PMFermiCOLPEm Resource

From: FermiCOL Resource
Sent: Wednesday, September 19, 2012 3:06 PM
To: PMFermiCOLPEm Resource
Subject: FW: Courtesy Copies of Fermi 3 RAI Letters
Attachments: NRC3-12-0024.pdf; NRC3-12-0025.pdf; NRC_Data_Request_1.pdf; NRC_Data_Request_2.pdf; NRC_Data_Request_3.pdf; NRC_Data_Request_6.pdf; NRC_Data_Request_8.pdf

Importance: High

Excel files have been converted to pdf files so they could be processed in ADAMS.

From: Ryan C Pratt [mailto:prattrc@dteenergy.com]
Sent: Friday, August 24, 2012 1:56 PM
To: Muniz, Adrian
Cc: Govan, Tekia; Michael K Brandon; Nicholas A Latzy
Subject: Courtesy Copies of Fermi 3 RAI Letters
Importance: High

Adrian,

Courtesy copies of the Detroit Edison responses to NRC RAI Letter Nos. 77 (NRC3-12-0025) and 78 (NRC3-12-0024) are attached.

Note that the response to RAI 01.05-1 includes a CD with Excel files containing data and calculation results, as requested. Three CDs have been included in the hard copy mailed to you. I have also attached a courtesy copy of these files to this email.

Feel free to contact me if you have any questions or concerns.

Thanks,

Ryan Pratt
Nuclear Development - Licensing
Detroit Edison
313.235.0109

Hearing Identifier: Fermi_COL_Public
Email Number: 1065

Mail Envelope Properties (0AA17736E4C4154CA37233EEBFC8DEB20111BA669D3A)

Subject: FW: Courtesy Copies of Fermi 3 RAI Letters
Sent Date: 9/19/2012 3:05:35 PM
Received Date: 9/19/2012 3:05:49 PM
From: FermiCOL Resource

Created By: FermiCOL.Resource@nrc.gov

Recipients:
"PMFermiCOLPEm Resource" <PMFermiCOLPEm.Resource@nrc.gov>
Tracking Status: None

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Files	Size	Date & Time
MESSAGE	909	9/19/2012 3:05:49 PM
NRC3-12-0024.pdf	646861	
NRC3-12-0025.pdf	4426329	
NRC_Data_Request_1.pdf	669428	
NRC_Data_Request_2.pdf	244169	
NRC_Data_Request_3.pdf	51062	
NRC_Data_Request_6.pdf	438916	
NRC_Data_Request_8.pdf	359701	

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The Detroit Edison Company
One Energy Plaza, Detroit, MI 48226-1279

DTE Energy
Detroit Edison

10 CFR 52.79

August 24, 2012
NRC3-12-0024

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. 78 Related to Chapter 1.05 for the Fermi 3 Combined License Application," dated July 3, 2012
3) SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated February 17, 2012

Subject: Detroit Edison Company Response to NRC Request for Additional Information Letter No. 78

In Reference 2, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combined License Application (COLA). The Requests for Additional Information (RAIs) in Reference 2 address the Fukushima Near-Term Task Force recommendations contained in Reference 3.

The responses to the RAIs in Reference 2 are provided in Attachments 1 and 2 of this letter.

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 24th day of August 2012.

Sincerely,

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

Attachments: 1) Response to RAI Letter No. 78 (Question No. 01.05-3)
2) Response to RAI Letter No. 78 (Question No. 01.05-4)

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
NRC3-12-0024
(7 pages)

Response to RAI Letter No. 78
(eRAI Tracking No. 6574)

RAI Question No. 01.05-3

NRC RAI 01.05-3

The NRC staff has been directed by the Commission to implement the Fukushima Near-Term Task Force recommendations contained in SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami" dated February 17, 2012. Attachment 2 to order EA-12-049 (ADAMS Accession No. ML12054A735) for all power reactor licensees and holders of construction permits in active or deferred status requires a phased approach for mitigating beyond-design-basis external events. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities. The transition phase requires providing sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. The final phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.

The design described in the Fermi 3 final safety analysis report (FSAR), Rev. 4 references the Economic Simplified Boiling-Water Reactor (ESBWR) design control document (DCD), Rev. 9 which includes passive design features that provide core, containment, and SFP cooling capability for 72 hours, without reliance on alternating current (ac) power. These features do not rely on access to any external water sources. The NRC staff reviewed these design features prior to issuance of the final safety evaluation report (ADAMS Accession No. ML110050215). The ESBWR design also includes equipment to maintain required safety functions in the long term (beyond 72 hours to 7 days) including capability to replenish water supplies. Connections are provided for pumping equipment that can be brought to the site to back up the installed equipment. The staff concluded in its FSER that the ESBWR design is capable of supporting extended operation of the passive safety systems to maintain required safety functions in the long term (i.e 72 hours to 7 days period) without reliance on offsite support. As such, this RAI requests Detroit Edison (Fermi 3 COL applicant) to address the following items relative to the final phase.

1. *Develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment and SFP cooling capabilities following a beyond-design-basis external event.*

2. *These strategies must be capable of mitigating a simultaneous loss of all ac power and loss of normal access to the normal heat sink and have adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities.*

3. *Provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities.*

4. *Describe capability of implementing the strategies in all modes.*

5. *Full compliance shall include procedures, guidance, training and acquisition, staging, or installing of equipment needed for the strategies.*

Response

The response to this RAI is based on SECY-12-0025, Enclosure 4, Attachment 3, "Requirements for Mitigation Strategies for Beyond-Design-Basis External Events at COL Holder Reactor Sites (Vogtle Units 3 and 4)." SECY-12-0025, Enclosure 4, Attachment 3 contains different requirements for Vogtle Units 3 and 4 than those described in SECY-12-0025, Enclosure 4, Attachment 2, because of the AP1000's passive design. As described in the RAI, the staff has found the ESBWR design to utilize similar passive design features. As such, a license condition is proposed in response to this RAI, with similar content as was required for Vogtle Units 3 and 4.

The proposed license condition reads as follows:

Mitigation Strategies for Beyond-Design-Basis External Events

Prior to initial fuel load, the following actions will be fully implemented associated with mitigation strategies including procedures, guidance, training, and acquisition, staging, or installation of equipment needed for the strategies:

A. Develop, implement, and maintain guidance and strategies to maintain or restore core, containment, and spent fuel pool cooling capabilities following a beyond-design-basis external event. These strategies must:

   - Be capable of mitigating a simultaneous loss of al AC power and loss of normal access to the normal heat sink, and
   - Have adequate capacity to address challenges for core, containment, and spent fuel pool cooling capabilities at all units on the Fermi 3 site, and
   - Have the capability to be implemented in all modes.

B. Provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core, containment, and spent fuel pool cooling capabilities at all units on the Fermi site.

Within one (1) year after issuance of the Fermi 3 COL, an overall integrated plan shall be submitted to the NRC for review, including a description of how compliance with the requirements described in this license condition will be achieved.

Initial status reports shall be provided to the NRC sixty (60) days following issuance of the Fermi 3 COL and at six (6) month intervals following submittal of the overall integrated plan described above which delineate progress made in implementing the requirements of this license condition.

Proposed COLA Revision

Part 10, Section 3, "Fermi 3 Proposed License Conditions," is revised as shown on the attached markup.

Markup of Detroit Edison COLA
(following 3 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by 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.

3.7 Emergency Planning Actions

Because various equipment set points and other information cannot be determined until as-built information is available, the COLA does not fully address certain aspects of the Emergency Action Level (EAL) scheme. Thus, COL applicants using EAL schemes in accordance with NEI 07-01 are proposed the following license condition:

The licensee shall submit a fully developed set of site-specific EALs to the NRC in accordance with the NRC-endorsed version of NEI 07-01, Revision 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.

Insert 1 on the following page

Insert 1 – Previously submitted in the response to RAI 01.05-2

3.8 Fukushima Actions

3.8.1 **Emergency Planning Actions**

The applicant is proposing the following license condition related to communications:

At least two (2) years prior to scheduled initial fuel load, the licensee shall have performed an assessment of on-site and offsite communications systems and equipment required during an emergency event to ensure communications capabilities can be maintained during prolonged station blackout conditions. The communications capability assessment will be performed in accordance with NEI 12-01, "Guidance for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," Revision 0, or other NRC approved guidance in effect six months prior to completion of the assessment.

At least one hundred eighty (180) days prior to scheduled initial fuel load, the licensee shall complete implementation of corrective actions identified in the communications capability assessment described above, including any related emergency plan and implementing procedure changes and associated training.

Insert 2 on the following page

Insert 2

3.8.2 **Mitigation Strategies for Beyond-Design-Basis External Events**

Prior to initial fuel load, the following actions will be fully implemented associated with mitigation strategies including procedures, guidance, training, and acquisition, staging, or installation of equipment needed for the strategies:

A. Develop, implement, and maintain guidance and strategies to maintain or restore core, containment, and spent fuel pool cooling capabilities following a beyond-design-basis external event. These strategies must:

- Be capable of mitigating a simultaneous loss of al AC power and loss of normal access to the normal heat sink, and
- Have adequate capacity to address challenges for core, containment, and spent fuel pool cooling capabilities at all units on the Fermi 3 site, and
- Have the capability to be implemented in all modes.

B. Provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core, containment, and spent fuel pool cooling capabilities at all units on the Fermi site.

Within one (1) year after issuance of the Fermi 3 COL, an overall integrated plan shall be submitted to the NRC for review, including a description of how compliance with the requirements described in this license condition will be achieved.

Initial status reports shall be provided to the NRC sixty (60) days following issuance of the Fermi 3 COL and at six (6) month intervals following submittal of the overall integrated plan described above which delineate progress made in implementing the requirements of this license condition.

Attachment 2
NRC3-12-0024
(9 pages)

Response to RAI Letter No. 78
(eRAI Tracking No. 6574)

RAI Question No. 01.05-4

NRC RAI 01.05-4

The NRC staff has been directed by the Commission to implement the Fukushima Near-Term Task Force recommendations contained in SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami" dated February 17, 2012. Attachment 2 to Order EA-12-051 (ADAMS Accession No. ML12054A679) for all power reactor licensees and holders of construction permits in active or deferred status requires reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck, and (3) level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

The design described in the ESBWR DCD, Rev. 9 as referenced in the Fermi 3 FSAR, Revision 4 addresses many of these attributes of spent fuel pool level instrumentation. The NRC staff reviewed these design features prior to issuance of the final safety evaluation report (ADAMS Accession No. ML110050215). The ESBWR design largely addresses the requirements in Attachment 2 by providing two safety-related pool level instrument channels for both the spent fuel and buffer pools. The instruments measure level from the top of the spent fuel pool to the top of the fuel racks to address the range requirements listed above.

The safety-related classification provides for the following additional design features:

- *Instruments*
- *Arrangement*
- *Mounting*
- *Qualification*
- *Independence*
- *Electrical isolation and physical separation between instrument channels*
- *Testing*
- *Display*

As such, this RAI requests Fermi 3 to address the following items that were not specified in ESBWR DCD, Rev. 9:

1. *The spent fuel pool/buffer pool level instrumentation shall include the following design features:*

    1.1. *Power supplies: Instrumentation channels shall provide for power connections from sources independent of the plant alternating current (ac) and direct current (dc) power distribution systems, such as portable generators or replaceable batteries. Power supply designs should provide for quick and accessible connection of sources independent of the plant ac and dc power distribution systems. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.*

1.2. Accuracy: The instrument shall maintain its designed accuracy following a power interruption or change in power source without recalibration.

2. The spent fuel pool/buffer pool instrumentation shall be maintained available and reliable through appropriate development and implementation of a training program. Personnel shall be trained in the use and the provision of alternate power to the safety-related level instrument channels.

Response

The response to this RAI is based on SECY-12-0025, Enclosure 6, Attachment 3, "Requirements for Reliable Spent Fuel Pool Level Instrumentation at COL Holder Reactor Sites." SECY-12-0025, Enclosure 6, Attachment 3 contains different requirements for Vogtle Units 3 and 4 than those described in SECY-12-0025, Enclosure 6, Attachment 2, because of the AP1000's passive design. As described in the RAI, the staff has found the ESBWR design to utilize similar passive design features. Additionally, as described in the RAI, the staff has found the ESBWR design to adequately address spent fuel pool level instrumentation arrangement, qualification, and display. As such, a license condition is proposed in response to this RAI with similar content as was required for Vogtle Units 3 and 4, except that the proposed license condition does not address spent fuel pool level instrumentation arrangement, qualification, or display, as provisions for those design features are included in the ESBWR design.

The proposed license condition reads as follows:

Reliable Spent Fuel Pool/Buffer Pool Level Instrumentation

Prior to initial fuel load, the following requirements for spent fuel pool/buffer pool level indication will be fully implemented.

A. The spent fuel pool/buffer pool level instrumentation shall include the following design features:

   1. Power supplies: Instrumentation channels shall provide for power connections from sources independent of the plant alternating current (AC) and direct current (DC) power distribution systems, such as portable generators or replaceable batteries. Power supply designs should provide for quick and accessible connection of sources independent of the plant AC and DC power distribution systems. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.
   2. Accuracy: The instrument shall maintain its designed accuracy following a power interruption or change in power source without recalibration.

B. The spent fuel pool/buffer pool instrumentation shall be maintained available and reliable through appropriate development and implementation of a training program. Personnel shall be trained in the use and the provision of alternate power to the safety-related level instrument channels.

Within one (1) year after issuance of the Fermi 3 COL, an overall integrated plan shall be submitted to the NRC for review, including a description of how compliance with the requirements described in this license condition will be achieved.

Initial status reports shall be provided to the NRC sixty (60) days following issuance of the Fermi 3 COL and at six (6) month intervals following submittal of the overall integrated plan described above which delineates progress made in implementing the requirements of this license condition.

Proposed COLA Revision

Part 10, Section 3, “Fermi 3 Proposed License Conditions,” is revised as shown on the attached markup.

Markup of Detroit Edison COLA
(following 4 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA. However, the same COLA content may be impacted by 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.

3.7 Emergency Planning Actions

Because various equipment set points and other information cannot be determined until as-built information is available, the COLA does not fully address certain aspects of the Emergency Action Level (EAL) scheme. Thus, COL applicants using EAL schemes in accordance with NEI 07-01 are proposed the following license condition:

The licensee shall submit a fully developed set of site-specific EALs to the NRC in accordance with the NRC-endorsed version of NEI 07-01, Revision 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.

Insert 1 on the following page

Insert 1 – Previously submitted in the response to RAI 01.05-2 (ML12199A150)

3.8 Fukushima Actions

3.8.1 **Emergency Planning Actions**

The applicant is proposing the following license condition related to communications:

At least two (2) years prior to scheduled initial fuel load, the licensee shall have performed an assessment of on-site and offsite communications systems and equipment required during an emergency event to ensure communications capabilities can be maintained during prolonged station blackout conditions. The communications capability assessment will be performed in accordance with NEI 12-01, "Guidance for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," Revision 0, or other NRC approved guidance in effect six months prior to completion of the assessment.

At least one hundred eighty (180) days prior to scheduled initial fuel load, the licensee shall complete implementation of corrective actions identified in the communications capability assessment described above, including any related emergency plan and implementing procedure changes and associated training.

Insert 2 on the following page

Insert 2 – Submitted in the response to RAI 01.05-3 (Attachment 1)

3.8.2 Mitigation Strategies for Beyond-Design-Basis External Events

Prior to initial fuel load, the following actions will be fully implemented associated with mitigation strategies including procedures, guidance, training, and acquisition, staging, or installation of equipment needed for the strategies:

A. Develop, implement, and maintain guidance and strategies to maintain or restore core, containment, and spent fuel pool cooling capabilities following a beyond-design-basis external event. These strategies must:

- Be capable of mitigating a simultaneous loss of al AC power and loss of normal access to the normal heat sink, and
- Have adequate capacity to address challenges for core, containment, and spent fuel pool cooling capabilities at all units on the Fermi 3 site, and
- Have the capability to be implemented in all modes.

B. Provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core, containment, and spent fuel pool cooling capabilities at all units on the Fermi site.

Within one (1) year after issuance of the Fermi 3 COL, an overall integrated plan shall be submitted to the NRC for review, including a description of how compliance with the requirements described in this license condition will be achieved.

Initial status reports shall be provided to the NRC sixty (60) days following issuance of the Fermi 3 COL and at six (6) month intervals following submittal of the overall integrated plan described above which delineate progress made in implementing the requirements of this license condition.

Insert 3 on the following page

Insert 3

3.8.3 **Reliable Spent Fuel Pool/Buffer Pool Level Instrumentation**

Prior to initial fuel load, the following requirements for spent fuel pool/buffer pool level indication will be fully implemented.

A. The spent fuel pool/buffer pool level instrumentation shall include the following design features:

    1. Power supplies: Instrumentation channels shall provide for power connections from sources independent of the plant alternating current (AC) and direct current (DC) power distribution systems, such as portable generators or replaceable batteries. Power supply designs should provide for quick and accessible connection of sources independent of the plant AC and DC power distribution systems. Onsite generators used as an alternate power source and replaceable batteries used for instrument channel power shall have sufficient capacity to maintain the level indication function until offsite resource availability is reasonably assured.
    2. Accuracy: The instrument shall maintain its designed accuracy following a power interruption or change in power source without recalibration.

B. The spent fuel pool/buffer pool instrumentation shall be maintained available and reliable through appropriate development and implementation of a training program. Personnel shall be trained in the use and the provision of alternate power to the safety-related level instrument channels.

Within one (1) year after issuance of the Fermi 3 COL, an overall integrated plan shall be submitted to the NRC for review, including a description of how compliance with the requirements described in this license condition will be achieved.

