DTE Energy
One Energy Plaza, Detroit, MI 48226-1279

DTE Energy

10 CFR 52.79

February 8, 2013
NRC3-13-0007

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

References:
1) Fermi 3
Docket No. 52-033
2) Letter from Tekia Govan (USNRC) to Peter W. Smith (DTE Electric), "Request for Additional Information Letter No. 82 Related to Chapters 02.05.02 and 03.07.02 for the Fermi 3 Combined License Application," dated January 14, 2013
3) Letter from Peter W. Smith (Detroit Edison) to USNRC, "Detroit Edison Company Interim Response to NRC Request for Additional Information Letter No. 79," NRC3-12-0030, dated October 12, 2012
4) Letter from Peter W. Smith (Detroit Edison) to USNRC, "Detroit Edison Company Interim Response to NRC Request for Additional Information Letter Nos. 77 and 79," NRC3-12-0033, dated December 14, 2012

Subject: DTE Electric Company Response to NRC Request for Additional Information Letter No. 82

In Reference 2, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combined License Application (COLA). Both Requests for Additional Information (RAIs) in Reference 2 are related to the shear wave velocity profiles that are described in FSAR Subsection 3.7.1.

Attachments 1 and 2 provide the responses to RAIs 03.07.02-10 and 02.05.02-20, respectively. As is noted in the RAIs, the shear wave velocity profiles are used as input to the site-specific soil-structure interaction (SSI) analyses. For this reason, the changes described in Attachments 1 and 2 will impact the proposed SSI analyses that were described in detail in Reference 3. There is no impact on the schedule for performing the SSI analyses that was provided in Reference 4 because of these changes. As described in Reference 4, markups to FSAR Subsection 3.7.1

D095
NRO

are scheduled to be submitted by April 26, 2013, and will address the responses to RAIs 03.07.02-10 and 02.05.02-20.

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 8th day of February 2013.

Sincerely,

Peter W. Smith, Director
Nuclear Development – Licensing and Engineering
DTE Electric Company

Attachments:
1) Response to RAI Letter No. 82 (RAI 03.07.02-10)
2) Response to RAI Letter No. 82 (RAI 02.05.02-20)

cc: Adrian Muniz, NRC Fermi 3 Project Manager
Tekia Govan, NRC Fermi 3 Project Manager
Michael Eudy, NRC Fermi 3 Project Manager (w/o attachments)
Bruce Olson, NRC Fermi 3 Environmental Project Manager (w/o attachments)
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 and Environment
Radiological Protection Section (w/o attachments)

Attachment 1
NRC3-13-0007
(2 pages)

Response to RAI Letter No. 82
(eRAI Tracking No. 6975)

RAI Question No. 03.07.02-10

NRC RAI 03.07.02-10

Fermi 3 FSAR Tier 2 Rev. 4 Section 3.7.1.1.4.4.3 describes the deterministic strain-iterated lower-bound (LB), best-estimate (BE), and upper-bound (UB) shear wave velocity profiles for the full soil column, which are used as input to the SSI analysis in accordance with SRP 3.7.2. These profiles are listed in FSAR Tables 3.7.1-205, 3.7.1-206, and 3.7.1-207, and shown in FSAR Figure 3.7.1-225. The FSAR indicates that UB and LB profiles were modified where necessary to maintain the minimum variation relative to the BE profile, such that GUB≥1.5 x GBE or GLB≤GBE / 1.5 is satisfied as required by SRP 3.7.2. The staff notes that the value 1.5 (corresponding to COV=50%) is applicable to subsurface site conditions that have been "well investigated" by the geotechnical investigation. Since the engineered granular backfill above the bedrock has not yet been built; the applicant is requested to provide the technical basis for using COV=50% and not considering a minimum COV=100% for the backfill portion of the LB and UB profiles.

Response

The engineered granular backfill in the lower bound (LB) and upper bound (UB) subsurface profiles will use a minimum coefficient of variation (COV) of 100 percent. The minimum COV of 50 percent will be used for the well investigated in situ bedrock units beneath the engineered granular backfill. The use of these minimum COV values satisfies the requirements of SRP 3.7.2.

