316) cite Obermeier for his examination of streambanks for liquefaction features in the Northeast Ohio seismic zone. Paleoliquefaction investigations are relevant to evaluating the potential for magnitude 6 or larger earthquakes that may have occurred within the Northeast Ohio seismic zone. Given the proximity of the Northeast Ohio seismic zone to the Fermi site, an earthquake of magnitude 6 or larger may impact the seismic hazard at the Fermi site. Therefore, please include a description of any paleoseismic investigations conducted in the Northeast Ohio seismic zone including the locations investigated and the level of detail of the investigations.

02.05.01-***

FSAR Section 2.5.1.1.4.3.3.1 makes the point that the “sequence of earthquakes near Ashtabula…is likely due to fluid injection causing failure along favorably oriented, pre-existing fractures….” Because artificial changes in subsurface hydrology can alter the mechanical conditions of the upper crust and trigger seismicity, it is important to know whether there are any other locations within the site region where large volumes of fluid are being injected or withdrawn. Please provide this information.

02.05.01-***

FSAR Section 2.5.1.1.4.3.3.1 indicates that “Seeber and Armbruster (FSAR Reference 2.5.1–346) speculate that a single-event rupture of a 5 to 10 km (3 to 6 mi) long fault could generate a magnitude 5 to 6 earthquake.” As stated, however, the relationship of such a fault to the Ashtabula seismicity is unclear. In FSAR Reference 2.5.1-346, Seeber and Armbruster indicate that a single active fault of this length is consistent with the combined Ashtabula seismicity (through 1992). Please clarify this point.

02.05.01-***

FSAR Section 2.5.1.1.4.3.3.2 cites Hansen (1993) (FSAR Reference 2.5.1–344) which suggests that the Anna seismic zone is capable of producing a magnitude 6.0 to 7.0

event. Given the proximity of the Anna seismic zone to the Fermi site, please provide a more complete discussion of the basis for this interpretation.

02.05.01-***

FSAR Section 2.5.1.1.4.3.3.2 indicates that Obermeier (FSAR Reference 2.5.1–350) investigated streambanks in the vicinity of the Anna seismic zone and found no evidence of paleoliquefaction features. Given the proximity of the Anna seismic zone to the Fermi site, please provide additional discussion regarding the extent of the Obermeier investigations, including the locations investigated, and the basis for his conclusion that no evidence for paleoliquefaction features exist in the Anna seismic zone vicinity.

02.05.01-***

FSAR Section 2.5.1.1.4.4.1 discusses the New Madrid seismic zone as a significant seismic source at a distance greater than 320 km (200 mi) from the Fermi site.

(a) The FSAR briefly presents Forte and others (Reference 2.5.1–357) as providing an explanation for earthquakes in the New Madrid seismic zone. The mechanism proposed by Forte and others explaining New Madrid seismicity is the only explanation presented in FSAR Section 2.5.1. While the explanation of Forte and others is the newest mechanism, it is not the only one. For example, Kenner and Segall (2000, Science, v. 289, p. 2,329–2,332) present another mechanism to explain the New Madrid seismicity. Other possible mechanisms have been published as well. Please discuss a range of published mechanisms and discuss if there is a consensus for their applicability to the New Madrid seismic zone.

(b) FSAR Section 2.5.1.1.4.4.1 makes a reference to the Reelfoot rift and the Cottonwood Grove fault, which are not shown in FSAR Figure 2.5.1–207. FSAR Figure 2.5.1–207, sheet 3 of 3, inset C is the cited figure for the discussion of the New Madrid seismic zone. Also, the 2008 M5.2 Mt. Carmel earthquake is cited in the following subsection on the Wabash seismic zone but not shown in inset D on this same page. Please add these three features to this figure or adjust the text appropriately.

02.05.01-***

FSAR Section 2.5.1.2.1 describes the physiographic subdivisions in the site vicinity. The St. Clair clay plain and the Maumee Lake plains are not shown on the regional physiographic map (FSAR Figure 2.5.1–202). Please include these subdivisions in the context of the overall physiographic framework, either on this map or on a larger-scale map showing the physiography of the site vicinity. Also, the term “section” is used within the FSAR text, but “subprovince” is used on the map. Please clarify the appropriate terminology.

02.05.01-***

FSAR Section 2.5.1.2.2.2 mentions that the shoreline of Glacial Lake Leverett “would have been in or near the site study vicinity…” Please indicate whether shorelines mapped within the site vicinity may be correlated to this (or other previously mapped) shorelines.

02.05.01-***

FSAR Section 2.5.1.2.2.2 states that “Lakes of the Mackinaw Interstade (Glacial Lakes Maumee and Arkona in the site vicinity) …. and younger lakes have surface expression continuity and preserved landforms that document the rebound history of the area.” Please describe this rebound history and cite any pertinent references. This appears to be important information bearing on the latest Pleistocene to Holocene history of vertical movement in the site vicinity.