Initial status reports shall be provided to the NRC sixty (60) days following issuance of the Fermi 3 COL and at six (6) month intervals following submittal of the overall integrated plan described above which delineates progress made in implementing the requirements of this license condition.

The Detroit Edison Company
One Energy Plaza, Detroit, MI 48226-1279

10 CFR 52.79

August 24, 2012
NRC3-12-0025

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. 77 Related to Chapter 1.05 for the Fermi 3 Combined License Application," dated May 17, 2012
3) SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," dated February 17, 2012
4) Letter from Peter W. Smith (Detroit Edison) to USNRC, "Detroit Edison Company Response to NRC Request for Additional Information Letter No. 77," NRC3-12-0018, dated June 18, 2012
5) Letter from Tekia Govan (USNRC) to Peter W. Smith (Detroit Edison), "Request for Additional Information Letter No. 79 Related to Chapters 03.07.02 and 13.03 for the Fermi 3 Combined License Application," dated August 7, 2012

Subject: Detroit Edison Company Response to NRC Request for Additional Information Letter No. 77

In Reference 2, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combined License Application (COLA). The Requests for Additional Information (RAIs) in Reference 2 address the Fukushima Near-Term Task Force recommendations contained in Reference 3.

In Reference 4, the analyses required to respond to RAI 01.05-1 were described and a submittal date of August 24, 2012, was established. The response to RAI 01.05-1 is provided in Attachment 1 to this letter.

The response to RAI 01.05-1 provides the Fermi 3 site-specific ground motion response spectra (GMRS) and foundation input response spectra (FIRS) based on the Central and Eastern United States (CEUS) Seismic Source Characterization (SSC) model presented in NUREG-2115. As described in the response, the Fermi 3 CEUS GMRS and FIRS are greater than the Fermi 3 GMRS and FIRS presented in the Fermi 3 FSAR, Revision 4, which are based on the updated EPRI Seismic Owners Group (SOG) model. As illustrated in the response, the CEUS FIRS remain enveloped by the ESBWR Certified Seismic Design Response Spectra (CSDRS).

Recognizing that the GMRS and FIRS represent the fundamental source of seismic inputs to the Fermi 3 site-specific soil-structure interaction (SSI) analyses, Detroit Edison intends to address the impact of the Fermi 3 CEUS GMRS and FIRS in conjunction with the response to RAI Letter No. 79 (Reference 5). RAI Letter No. 79 includes several questions associated with the Fermi 3 site-specific SSI analyses, including consistency in analyses inputs. Detroit Edison is currently developing a plan and schedule for analytical work anticipated to be necessary to address RAI Letter No. 79. The initial response to RAI Letter No. 79 is due September 7, 2012.

On July 12, 2012, during the weekly Fermi 3 open items call with the NRC, the staff requested that Detroit Edison provide electronic files containing data and analysis results related to the RAI 01.05-1 response. The staff's eight requests and Detroit Edison's descriptions of the data and results provided are listed in Enclosure 1 of Attachment 1. Enclosure 1 of Attachment 1 includes a CD containing electronic files as requested by the NRC staff. The file format and names on the enclosed CD do not comply with the requirements for electronic submission in the NRC Guidance Document, "Guidance for Electronic Submission to the NRC," Revision 6, dated May 17, 2010; the files are not "pdf" formatted. The NRC staff requested the files be submitted in their native formats required by the software in which they are utilized in order to support NRC review of the Fermi 3 COLA.

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 24th day of August 2012.

Sincerely,

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

Attachment: 1) Response to RAI Letter No. 77 (Question No. 01.05-1)

cc: Adrian Muniz, NRC Fermi 3 Project Manager
Tekia Govan, NRC Fermi 3 Project Manager
Michael Eudy, NRC Fermi 3 Project Manager (w/o attachment)

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

Attachment 1
NRC3-12-0025
(70 pages)

Response to RAI Letter No. 77
(eRAI Tracking No. 6446)

RAI Question No. 01.05-1

NRC RAI 01.05-1

This request for additional information (RAI) specifically addresses Recommendation 2.1, of the Fukushima Near-Term Task Force recommendations contained in SECY-12-0025 as it pertains to the seismic hazard evaluation. This recommendation specifies the use of NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," (CEUS-SSC) in a site probabilistic seismic hazard analysis (PSHA). Consistent with Recommendation 2.1, as well as the need to consider the latest available information in the (PSHA) for the Fermi Unit 3 planned reactor site, the NRC staff requests that Detroit Edison:

a) Evaluate the potential impacts of the newly released CEUS-SSC model, with potential local and regional refinements as identified in the CEUS-SSC model, on the seismic hazard curves and the site-specific ground motion response spectra (GMRS)/foundation input response spectra (FIRS). For re-calculation of the PSHA, please follow either the cumulative absolute velocity (CAV) filter or minimum magnitude specifications outlined in Attachment 1 to Seismic Enclosure 1 of the March 12, 2012 letter " Request for information pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding recommendations 2.1,2.3, and 9.3, of the near-term task force review of insights from the Fukushima Dai-ichi accident." (ML12053A340).

b) Modify the site-specific GMRS and FIRS if you determine changes are necessary given the evaluation performed in part a) above.

In order to minimize delays to the current licensing schedule, we request that you respond within 60-days of receipt of this RAI or provide a schedule for your response within 30-days.

Response

As requested, the Central and Eastern United States (CEUS) Seismic Source Characterization (SSC) model presented in NUREG-2115 (EPRI/USDOE/USNRC, 2012) was used to reassess the seismic hazard at the Fermi 3 site. This response contains the following four main items.

1. Results of demonstration calculations showing adequate implementation of the CEUS SSC model using the software for the Fermi 3 project.
2. Seismic hazard results for the reference CEUS hard rock condition including source contributions and deaggregation.
3. Hazard results at the GMRS elevation that incorporate the CEUS SSC model and the specified modification in the application of the Cumulative Absolute Velocity (CAV) filter.
4. Updated GMRS and associated Truncated Soil Column Response (TSCR) Foundation Input Response Spectra (FIRS) for the Reactor Building/Fuel Building (RB/FB), Control Building (CB), and Fire Water Service Complex (FWSC).

Verification of Implementation of CEUS SSC Model

Chapter 8 of NUREG-2115 presents the results of hazard calculations at seven demonstration sites. The CEUS SSC model input parameters were obtained from the CEUS SSC web site and the model was implemented using the Probabilistic Seismic Hazard Analysis (PSHA) software for the Fermi 3 project. Calculations of hazard at the seven demonstration sites were performed and compared to the results tabulated in Chapter 8 of NUREG-2115. Figures 1 through 7 compare the mean, 15th percentile, 50th percentile, and 85th percentile hazard curves obtained using software for the Fermi 3 project with those tabulated in Chapter 8 of NUREG-2115.

The comparison plots shown on Figures 1 through 7 demonstrate that the implementation of the CEUS SSC model using software for the Fermi 3 project closely matches the mean and fractile hazard curves at the seven demonstration sites. The mean hazard curves listed in Chapter 8 of NUREG-2115 and those computed using software for the Fermi 3 project were used to compute ground motion levels with annual exceedance frequencies of 10^{-4}, 10^{-5}, and 10^{-6} for 1 Hz, 10 Hz, and 100 Hz (Peak Ground Acceleration [PGA]). These results are listed in Table 1. The differences in the ground motion values are generally less than 5 percent. This translates into differences in mean hazard generally less than 15 percent in the exceedance frequency range of 10^{-4} to 10^{-6}. As discussed in Chapter 9 of NUREG-2115, this difference in mean ground motion levels is not considered significant. Therefore, it is concluded the implementation of the CEUS SSC model using software for the Fermi 3 project is suitable for computing seismic hazard at CEUS sites.

For the Savannah demonstration site, larger differences between the seismic hazard calculated in NUREG-2115 and the software used for the Fermi 3 project were observed. The larger differences at the Savannah demonstration site are due to differences in the details of modeling the large magnitude rupture from the nearby repeated large-magnitude earthquakes (RLME) in the Charleston seismic zone. In the standard implementation of the Charleston RLME in the Project software, large magnitude earthquake ruptures are modeled as uniformly distributed on pseudo-faults oriented parallel to the long dimension of the source. Using this approach, the calculated hazard from the Charleston RLME at the Chattanooga demonstration site is consistent with that shown in Chapter 8 of NUREG-2115. However, the calculations performed at the Savannah demonstration site produced lower hazard for the Charleston RLME source than that shown in Chapter 8 of NUREG-2115. Discussions with Dr. Robin McGuire indicated that a different modeling approach was used for the Charleston RLME source in the demonstration calculations presented in NUREG-2115. The Regional and Local source zones were filled with a uniform grid of epicentral locations. At each location, magnitude-dependent ruptures were placed with the specified northeast orientation with a random location on each grid point. The “strict” boundary condition was then imposed by forcing the ruptures to remain within the source boundary. The net effect of this model is to increase the probability of rupture locations near the boundary compared to the assumption of a uniform distribution of rupture within the source. Implementing this approach in a special calculation using Excel produced hazard results that were more consistent with those shown in Chapter 8 of NUREG-2115. These special calculations were used to produce the results shown on Figure 6.