The use of a minimum COV of 100 percent for the engineered granular backfill and a minimum COV of 50 percent for the in situ bedrock units beneath the engineered granular backfill will be documented in the markup of Fermi 3 FSAR Subsection 3.7.1 and a supplement to this RAI response. The markup of the Fermi 3 FSAR Subsection 3.7.1 will include the Central and Eastern United States (CEUS) Seismic Source Characterization (SSC) model from NUREG-2115 as the basis for the seismic hazard analysis and subsequent seismic analyses.

Proposed COLA Revision

The markup of FSAR Subsection 3.7.1 will be provided by April 26, 2013.

Attachment 2
NRC3-13-0007
(4 pages)

Response to RAI Letter No. 82
(eRAI Tracking No. 6976)

RAI Question No. 02.05.02-20

<u>NRC RAI 02.05.02-20</u>

10 CFR Part 100, Appendix A requires the determination of the static and dynamic engineering properties of the materials underlying the site, which should include properties needed to determine the behavior of the underlying material during earthquakes and the characteristics of the underlying material in transmitting earthquake-induced motions to the foundations of the plant. FSAR Section 3.7.1.1.4.1.1 describes the dynamic properties of the engineered granular backfill above the bedrock; however, in order to satisfy the requirements of 10 CFR Part 100, Appendix A, please provide the information described below.

a) *FSAR Section 3.7.1.1.4.1.1 states that the shear-wave velocity for the granular backfill is estimated based on empirical relationships for angular-grained material from Richart et al. (1970). Please provide the range of parameters (i.e., void ratio and average effective confining pressure) that were used to define the lower range (LR), intermediate range (IR) and upper range (UR) shear-wave velocity profiles and explain why they are appropriate for the backfill material to be used at the site. Furthermore, please justify the use of Richart et al. (1970) in light of more recently published empirical relationships, e.g. Menq (2003), and include a discussion of the potential applicability of the more recent relationships.*

b) *FSAR Section 3.7.1.1.4.1.1.2 states that the shear modulus reduction and damping relationships selected for the granular backfill correspond to generic sand curves from EPRI (1993). Please justify the use of the EPRI (1993) generic sand curves rather than more recently published shear modulus reduction and damping relationships, e.g. Darendeli (2001) and Menq (2003), which may be more representative of the proposed backfill material. In addition, include a discussion of the potential applicability of the more recent relationships.*

References

Darendeli, M. B. (2001), "Development of a New Family of Normalized Modulus Reduction and Material Damping Curves", Ph. D. Dissertation, University of Texas at Austin.

EPRI (1993), "Guidelines for Determining Design Basis Ground Motions," Early Site Permit Demonstration Program, Project RP3302.

Menq, F. Y. (2003), "Dynamic Properties of Sandy and Gravelly Soils", School of Civil Engineering, Ph.D. Dissertation, University of Texas at Austin.

Richart, F.E., Woods, R.D., and Hall J.R. (1970), "Vibration of Soils and Foundations," Prentice-Hall.

<u>Response</u>

This response provides a discussion of the approach that will be used to respond to RAI 02.05.02-20. A detailed supplemental response is scheduled to be submitted with the markup to Fermi 3 FSAR Subsection 3.7.1. Parts a) and b) of RAI 02.05.02-20 are addressed as follows:

a) *FSAR Section 3.7.1.1.4.1.1 states that the shear-wave velocity for the granular backfill is estimated based on empirical relationships for angular-grained material from Richart et al. (1970). Please provide the range of parameters (i.e., void ratio and average effective confining pressure) that were used to define the lower range (LR), intermediate range (IR) and upper range (UR) shear-wave velocity profiles and explain why they are appropriate for the backfill material to be used at the site. Furthermore, please justify the use of Richart et al. (1970) in light of more recently published empirical relationships, e.g. Menq (2003), and include a discussion of the potential applicability of the more recent relationships.*

The range of parameters used to define the engineered granular backfill lower range (LR), intermediate range (IR), and upper range (UR) shear wave velocity profiles will be documented in the supplemental response to this RAI. The range of engineered granular backfill parameters was selected to represent the possible range of properties based on the anticipated engineered granular backfill types described in Fermi 3 FSAR Subsection 2.5.4.5.1.