02.05.01-***

In FSAR Section 2.5.1.2.4.1, there are numerous incorrect figure references. For example, the discussion of Structures Within the Site Vicinity refers to FSAR Figure 2.5.1–234 (“Maps Showing Late Wisconsinan Ice Margins and Proglacial Lake Shorelines”) when discussing the Bowling Green fault and the Howell anticline. When discussing the Bowling Green fault, the FSAR incorrectly refers to FSAR Figure 2.5.1–231 and to FSAR Figure 2.5.1-246. Please make the appropriate corrections.

02.05.01-***

FSAR Section 2.5.1.2.4.1 discusses structures in the site vicinity (including a description of the Maumee fault) and cites FSAR Figure 2.5.1–231. In this figure (and also in FSAR Figure 2.5.2–230), the bathymetry of Lake Erie shows a very straight, northeast-trending feature that extends into the lake from the mouth of the Maumee River. It lies on the projection of the on-land Maumee fault. If this feature is an accurate representation of the lake-bottom topography, then please explain the origin of this >25-km-long feature on the lake bottom.

02.05.01-***

FSAR Figure 2.5.1-227 shows a high incidence landslide area less than 50 km southwest of the proposed Fermi 3 site, and possibly within the 40 km site vicinity. Please discuss the relevance of such high landslide susceptibility within the site vicinity.

02.05.01-***

FSAR Section 2.5.1.2.5 states that “The natural slopes are probably not landslide prone; however, the stability of the lacustrine deposits should be considered in excavation design (Reference 2.5.1-387)” Please provide any appropriate references to more detailed discussions included elsewhere in the FSAR regarding the stability of the lacustrine deposits.

02.05.01-***

FSAR Table 2.5.1-201 (Sheet 13) states that the Burning Springs Anticline (BSA) (discussed in FSAR Section 2.5.1.1.4.3.2.4) exhibits "only folding in Late Silurian Salina Group and younger strata." This implies that post-Silurian strata are folded and that the BSA could still be active. Please clarify this description to include the geologic constraints that define when deformation on the BSA ceased.

02.05.01-***

FSAR Figure 2.5.1–203 shows numerous faults within the 320 km site radius, including: the Outlet fault, the Marian fault, and the Colchester fault. These three structures are not discussed in the FSAR text even though they are located well within the 320 km site radius. Please provide a discussion of these faults similar to those presented for other regional structures described in the FSAR.

02.05.01-***

FSAR Figure 2.5.1-236 shows an enlargement of the site exploration plan with geologic cross section locations. The cross section labels (A–A’, B–B’, etc.) are obscured and difficult to read. Please provide an updated figure with clear labels in order to identify each of the geologic cross section locations.

02.05.01-***

FSAR Figure 2.5.1–237 shows the cross-section of a syncline that underlies the Fermi Site. The cross section reveals a topographic low above the syncline axis that is filled with postglacial lacustrine deposits. These relations imply that the underlying glacial till was subject to postlacustrine folding. Please explain this apparent deformation of the glacial till and (or) thickness changes as depicted in FSAR Figure 2.5.1–237. Please explain if the overlying lacustrine deposits are deformed?

02.05.01-***

Please provide the following text and figural corrections:

a. FSAR Section 2.5.1.1.4.2.1 discusses the gravity and magnetic data and states “Figure 2.5.2–219 illustrates the boundary interpreted by Van Schumus.” This figure number is incorrect; it should be FSAR Figure 2.5.1–220.

b. FSAR Section 2.5.1.1.4.3.3 introduces and describes the Northeast Ohio and Anna seismic zones. Although these zones are shown in FSAR Figure 2.5.1–207 (Sheets 1 through 3), this figure is not cited in this FSAR section. Please include the appropriate figure citations.

c. The two references to “FSAR Subsection 2.5.1.1.4.4” in FSAR Section 2.5.1.1.4.3 should read “Subsection 2.5.1.1.4.3.3”.

Request for Additional Information No. 3917 Revision 1

Fermi Unit 3
Detroit Edison
Docket No. 52-033
SRP Section: 02.05.03 - Surface Faulting
Application Section: 2.5.3

QUESTIONS for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

02.05.03-***

FSAR Section 2.5.3.2.1 states that “only one possible fault, the fault trend associated with the New Boston pool” may extend into the site area. However, Figures 2.5.3-202 and 2.5.3-203 show the possible Sumpter pool fault, and not the New Boston pool fault, extending into the site area. In addition, FSAR Section 2.5.1.2.4.1 suggests that the Sumpter pool fault is the only fault that extends into the site area. Please reconcile the inconsistency between the FSAR statements and FSAR Figures 2.5.3-202 and 2.5.3-203.