The details of modeling the distribution of RLME ruptures in the Charleston RLME are not significant to the hazard assessment for the Fermi 3 site. As shown by the results obtained at the Chattanooga demonstration site, the standard representation of the Charleston RLME in the project software produces hazard results consistent with those presented in Chapter 8 of NUREG-2115 at large distances from the Charleston RLME source. Chattanooga is approximately 400 km from the Charleston RLME source while Fermi 3 is over 900 km from the Charleston RLME source.

Hard Rock Hazard at the Fermi 3 Site Using the CEUS SSC Model

The CEUS SSC model was implemented for computing seismic hazard for hard rock conditions at the Fermi 3 site. As described in NUREG-2115, the CEUS SSC model contains the following two types of seismic sources:

- Distributed seismicity source zones that model the occurrence of earthquakes throughout the CEUS over the magnitude range from **M** 5.0 (or **M** 4.0 if CAV is used) to the largest possible in each source (approximately **M** 8.1).
- RLME sources that model the repeated occurrence of 10 large magnitude earthquakes at specific locations.

Two types of distributed seismicity source zones were defined: Mmax source zones in which the source zones demarcate areas where the principal distinction is the difference in the maximum magnitude distributions, and Seismotectonic source zones that demarcate areas with differing geology and tectonic history. Figures 8 and 9, respectively, show examples of these distributed seismicity source zones. Figure 10 shows the locations of the 10 RLME sources.

The hazard calculations for the Fermi 3 site include those portions of each distributed seismicity source zone located within 1,000 km from the Fermi 3 site. This was the process used for the demonstration site calculations presented on Figures 1 through 7. The portions of the distributed seismicity source zones beyond 1,000 km from the Fermi 3 site were not included in the analysis, because only relatively frequent, large magnitude earthquakes contribute to the hazard at these large distances. The sources of such earthquakes are the RLME sources, which were examined separately.

The hazard calculations were performed using the EPRI (2004, 2006) ground motion models for the Mid-Continent region (Fermi 3 FSAR References 2.5.2-259 and 2.5.2-267). The ground motion models for EPRI (2004) ground motion clusters 1, 2, and 3 were used to model the hazard from the distributed seismicity sources employing the adjustments from epicentral distance to rupture or Joyner-Boore distance developed in EPRI (2004). The EPRI (2004) ground motion models for ground motion clusters 1, 2, 3, and 4 were used to model the hazard from the RLME sources. Cluster 4 was developed for only **M** 6 and larger earthquakes and is appropriate for RLME sources.

The process used in Subsection 2.5.2.4 of the Fermi 3 FSAR to identify the EPRI-SOG (Fermi 3 FSAR Reference 2.5.2-201) seismic sources to include in the hazard model for the Fermi 3 site was to include those sources that contributed at least 1 percent to the total mean hazard, tested at spectral frequencies of 1 and 10 Hz. This process was repeated to identify which of the 10 RLME sources should be included in the CEUS SSC model implementation for the Fermi 3 site. Figures 11 and 12 show the results of initial hazard calculations for 1 Hz and 10 Hz spectral acceleration, respectively. The curves labeled “CEUS SSC Distributed” show the mean hazard from the combined model for distributed seismicity sources. Also shown are the mean hazard curves from the nearest eight RLME sources. Three of these sources, the New Madrid RLME (NMF), the Wabash Valley RLME (WBV), and the Charleston RLME (CHS) clearly contribute over one percent to the hazard for 1 Hz. The Charlevoix RLME (CHV) also contributes about 1 percent to the 1 Hz hazard. The curve labeled “CEUS SSC Total” shows the sum of the mean hazard from the distributed sources and these four RLME sources. The red dashed curve shows 1 percent of the total hazard from the distributed sources and the four RLME sources

(NMF, WBV, CHS, and CHV). The mean hazard curves from the other four RLMEs fall below this line and thus they were not included in the final hazard calculations for the Fermi 3 site. The other two RLME sources, Cheraw and Meers, are located at larger distances from the Fermi 3 site than the eight RLMEs tested (see Figure 10) and thus are expected to have even lower contribution to the hazard than the RLME sources tested. The results shown for 10 Hz on Figure 12 indicate that the RLMEs have lower contribution to the site hazard at intermediate spectral frequencies than at low spectral frequencies.

Figures 13 through 19 show the resulting seismic hazard curves for the seven spectral frequencies defined in the EPRI (2004) ground motion models: 0.5 Hz, 1 Hz, 2.5 Hz, 5 Hz, 10 Hz, 25 Hz, and 100 Hz (PGA). The mean and fractile Fermi 3 hazard curves obtained using the CEUS SSC model are compared on the figures to those based on the Updated EPRI-SOG seismic source model presented in Subsection 2.5.2.4 of the Fermi 3 FSAR. These results show that the Fermi 3 rock hazard based on the CEUS SSC model is generally higher than that obtained from the Updated EPRI-SOG model presented in the Fermi 3 FSAR.

Figures 20 through 26 show total mean hazard and the contributions from the distributed seismicity sources and the four RLME sources that make up the CEUS SSC model components included in the hazard calculation for the Fermi 3 site. The results obtained for Fermi 3 using the CEUS SSC model are compared to those obtained from the Updated EPRI-SOG model presented in Subsection 2.5.2.4 of the Fermi 3 FSAR. In making these comparison plots, the hazard from the distributed seismicity sources in the Updated EPRI-SOG model is shown as the sum of the Wabash Valley and EPRI-SOG sources because in the Updated EPRI-SOG model the Wabash Valley sources also represented distributed seismicity sources whose maximum magnitude was updated based on paleoseismic data. The hazard from these sources was shown as separate curves on Fermi 3 FSAR Figure 2.5.2-236.

The results shown on Figures 20 through 26 indicate that the higher hazard computed using the CEUS SSC model is primarily due to the higher hazard obtained from the distributed seismicity sources. The increase in hazard from the distributed seismicity sources is larger for lower frequency ground motions. This result is because of the larger maximum magnitude distributions for these distributed seismicity sources in the CEUS SSC model compared to the assessments in the EPRI-SOG (1986) model and the fact that low frequency ground motions show greater increases in amplitude than high frequency ground motions due to increases in earthquake magnitude. The increase in hazard from the distributed seismicity sources does not translate into a comparable increase in total hazard at the lowest spectral frequencies (0.5 and 1 Hz), because the hazard at these spectral frequencies is dominated by the New Madrid RLME source, which shows little change.

The CEUS SSC New Madrid RLME source produces hazard that is equal to or slightly less than the New Madrid source used in the Updated EPRI-SOG model. The characterization of the New Madrid RLME source in the CEUS SSC model is very similar to the characterization of the New Madrid source in the Updated EPRI-SOG model. The difference in hazard is attributed primarily to differences in the implementation of the recurrence model in the two hazard calculations. The maximum magnitude distribution developed for the New Madrid source model in Subsection 2.5.2.4 of the Fermi 3 FSAR was defined in terms of moment magnitude (**M**). In the hazard calculations presented in the Fermi 3 FSAR the expected moment magnitudes (**M**) for the three New Madrid fault sources – New Madrid South (NMS), Reelfoot Thrust (RF), and New Madrid North (NMN) – were converted into m_b values for consistency in combining with the hazard from the EPRI-SOG sources. In that implementation, the magnitude aleatory distribution was implemented as ±0.25 m_b magnitude units about the converted m_b central magnitude values. These magnitudes were then converted back to **M** for the purpose of computing ground motions. As a result, the effective moment magnitudes (**M**) at the upper end of the magnitude ranges are larger than the corresponding values in the CEUS SSC New Madrid RLME source, which is defined in moment magnitude (**M**).

The upper half of Table 2 shows the results of the process described above. The first three columns list the maximum magnitude distribution for the New Madrid source in the Updated EPRI-SOG model presented in Fermi 3 FSAR Subsection 2.5.2.4. This distribution was defined in terms of the moment magnitude (**M**) scale. For the purpose of the hazard calculations, these values of **M** were converted into values of m_b using the following three m_b to **M** conversion relationships used to perform the hazard using the Updated EPRI-SOG model: Atkinson and Boore (1995, Fermi 3 FSAR Reference 2.5.2-262), Johnston (1996, Fermi 3 FSAR Reference 2.5.2-268), and EPRI (1993, Fermi 3 FSAR Reference 2.5.2-269). The three conversion relationships that were used in the hazard calculations using the Updated EPRI-SOG model are shown on Figure 27. The three right hand columns of Table 2 show the resulting effective upper end of the aleatory magnitude distribution obtained by the process of converting the central values of **M** to m_b, adding 0.25 m_b units, and then converting these values back to **M** for ground motion calculation.