Both the Richart et al. (Fermi 3 FSAR Reference 3.7.1-201) and Menq (Reference 2) empirical relationships will be applied to estimate the shear wave velocities of the engineered granular backfill. The LR, IR, and UR shear wave velocities for the engineered granular backfill will be provided in the supplement to this RAI response and the markup to Fermi 3 FSAR Subsection 3.7.1 scheduled to be submitted by April 26, 2013. Additionally, the range of engineered granular backfill parameters used to apply both the Richart et al. and Menq empirical relationships will be discussed in the supplement to this RAI response.

b) *FSAR Section 3.7.1.1.4.1.1.2 states that the shear modulus reduction and damping relationships selected for the granular backfill correspond to generic sand curves from EPRI (1993). Please justify the use of the EPRI (1993) generic sand curves rather than more recently published shear modulus reduction and damping relationships, e.g. Darendeli (2001) and Menq (2003), which may be more representative of the proposed backfill material. In addition, include a discussion of the potential applicability of the more recent relationships.*

The generic EPRI (Fermi 3 FSAR Reference 2.5.2-269) modulus reduction and damping relationships for sand are suitable for generic site response studies in Eastern North America, and are intended to represent soils in the general range of gravelly sand to low plasticity silty clays or sandy clays. The EPRI (1993) generic sand curves are considered suitable for the Fermi 3 engineered granular backfill based on their intended application to gravelly sands that are similar to the proposed Fermi 3 engineered granular backfill.

The modulus reduction and damping relationships of Darendeli (Reference 1) are for different levels of plasticity, including a plasticity index of 0 for use with sand-rich materials. As stated by Darendeli in Reference 1:

> "It is important to note that soils with a wide range of plasticity are represented in this database. About half of the soils classify as fine-grained soils. Coarse-grained soils included in this study are limited to sands. Due to limitations on specimen size, gravelly soils were not tested as part of this work."

The modulus reduction and damping relationships of Menq are preferred over those of Darendeli for the Fermi 3 site because both relationships use a similar mathematical formulation, but Menq incorporates the influence of gradation parameters based on tested samples of nonplastic sandy and gravelly soils that are anticipated to be more similar to the engineered granular backfill. The modulus reduction and damping relationships of Menq will be considered in the response of the engineered granular backfill to seismic ground motions.

The EPRI generic sand modulus reduction and damping curves produce less modulus reduction and damping than the Menq estimates; therefore, they will be applied to the UR shear wave velocity profile of the engineered granular backfill. The Menq modulus reduction and damping relationships apply to material properties similar to those used to estimate the LR shear wave velocity values; therefore, they will be applied to the LR shear wave velocity profile of the engineered granular backfill. The use of both the EPRI and Menq modulus reduction and damping relationships, along with randomization of the relationships to account for variations in the material properties, results in a wider range of modulus reduction and damping curves used to establish the LB and UB profiles.

The IR shear wave velocity values estimated for the engineered granular backfill will use an intermediate modulus reduction and damping relationship. The intermediate range modulus reduction and damping values will be developed by averaging the LR values based on Menq and the UR values based on EPRI generic sand curves.

All modulus reduction and damping curves will be randomized using standard deviations set so the randomized relationships fall within the recommended bounds provided by Silva (Fermi 3 FSAR Reference 2.5.2-287). The damping ratio curves will be limited to a maximum of 15 percent damping as recommended in Appendix E of Regulatory Guide 1.208.

References:

1. Darendeli, M. B. (2001), "Development of a New Family of Normalized Modulus Reduction and Material Damping Curves," Ph. D. Dissertation, University of Texas at Austin.

2. Menq, F. Y. (2003), "Dynamic Properties of Sandy and Gravelly Soils," School of Civil Engineering, Ph.D. Dissertation, University of Texas at Austin.

Proposed COLA Revision

The markup of FSAR Subsection 3.7.1 will be provided by April 26, 2013.