02.05.03-***

FSAR Section 2.5.3.1 indicates that field and aerial reconnaissance studies were done to examine known faults in the site vicinity. In addition, FSAR Section 2.5.3.4 states that “no evidence of paleoliquefaction is reported in the literature or was observed within the site vicinity or site region.” However, in the central and eastern U.S. (CEUS), large historical earthquakes tend not to produce surface rupture but are expressed in the geologic record by liquefaction features. Most evidence of large prehistoric earthquakes in the CEUS is based on the recognition and analysis of paleoliquefaction features. It is noteworthy that several aspects of the Quaternary deposits in the Fermi site area make them potentially suitable for liquefaction. The topographic map of the site (FSAR Figure 2.5.1–229) shows abundant marshy areas, which is obvious evidence of locally high water tables. In addition, the site is underlain by fine-grained lacustrine deposits that are interbedded with sandy shoreline and beach deposits. The combination of high water table and interbedded fine-grained and sandy deposits may be optimal conditions for liquefaction. The FSAR does not discuss nor mention efforts to search the site vicinity for evidence of strong ground shaking as recorded by paleoliquefaction features. Please indicate if any such studies were conducted or if any of the field reconnaissance concentrated on the search for such evidence. Please provide a detailed description of all paleoliquefaction investigations conducted in the site vicinity including (1) the locations investigated, (2)the site conditions for these investigations and whether or not the conditions are appropriate for liquefaction to occur, and (3) the types of outcrops, surfaces, and sediments examined as well as the quality of the exposures. In addition, please include any relative figures that document conclusions regarding the presence or absence of paleoliquefcation features.

02.05.03-***

FSAR Section 2.5.3.2.1 briefly discusses Quaternary stratigraphy based on FSAR Section 2.5.1 but does not report details of observations that bear on the deformation or lack of deformation of Quaternary deposits as revealed in stratigraphic exposures. Please describe any observations of the stratigraphy (from pits, trenches, boreholes, or natural exposures) that help constrain postglacial deformation in the site vicinity, especially with respect to the lacustrine deposits. In addition, please provide any relevant figures to help document your observations and conclusions regarding the Quaternary deposits surrounding the Fermi site.

02.05.03-***

FSAR Section 2.5.3.2.3 indicates that a lineament analysis was conducted for the site vicinity using a USGS 10-m DEM (Digital Elevation Model). However, the FSAR also states that "Given the low strain rates in the site region, the young surficial and near surface deposits are unsuitable for detecting long-term neotectonic strain deformation." If this is the case, then please discuss the vertical resolution of the USGS 10-m DEM and whether it is appropriate to base a negative conclusion on this dataset. Also, please discuss the availability of LiDAR high-resolution topographic datasets for the site vicinity and how these data might be used for a more detailed analysis of possible postglacial surface deformation.

02.05.03-***

The Fermi site is located on the western shore of Lake Erie, and several faults and folds discussed in the FSAR trend directly into the lake. However, the FSAR does not address if there are any high-resolution bathymetric data or seismic-reflection data that might better characterize the presence or absence of young tectonic deformation in the site region. Please discuss any relevant marine seismic and bathymetric data for Lake Erie in the context of placing limits on recent tectonic deformation in the site region.

02.05.03-***

FSAR Section 2.5.3.2.3 refers to FSAR Figure 2.5.3–201 and states that paleo-shoreline features in the site vicinity cross possible fault trends with no apparent disruption. Please indicate the resolution of this observation and whether it was based on field or map analyses. The FSAR does not address whether shoreline-elevation data in the site vicinity record possible deformation over a broader area. Please provide a discussion of this topic and, if tilting is evident, whether it can be attributed solely to glacial isostatic adjustments or whether it may suggest diffuse tectonic deformation. If appropriate, please include a figure showing elevation changes along paleo-shorelines identified in FSAR Figure 2.5.3–201 (in particular, n1 and n3).

02.05.03-***

FSAR Sections 2.5.3.2.3 and 2.5.3.6 state that "Given the low strain rates in the site region, the young surficial and near surface deposits are unsuitable for detecting long-term neotectonic strain deformation." FSAR Section 2.5.3.6 later argues that none of the mapped bedrock faults are assessed to be capable tectonic sources based on lack of evidence for post-Mesozoic deformation and the absence of Quaternary deformation in the site area. Please explain more fully how potential capable tectonic sources can be confidently characterized in the Site Region if: (1) the Mesozoic stratigraphic record is missing, (2) the Quaternary record is limited to glacial deposits younger than ~13 ka that unconformably overlie Paleozoic rocks, and (3) the young surficial and near-surface deposits are indeed "unsuitable for detecting long-term neotectonic strain deformation" as previously stated in the FSAR.