The lower half of Table 2 shows the equivalent results for the CEUS SSC model. The left three columns show the New Madrid RLME source magnitude distribution. It is very similar to the distribution used in the Updated EPRI-SOG model, with the first four scenarios being the same, while the last two scenarios have slightly smaller magnitudes. The right hand part of the table shows the upper end of the aleatory distributions for RLME magnitudes which are simply obtained by adding 0.25 **M** units to the central estimates. Comparing these values to the corresponding values in the upper half of Table 2 shows that hazard calculations for the New Madrid fault sources in the Updated EPRI-SOG model extended to larger moment magnitudes than the calculations performed using the CEUS SSC model. These larger magnitudes are the likely reason for the larger hazard computed for the New Madrid fault sources in the Updated EPRI-SOG model compared to the hazard computed for the New Madrid RLME source for the CEUS SSC model.

The mean hard rock hazard curves obtained using the CEUS SSC model are used to compute hard rock uniform hazard response spectra (UHRS). On Figure 28 and in Table 3, the CEUS SSC hard rock UHRS are compared with the results presented in Fermi 3 FSAR Subsection 2.5.2.4. The Fermi 3 hard rock UHRS based on the CEUS SSC model are generally higher than those based on the Updated EPRI-SOG model. This higher hazard from the CEUS SSC model is due primarily to changes in the characterization of the distributed seismicity sources.

Figures 29, 30, 31, and 32 show the results from deaggregation of the CEUS SSC model mean hazard for exceedance frequencies of 10^{-3}, 10^{-4}, 10^{-5}, and 10^{-6}, respectively. These results were obtained following the procedure given in Appendix D of Regulatory Guide 1.208. Table 4 compares the magnitudes and distances for the reference (controlling) earthquake (RE) and the magnitudes, distances, and relative weights for the deaggregation earthquake (DE) developed from deaggregation of the CEUS SSC model mean hazard with the REs and DEs developed from deaggregation of the Updated EPRI-SOG model mean hazard (Fermi 3 FSAR Table 2.5.2-219). The deaggregation results from the two source models are generally similar. The magnitudes of the Updated EPRI-SOG model are given in terms of m_b while those for the CEUS SSC hazard results are given in terms of **M**. Thus, the magnitudes for the CEUS SSC model hazard results are expected to be somewhat larger based on the magnitude conversions between m_b and **M** used in the hazard calculations for the Updated EPRI-SOG model. These magnitude conversion relationships were shown previously on Figure 27.

Seismic Hazard Results at the GMRS Elevation Incorporating Modifications in the Application of the CAV Filter

The CEUS SSC model was then used to compute the hazard at the Fermi 3 GMRS elevation. For the purposes of computing the hazard with CAV, the seismicity parameters defined in NUREG-2115 for a minimum magnitude **M** 4.0 were used. The hazard calculations then integrated the contributions from all earthquakes of **M** 4.0 and larger, applying the EPRI (Fermi 3 FSAR Reference 2.5.2-290) CAV filter only to earthquakes less than magnitude **M** 5.5.

The hazard calculations for the Fermi 3 GMRS elevation incorporate site amplification from hard rock. The site amplification functions used for the Fermi 3 FSAR are adequate for the purpose of computing the CAV hazard at the Fermi 3 GMRS elevation for the following reasons:

- As discussed in the previous section, the deaggregation of the hazard computed using the CEUS SSC model shows relative magnitude and distance contributions similar to the hazard based on the Updated EPRI-SOG model.
- The site amplification functions previously developed for the Fermi 3 GMRS elevation in Fermi 3 FSAR Subsection 2.5.2.5 are nearly the same for all three DE inputs for frequencies below about 20 Hz, and the HF amplification function shows relatively low sensitivity to the alternative DE earthquakes at higher frequencies (e.g., Fermi 3 FSAR Figure 2.5.2-269).

Therefore, the relatively small differences in magnitudes, distances, and relative weights assigned to the DEs in Table 4 are not expected to produce significant changes in the mean amplification functions.

Figures 33 through 39 compare the mean hazard curves computed at the GMRS elevation for the CEUS SSC model with CAV applied only to earthquakes less than **M** 5.5 (modified CAV) to the mean hazard curves computed using the Updated EPRI-SOG model with application of CAV to all magnitudes (full CAV). The mean hard rock hazard curves for the Updated EPRI-SOG and CEUS SSC models are also shown. The results on Figures 33 through 39 show the influence of applying the EPRI (2006a) CAV model only to earthquakes with magnitudes less than **M** 5.5, as specified in RAI 01.05-1. Instead of leveling off at a specific exceedance frequency at low ground motions, the hazard curves with modified CAV computed using the CEUS SSC model continue to rise as the ground motion level decreases, following the trend of the hard rock hazard curves. (The CAV filter is not applied to the hard rock hazard curves.) The modification to the application of the CAV filter significantly affects the mean hazard for frequencies of exceedance of about 10^{-4} and greater. At 10^{-5} and lower exceedance frequencies, the effect of the CAV filter modification is smaller. At these lower exceedance frequencies, the hard rock and GMRS hazard curves have a similar trend and the difference in the hazard curves principally reflects the difference in hard rock hazard between the CEUS SSC model and the Updated EPRI-SOG model.

Figure 40 compares the UHRS for the GMRS elevation based on the CEUS SSC model with the modified CAV filter to the results based on the Updated EPRI-SOG model with the full CAV filter. The UHRS amplitudes only show the seven computed spectral frequencies from the hazard calculations – 0.5 Hz, 1 Hz, 2.5 Hz, 5 Hz, 10 Hz, 25 Hz, and 100 Hz (PGA) – and have not been smoothed. The 10^{-3} UHRS for the Updated EPRI-SOG model with the full CAV filter was undefined; therefore, no spectrum is shown. The results show that the UHRS based on the CEUS SSC model and the modified CAV filter are higher than those based on the Updated EPRI-SOG model with the full CAV filter. The increase in amplitude for the 10^{-5} and 10^{-6} UHRS principally reflect increases in the hard rock hazard. The larger increase in the amplitude for the 10^{-4} UHRS includes the additional effects of the modified CAV filter.

GMRS and FIRS Based on the CEUS SSC Model with Modified CAV Filter

The computed UHRS based on the CEUS SSC model and the modified CAV filter were used to develop the outcropping spectra for the GMRS and FIRS profiles.

The process used to develop the GMRS based on the Updated EPRI-SOG model presented in Fermi 3 FSAR Subsection 2.5.2.6 consisted of the following three steps:

1. Smoothed surface UHRS for exceedance frequencies of 10^{-4} and 10^{-5} were constructed by scaling the RE hard rock response spectra and extended hard rock UHRS by the mean site amplification functions. Smooth envelope spectra were then constructed from the values representing the UHRS without the CAV filter at the GMRS elevation for a minimum magnitude of m_b 5.0.
2. Hazard calculations at the GMRS elevation were performed for two cases: minimum magnitude of m_b 5.0 with no CAV and a minimum magnitude of m_b 4.0 with full CAV, with both calculations including the site amplification functions. The hazard curves from these calculations are interpolated to obtain 10^{-4} and 10^{-5} spectral amplitudes at the seven spectral frequencies. The ratio of the results – CAV/nonCAV – provide scale factors at the seven spectral frequencies to adjust the results of Step 1 to account for the effects of the CAV filter. The values at the seven frequencies are interpolated and extrapolated to cover the range from 0.1 to 100 Hz. These interpolated scale factors are multiplied times the nonCAV smoothed surface UHRS from Step 1 to produce smoothed surface UHRS that incorporate CAV.
3. The performance based approach outlined in Regulatory Guide 1.208 is then applied to the smoothed surface UHRS from Step 2 to develop the GMRS.

The process used to develop the GMRS based on the CEUS SSC model and modified CAV follows these same three steps, with modification, as follows:

1. Use the smoothed surface UHRS from the Updated EPRI-SOG model described in Step 1 above.
2. Use the hazard results from the Updated EPRI-SOG model for a minimum magnitude of m_b 5.0 with no CAV (nonCAV) because they are consistent with the smoothed surface UHRS from Step 1. However, calculate new hazard results using the CEUS SSC model and the modification to the application of CAV. These are the results shown on Figures 33 through 39. The new hazard results with the CEUS SSC model and the modification to the application of CAV uses the same amplitude dependent site amplification functions used to develop the smoothed surface UHRS in Step 1 and the nonCAV hazard at the GMRS elevation. As stated in the previous section, these site amplification functions are considered adequate for the purpose of computing the CAV hazard at the Fermi 3 GMRS elevation. New ratios of the results are then computed for

the seven spectral frequencies – (CEUS SSC with modified CAV)/(Updated EPRI-SOG nonCAV) – that include two effects: the change in the source model and the change in the application of the CAV filter. Using spectral ratios is appropriate because the amplification functions are not sensitive to the different DE spectral shapes and the amplitude-dependence of the amplification functions is incorporated into the hazard calculations performed using the CEUS SSC model with modified CAV. The result of the modified Step 2 is to produce new smoothed UHRS at the GMRS elevation that represent the hazard from the CEUS SSC model and the modified CAV filter.

3. The performance based approach outlined in Regulatory Guide 1.208 is then applied to the new smoothed surface UHRS from Step 2 to develop the GMRS that represents the hazard from the CEUS SSC model and the modified CAV filter.

Deaggregation of the hazard results for a frequency of 0.5 Hz, the lowest frequency the hazard is calculated, based on the CEUS SSC model shows that the mean magnitude is approximately **M** 7.5 with a mean distance of about 650 km. This mean magnitude and distance are different than those obtained for the Updated EPRI-SOG model, and reflect the increased contribution from the distributed seismicity sources and other RLMEs at the Fermi 3 site. Similar to Fermi 3 FSAR Subsection 2.5.2.4, the hard rock UHRS was extended from 0.5 Hz to a frequency of 0.1 Hz using spectral shapes consistent with the mean magnitude and distance from the deaggregation of the 0.5 Hz hazard results based on the CEUS SSC model. The resulting spectral shapes are presented on Figure 41 in terms of pseudo spectral velocity normalized by the predicted spectral velocity at 0.5 Hz. Two updated ground motion models for hard rock motions in the CEUS that extend to lower frequencies were also used to supplement the ground motion models presented in FSAR Figure 2.5.2-250. These ground motion models are the Atkinson and Boore (2011) modification to the Atkinson (2008) Referenced Empirical model (designated by the authors as Atkinson 2008 prime), and the Pezeshk et al. (2011) hybrid model that replaces the Campbell (Fermi 3 FSAR Reference 2.5.2-263) and Tavakoli and Pezeshk (Fermi 3 FSAR Reference 2.5.2-266) hybrid models, because it is based on more up to date western US ground motion models and CEUS data.

The heavy red dashed line in Figure 41 shows the low frequency extension from 0.5 to 0.1 Hz. The extension represents an envelope of the spectral shapes consistent with the mean magnitude and distance from the deaggregation of the 0.5 Hz hazard results based on the CEUS SSC model. The extension defines constant spectral velocity from 0.5 to 0.2 Hz, followed by a small decrease from constant spectral velocity extending from 0.2 to 0.1 Hz. The spectral amplitude at 0.133 Hz (7.5 seconds spectral period) is 90 percent of what it would be for a constant spectral velocity value and the spectral amplitude at 0.1 Hz is 80 percent of the constant spectral velocity value. This extension is used to produce the low-frequency hard rock UHRS to which the site amplification functions are applied.

The low frequency extension reflects both the difference between the mean magnitudes and distances of the CEUS SSC model and the Updated EPRI-SOG model, which reduces the 0.1 Hz spectral velocity value, and recent ground motion models that contain estimates of 0.1 Hz motions that result in lower relative motions at 0.1 Hz than would be obtained assuming constant spectral velocity from 0.5 to 0.1 Hz. The change from constant spectral velocity at frequencies below 0.2 Hz is consistent with the response spectrum approaching constant displacement. Equation (21) of Abrahamson and Silva (Fermi 3 FSAR Reference 2.5.2-275) suggests that the spectra for **M** 7.5 earthquakes should reach constant displacement at a period of 10 seconds (frequency of 0.1 Hz). The spectral shape in the frequency range between 0.1

and 0.2 Hz shown on Figure 41 represents this transition from constant velocity to constant displacement.

Table 5 lists the GMRS based on the CEUS SSC model and modified CAV application. The vertical GMRS is obtained from the horizontal GMRS using the vertical to horizontal spectral ratios presented in Fermi 3 FSAR Subsection 2.5.2.6. Figure 42 compares the GMRS based on the Updated EPRI-SOG model with full CAV to the GMRS based on the CEUS SSC model with modified CAV. The GMRS based on the CEUS SSC model and modified CAV is higher than the GMRS based on the EPRI-SOG model and full CAV at most frequencies. Near 0.1 Hz the GMRS based on the CEUS SSC model and modified CAV is about 12 percent lower than GMRS based on the EPRI-SOG model and full CAV due to the updated low frequency extension of the hard rock UHRS. The GMRS based on the CEUS SSC model and modified CAV compared to the GMRS based on the EPRI-SOG model and full CAV is summarized as follows:

- At 0.14 Hz the GMRS for the CEUS SSC and EPRI-SOG models are approximately equal.
- Above 0.14 Hz, the CEUS SSC GMRS is greater than the EPRI-SOG GMRS, with a maximum difference of 39 percent near 5 Hz.
- At 100 Hz (PGA), the CEUS SSC GMRS is about 22 percent greater than the EPRI-SOG GMRS.

The procedures described above for development of the GMRS were used to develop the TSCR FIRS for the foundation elevations of the RB/FB, CB, and FWSC. Table 6 lists the resulting TSCR FIRS for the RB/FB, CB, and FWSC. The TSCR FIRS for the FWSC was computed using the site amplification functions based on the 4,500 psi fill concrete extending from below the FWSC foundation to the top of bedrock and incorporating the 2-dimensional effects quantified in the response to RAI 03.07.01-4. The resulting FIRS are compared to those developed using the Updated EPRI-SOG model with full CAV on Figures 43, 44, and 45. Because the same CAV/nonCAV spectral ratios are applied to the FIRS and the GMRS, the percent changes in the spectra are the same as those described above for the GMRS, except for the FWSC. For the FWSC, the new FIRS accounts for the effects of the change in fill concrete properties and site amplification function quantified in the response to RAI 03.07.01-4. Also shown on Figures 43, 44, and 45 are the ESBWR Certified Seismic Design Response Spectra (CSDRS) (Fermi 3 FSAR Reference 2.5.2-291). The FIRS are enveloped by the ESBWR CSDRS in all cases.

Summary of Results and Path Forward

The results of the analyses performed using the CEUS SSC model along with the modifications to the application of the EPRI (Fermi 3 FSAR Reference 2.5.2-290) CAV model produced increases in the GMRS and TSCR FIRS. The resultant Fermi 3 CEUS SSC model GMRS and FIRS are greater than the Updated EPRI-SOG model Fermi 3 GMRS and FIRS. As illustrated in the response, the CEUS SSC model FIRS remain enveloped by the ESBWR Certified Seismic Design Response Spectra (CSDRS).

Recognizing that the GMRS and FIRS represent the fundamental source of seismic inputs to the Fermi 3 site-specific soil-structure interaction (SSI) analyses, Detroit Edison intends to address the impact of the Fermi 3 CEUS GMRS and FIRS in conjunction with the response to

RAI Letter No. 79. RAI Letter No. 79 includes several questions associated with the Fermi 3 site-specific SSI analyses, including consistency in analyses inputs. Detroit Edison is currently developing a plan and schedule for analytical work anticipated to be necessary to address RAI Letter No. 79. The initial response to RAI Letter No. 79 is due September 7, 2012.

On July 12, 2012, during the weekly Fermi 3 Open Items call with the NRC, the NRC staff requested that Detroit Edison provide electronic files containing data and analysis results related to the response to this RAI. The staff's eight requests and Detroit Edison's descriptions of the data and results provided are listed in Enclosure 1. Enclosure 1 includes a CD containing electronic files as requested by the NRC staff.

References:

1. Atkinson, G., 2008, Alternative ground-motion prediction equations for eastern North America from a referenced empirical approach: Implications for epistemic uncertainty, *Bulletin of the Seismological Society of America*, v. 98, p .1304-1318.
2. Atkinson, G., and D. Boore, 2011, Modifications to existing ground-motion prediction equations in light of new data, *Bulletin of the Seismological Society of America*, v.101, p.1121-1135.
3. Electric Power Research Institute, U.S. Department of Energy, and U.S. Nuclear Regulatory Commission (EPRI/DOE/NRC), 2012. Technical Report: Central and Eastern United States Seismic Source Characterization for Nuclear Facilities, published as NUREG 2115 by the U.S. Nuclear Regulatory Commission.
4. Pezeshk, S., A. Zandieh, and B Tavakoli, 2011, Hybrid empirical ground-motion prediction equations for Eastern North America using NGA models and updated seismological parameters, *Bulletin of the Seismological Society of America*, v. 101, p. 1859-1870.

Proposed COLA Revision

COLA markups will be developed and provided in conjunction with the response to RAI Letter No. 79, RAI 03.07.02-9.