02.05.03-***

FSAR Section 2.5.3.2.3 discusses the results of lineament analyses and implies that the postulated Sumpter Pool fault may line up with a mapped lineament. Please clarify which topographic lineament/s could be possible continuations of the postulated Sumpter Pool fault.

Request for Additional Information No. 3918 Revision 0

Fermi Unit 3
Detroit Edison
Docket No. 52-033
SRP Section: 02.05.02 - Vibratory Ground Motion
Application Section: 2.5.2

QUESTIONS for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

02.05.02-***

FSAR Section 2.5.2.4.1.1 and FSAR Appendix 2.5BB discuss the updated characterization of large magnitude New Madrid seismic zone (NMSZ) earthquakes. Please provide the initial time (t_0) parameter used in modeling the time dependent seismic hazard model for the NMSZ. The ESBWR is designed with an operating life of 60 years and the fuel loading time is not yet certain. Please explain how you considered these factors in choosing the t_0 and Δt parameters. In addition, demonstrate the sensitivity of those parameters to the seismic hazard at the Fermi site.

02.05.02-***

FSAR Section 2.5.2.4 includes an update of the EPRI SOG seismic source parameters (specifically, maximum magnitudes) based on the latest earthquake information. Please explain why the maximum magnitudes for the Bechtel BZ3 source were updated but the Law Engineering source114 maximum magnitudes were not updated. In addition, with regard to updating the EPRI SOG source parameters, describe whether or not a SSHAC process was followed.

02.05.02-***

FSAR Sections 2.5.1.1.4.4 and 2.5.2.4.1 discuss significant seismic sources at distances greater than 320 km from the Fermi site, including the New Madrid and Wabash Valley seismic zones. The FSAR does not discuss the Western Quebec seismic zone (WQSZ) in Canada even though it is a similar distance from the Fermi site as the New Madrid seismic zone (NMSZ). Previous research has provided paleoseismic evidence for two **M** > 7 earthquakes in the past 7000 years in the Ottawa River Valley (Aylsworth and Lawrence 2000, Geology, v28, no 10, p 903-906). Please include a discussion of the WQSZ, including the significance of this paleoseismic evidence to the seismic zone's characterization and its consequent impact on seismic hazard at the Fermi site.

02.05.02-***

FSAR section 2.5.2.4.2.1 and FSAR Figure 2.5.2–221 compare the EPRI 2004 ground motion models to newer ground motion models for the CEUS. The FSAR concludes that the newer ground motion models fall within the range of the EPRI models. However, it appears that two of the newer models (Atkinson and Boore, 2006, and Tavakoli and

Pezeshk, 2005) fall close to (or above) the EPRI models at distances and frequencies relevant to seismic hazard at the Fermi site. For example, the median Atkinson and Boore (2006) model for a **M** 7.5 event, 1 Hz Spectral Acceleration, and distances of greater than 300 km, is above the EPRI Cluster 2 median and approaches the 95 percent level (FSAR Figure 2.5.2–221). The Tavakoli and Pezeshk (2005) model (**M** = 5) is also above the EPRI Cluster 3 median at short (less than 20 km) distances and high frequencies. The Tavakoli and Pezeshk model also exceeds the 95 percent level at very short distances. Please explain how the inclusion of these models instead of the EPRI Cluster 2 and 3 models would affect both low and high frequency seismic hazard at the Fermi site.

02.05.02-***

FSAR Section 2.5.2.5.1.2 discusses soil dynamic properties for the Fermi site. Please justify your position that soils (claystones with Vs of approximately 3000 ft/s) at the Fermi site would behave linearly under the local strain conditions. In addition, explain why you used Vucetic and Dorby's clay dynamic property, instead of site-specific modulus and damping curves to represent the soil non-linear behavior for the glacial till. Please provide the basis for the FSAR statement that "lean concrete backfill was assumed to remain linear for shear strain less than 0.01 percent and then exhibit a mild degree of nonlinearity at high strains."

02.05.02-***

FSAR Section 2.5.2.4.4.3 indicates that you used Baker and Cornell's response spectral correlation method to extrapolate spectral shapes. However, the Baker and Cornell method used worldwide recordings from both the NEHRP B/C type soil boundary and the first story of structures. Please explain 1) why the free field and first story recordings can be mixed together to predict the correlation, and 2) why the correlation from the B/C boundary can be used to represent the other soil types.

02.05.02-***

FSAR Figures 2.5.2–236 through 2.5.2–241 display the effects of various factors (seismic sources, ground motion models, model uncertainties, etc.) on the calculated seismic hazard at the Fermi site. However, these figures alternate between comparing mean and median ground motion. Please verify the content of the "mean" and "median" in those figures.