Table 1
Comparison of Ground Motions Computed from Mean Hazard Curves for the Seven Demonstration Sites

Demonstration Site Name	**Ground Motion Parameter**	**Ground Motion Level (g)**		**Percent Difference**
		Software for Fermi 3	**NUREG-2115 Chapter 8**	
Central Illinois	10^{-4} PGA	0.183	0.178	2.5%
	10^{-5} PGA	0.611	0.581	5.2%
	10^{-6} PGA	1.691	1.613	4.8%
	10^{-4} 10 Hz PSA	0.365	0.357	2.0%
	10^{-5} 10 Hz PSA	1.113	1.070	4.0%
	10^{-6} 10 Hz PSA	2.952	2.831	4.3%
	10^{-4} 1 Hz PSA	0.108	0.106	2.2%
	10^{-5} 1 Hz PSA	0.246	0.240	2.6%
	10^{-6} 1 Hz PSA	0.507	0.495	2.5%
Chattanooga	10^{-4} PGA	0.338	0.329	2.7%
	10^{-5} PGA	1.113	1.086	2.5%
	10^{-6} PGA	2.592	2.537	2.2%
	10^{-4} 10 Hz PSA	0.624	0.609	2.5%
	10^{-5} 10 Hz PSA	1.963	1.917	2.4%
	10^{-6} 10 Hz PSA	4.542	4.458	1.9%
	10^{-4} 1 Hz PSA	0.115	0.113	1.8%
	10^{-5} 1 Hz PSA	0.288	0.282	2.1%
	10^{-6} 1 Hz PSA	0.677	0.667	1.6%
Houston	10^{-4} PGA	0.039	0.037	3.1%
	10^{-5} PGA	0.140	0.135	3.6%
	10^{-6} PGA	0.593	0.571	3.9%
	10^{-4} 10 Hz PSA	0.081	0.079	2.8%
	10^{-5} 10 Hz PSA	0.288	0.279	3.4%
	10^{-6} 10 Hz PSA	1.078	1.044	3.3%
	10^{-4} 1 Hz PSA	0.045	0.044	2.3%
	10^{-5} 1 Hz PSA	0.124	0.120	3.2%
	10^{-6} 1 Hz PSA	0.274	0.266	3.2%
Jackson	10^{-4} PGA	0.108	0.106	2.4%
	10^{-5} PGA	0.305	0.297	2.8%
	10^{-6} PGA	1.035	1.000	3.5%
	10^{-4} 10 Hz PSA	0.226	0.221	2.5%
	10^{-5} 10 Hz PSA	0.620	0.605	2.3%
	10^{-6} 10 Hz PSA	1.804	1.757	2.7%
	10^{-4} 1 Hz PSA	0.095	0.091	4.7%
	10^{-5} 1 Hz PSA	0.221	0.213	3.9%
	10^{-6} 1 Hz PSA	0.451	0.437	3.4%

Table 1
Comparison of Ground Motions Computed from Mean Hazard Curves for the Seven Demonstration Sites

Demonstration Site Name	Ground Motion Parameter	Ground Motion Level (g)		Percent Difference
		Software for Fermi 3	NUREG-2115 Chapter 8	
Manchester	10^{-4} PGA	0.247	0.240	2.8%
	10^{-5} PGA	0.904	0.879	2.9%
	10^{-6} PGA	2.268	2.218	2.2%
	10^{-4} 10 Hz PSA	0.463	0.452	2.6%
	10^{-5} 10 Hz PSA	1.609	1.572	2.4%
	10^{-6} 10 Hz PSA	3.991	3.914	2.0%
	10^{-4} 1 Hz PSA	0.069	0.068	1.0%
	10^{-5} 1 Hz PSA	0.217	0.214	1.6%
	10^{-6} 1 Hz PSA	0.610	0.601	1.6%
Savannah	10^{-4} PGA	0.304	0.329	-7.4%
	10^{-5} PGA	0.805	0.886	-9.2%
	10^{-6} PGA	1.890	1.996	-5.3%
	10^{-4} 10 Hz PSA	0.616	0.667	-7.6%
	10^{-5} 10 Hz PSA	1.588	1.766	-10.0%
	10^{-6} 10 Hz PSA	3.568	3.886	-8.2%
	10^{-4} 1 Hz PSA	0.151	0.163	-7.5%
	10^{-5} 1 Hz PSA	0.376	0.426	-11.8%
	10^{-6} 1 Hz PSA	0.799	0.920	-13.1%
Topeka	10^{-4} PGA	0.124	0.120	3.3%
	10^{-5} PGA	0.512	0.493	3.7%
	10^{-6} PGA	1.621	1.562	3.8%
	10^{-4} 10 Hz PSA	0.243	0.236	3.0%
	10^{-5} 10 Hz PSA	0.921	0.891	3.4%
	10^{-6} 10 Hz PSA	2.622	2.553	2.7%
	10^{-4} 1 Hz PSA	0.069	0.068	1.8%
	10^{-5} 1 Hz PSA	0.177	0.172	2.6%
	10^{-6} 1 Hz PSA	0.397	0.388	2.3%

g - Gravity

Table 2
Comparison of the Upper Limit of Magnitude Distributions for New Madrid Earthquakes

Updated EPRI-SOG Model					
New Madrid Source Maximum Magnitude Distribution			Upper End of Magnitude Distribution Used in Hazard Calculation		
Scenario	Weight	Expected Magnitude for NMS, RF, NMN (**M**)	Equivalent **M** using Atkinson and Boore (1995) m_b to **M** relationship	Equivalent **M** using Johnston (1996) m_b to **M** relationship	Equivalent **M** using EPRI (1993) m_b to **M** relationship
1	0.1667	7.8, 7.7, 7.5	8.21, 8.11, 7.90	8.20, 8.11,7.90	8.30, 8.20, 8.03
2	0.1667	7.9, 7.8, 7.6	8.32, 8.21, 8.01	8.30, 8.20,7.99	8.39, 8.30, 8.12
3	0.25	7.6, 7.8, 7.5	8.01, 8.21, 7.90	7.99, 8.20, 7.90	8.12, 8.30, 8.03
4	0.0833	7.2, 7,4, 7.2	7.59, 7.80, 7.59	7.58, 7.78, 7.58	7.75, 7.94, 7.75
5	0.1667	7.2, 7.4, 7.0	7.59, 7.80, 7.38	7.58, 7.78, 7.38	7.75, 7.94, 7.54
6	0.1667	7.3, 7.5, 7.0	7.70, 7.90, 7.38	7.69, 7.90, 7.38	7.84, 8.03, 7.54

CEUS SSC Model			
RLME Magnitude Distribution			Upper End of Magnitude Distribution Used in Hazard Calculation
Scenario	Weight	Expected Magnitude for NMS, RF, NMN (**M**)	
1	0.167	7.8, 7.7, 7.5	8.05, 7.95, 7.75
2	0.167	7.9, 7.8, 7.6	8.15, 8.05, 7.85
3	0.25	7.6, 7.8, 7.5	7.85, 8.05, 7.75
4	0.083	7.2, 7.4, 7.2	7.45, 7.65, 7.45
5	0.25	6.9, 7.3, 7.0	7.17, 7.55, 7.25
6	0.083	6.7, 7.1, 6.8	6.95, 7.35, 7.05

Table 3
Hard Rock UHRS for the Fermi 3 Site obtained using the Updated EPRI-SOG Model and CEUS SSC model

Spectral Frequency (Hz)	Spectral Acceleration (g)								Percent Difference			
	Updated EPRI-SOG Model				CEUS SSC Model							
	Mean 10-3	Mean 10-4	Mean 10-5	Mean 10-6	Mean 10-3	Mean 10-4	Mean 10-5	Mean 10-6	Mean 10-3	Mean 10-4	Mean 10-5	Mean 10-6
100	0.0233	0.0997	0.4101	1.2088	0.0289	0.1149	0.4609	1.3396	24.0%	15.2%	12.4%	10.8%
25	0.0584	0.2799	1.1173	3.4735	0.0724	0.3255	1.2475	3.8678	24.0%	16.3%	11.7%	11.4%
10	0.0461	0.1922	0.7205	2.0545	0.0573	0.2250	0.8330	2.3847	24.3%	17.1%	15.6%	16.1%
5	0.0361	0.1359	0.4473	1.2438	0.0456	0.1625	0.5445	1.4949	26.3%	19.6%	21.7%	20.2%
2.5	0.0254	0.0886	0.2451	0.6288	0.0316	0.1045	0.3004	0.8124	24.4%	17.9%	22.6%	29.2%
1	0.0139	0.0537	0.1422	0.3080	0.0177	0.0592	0.1529	0.3546	27.3%	10.2%	7.5%	15.1%
0.5	0.0083	0.0402	0.1236	0.2832	0.0111	0.0441	0.1244	0.2760	33.7%	9.7%	0.6%	-2.5%

Table 4

Rock Hazard Reference and Deaggregation Earthquakes

Hazard Level	Reference (Controlling) Earthquake CEUS SSC Model		Deaggregation Earthquakes CEUS SSC Model			Reference (Controlling) Earthquake EPRI-SOG/UCSS Model		Deaggregation Earthquakes EPRI-SOG/UCSS Model		
	Magnitude (M)	Distance (km)	Magnitude (M)	Distance (km)	Weight	Magnitude (m_b)	Distance (km)	Magnitude (m_b)	Distance (km)	Weight
Mean 10^{-3} 5 and 10 Hz	6.1	143	5.5	84	0.587	6.1	139	5.4	52	0.440
			6.5	152	0.198			6.1	148	0.265
			7.4	580	0.215			7.1	566	0.295
Mean 10^{-3} 1 and 2.5Hz	6.8 7.1*	290 439*	5.5	72	0.231	6.8 7.0*	328 479*	5.4	33	0.126
			6.5	161	0.165			6.2	145	0.148
			7.4	588	0.605			7.1	582	0.726
Mean 10^{-4} 5 and 10 Hz	6.0	48	5.4	25.7	0.615	5.9	44	5.4	17.5	0.595
			6.5	76	0.292			6.3	71	0.224
			7.6	585	0.094			7.2	507	0.181
Mean 10^{-4} 1 and 2.5Hz	6.8 7.4*	165 457*	5.5	22.4	0.239	6.8 7.1*	224 500*	5.5	16.3	0.172
			6.6	84	0.251			6.3	58	0.117
			7.6	585	0.511			7.2	535	0.711
Mean 10^{-5} 5 and 10 Hz	5.9	15.1	5.5	10.8	0.655	5.8	13.7	5.5	9.7	0.687
			6.6	26	0.337			6.4	22	0.290
			7.7	585	0.008			7.4	600	0.023
Mean 10^{-5} 1 and 2.5Hz	6.7 7.6*	63 468*	5.5	11.5	0.292	6.7 7.2*	107 504*	5.6	10.2	0.220
			6.7	37	0.396			6.5	34	0.290
			7.7	594	0.311			7.3	598	0.490
Mean 10^{-6} 5 and 10 Hz	6.0	10.9	5.5	8.3	0.530	5.9	9.8	5.5	8.1	0.550
			6.4	12.5	0.386			6.4	11.5	0.442
			7.4	26	0.084			7.2	161	0.008
Mean 10^{-6} 1 and 2.5Hz	6.6 7.7*	24.5 445*	5.6	8.7	0.235	6.6 7.3*	41 492*	6.0	8.0	0.415
			6.7	20	0.650			6.6	32	0.306
			7.7	595	0.113			7.3	600	0.279

*computed using earthquakes with distances > 100 km

Table 5: GMRS for the Fermi 3 Site Based on the CEUS SSC Model and Modified CAV (Sheet 1 of 2)

Spectral Frequency (Hz)	5% Damped Spectral Acceleration (g)				
	10^{-4} UHRS	10^{-5} UHRS	Horizontal GMRS	Vertical/Horizontal	Vertical GMRS
100.000	0.2505	1.0919	0.4913	1.0000	0.4913
60.241	0.4096	1.7058	0.7694	1.1374	0.8751
50.000	0.4549	1.9374	0.8718	1.1244	0.9802
40.000	0.5555	2.3580	1.0611	1.0426	1.1064
33.333	0.6637	2.6956	1.2220	0.9675	1.1823
30.303	0.7407	2.9498	1.3425	0.9400	1.2620
25.000	0.9186	3.6155	1.6493	0.8800	1.4514
23.810	0.9470	3.7037	1.6917	0.8681	1.4686
22.727	0.9691	3.7633	1.7214	0.8569	1.4751
21.739	0.9671	3.7696	1.7230	0.8461	1.4579
20.833	0.9463	3.6819	1.6835	0.8355	1.4066
20.000	0.9261	3.6339	1.6588	0.8255	1.3693
18.182	0.8369	3.4954	1.5757	0.8069	1.2714
16.667	0.7560	3.2999	1.4849	0.7984	1.1855
15.385	0.6961	3.0456	1.3705	0.7906	1.0835
14.286	0.6411	2.8345	1.2755	0.7834	0.9993
13.333	0.6192	2.6984	1.2143	0.7769	0.9433
12.500	0.5993	2.5770	1.1597	0.7708	0.8938
11.765	0.5813	2.4680	1.1106	0.7651	0.8497
11.111	0.5648	2.3694	1.0672	0.7597	0.8108
10.526	0.5496	2.2798	1.0291	0.7547	0.7767
10.000	0.5355	2.1979	0.9943	0.7500	0.7457
9.091	0.5087	2.0386	0.9266	0.7500	0.6950
8.333	0.4855	1.9032	0.8689	0.7500	0.6517
7.692	0.4650	1.7867	0.8190	0.7500	0.6142
7.143	0.4468	1.6852	0.7753	0.7500	0.5815
6.667	0.4305	1.5958	0.7368	0.7500	0.5526
6.250	0.4158	1.5165	0.7024	0.7500	0.5268
5.882	0.4024	1.4457	0.6717	0.7500	0.5037
5.556	0.3902	1.3819	0.6439	0.7500	0.4829
5.263	0.3790	1.3241	0.6186	0.7500	0.4640
5.000	0.3687	1.2716	0.5956	0.7500	0.4467
4.545	0.3490	1.1740	0.5527	0.7500	0.4145
4.167	0.3319	1.0915	0.5161	0.7500	0.3871
3.846	0.3170	1.0207	0.4847	0.7500	0.3635
3.571	0.3068	0.9704	0.4625	0.7500	0.3468
3.333	0.2940	0.9222	0.4402	0.7500	0.3302
3.125	0.2744	0.8523	0.4076	0.7500	0.3057
2.941	0.2547	0.7835	0.3755	0.7500	0.2816
2.778	0.2356	0.7157	0.3439	0.7500	0.2579
2.632	0.2191	0.6607	0.3179	0.7500	0.2384
2.500	0.2029	0.6073	0.2926	0.7500	0.2195
2.381	0.1876	0.5556	0.2683	0.7500	0.2012
2.273	0.1747	0.5124	0.2479	0.7500	0.1859

Table 5 GMRS for the Fermi 3 Site Based on the CEUS SSC Model and Modified CAV (Sheet 2 of 2)

Spectral Frequency (Hz)	5% Damped Spectral Acceleration (g)				
	10^{-4} UHRS	10^{-5} UHRS	Horizontal GMRS	Vertical/Horizontal	Vertical GMRS
2.174	0.1621	0.4730	0.2291	0.7500	0.1718
2.083	0.1538	0.4454	0.2160	0.7500	0.1620
2.000	0.1446	0.4158	0.2020	0.7500	0.1515
1.818	0.1251	0.3554	0.1731	0.7500	0.1298
1.667	0.1104	0.3106	0.1515	0.7500	0.1136
1.538	0.0992	0.2748	0.1345	0.7500	0.1009
1.429	0.0899	0.2461	0.1207	0.7500	0.0906
1.333	0.0830	0.2250	0.1106	0.7500	0.0829
1.250	0.0785	0.2114	0.1041	0.7500	0.0780
1.176	0.0743	0.1987	0.0979	0.7500	0.0735
1.111	0.0714	0.1893	0.0935	0.7500	0.0701
1.053	0.0682	0.1796	0.0888	0.7500	0.0666
1.000	0.0654	0.1717	0.0849	0.7500	0.0637
0.909	0.0618	0.1641	0.0810	0.7500	0.0608
0.833	0.0591	0.1575	0.0777	0.7500	0.0583
0.769	0.0564	0.1517	0.0747	0.7500	0.0560
0.714	0.0542	0.1476	0.0725	0.7500	0.0544
0.667	0.0526	0.1443	0.0707	0.7500	0.0531
0.625	0.0509	0.1407	0.0689	0.7500	0.0517
0.588	0.0493	0.1376	0.0672	0.7500	0.0504
0.556	0.0482	0.1352	0.0660	0.7500	0.0495
0.526	0.0469	0.1322	0.0645	0.7500	0.0483
0.500	0.0458	0.1300	0.0633	0.7500	0.0475
0.455	0.0423	0.1210	0.0588	0.7500	0.0441
0.417	0.0394	0.1137	0.0552	0.7500	0.0414
0.385	0.0369	0.1074	0.0520	0.7500	0.0390
0.357	0.0348	0.1026	0.0496	0.7500	0.0372
0.333	0.0332	0.0983	0.0475	0.7500	0.0356
0.313	0.0316	0.0943	0.0455	0.7500	0.0341
0.294	0.0302	0.0904	0.0436	0.7500	0.0327
0.278	0.0291	0.0870	0.0419	0.7500	0.0315
0.263	0.0280	0.0841	0.0405	0.7500	0.0304
0.250	0.0269	0.0815	0.0392	0.7500	0.0294
0.238	0.0261	0.0789	0.0379	0.7500	0.0285
0.227	0.0252	0.0767	0.0369	0.7500	0.0276
0.217	0.0244	0.0746	0.0358	0.7500	0.0268
0.208	0.0236	0.0726	0.0348	0.7500	0.0261
0.200	0.0228	0.0709	0.0339	0.7500	0.0254
0.182	0.0208	0.0655	0.0312	0.7500	0.0234
0.167	0.0190	0.0606	0.0288	0.7500	0.0216
0.154	0.0176	0.0564	0.0268	0.7500	0.0201
0.143	0.0163	0.0527	0.0250	0.7500	0.0187
0.133	0.0152	0.0495	0.0235	0.7500	0.0176
0.125	0.0141	0.0465	0.0220	0.7500	0.0165
0.118	0.0132	0.0438	0.0206	0.7500	0.0155
0.111	0.0123	0.0415	0.0195	0.7500	0.0146
0.100	0.0110	0.0372	0.0175	0.7500	0.0131

Table 6 RB/FB, CB, and FWSC TSCR FIRS for the Fermi 3 Site Based on the CEUS SSC Model and Modified CAV (Sheet 1 of 2)

Spectral Frequency (Hz)	5 Percent Damped Spectral Acceleration (g)					
	Horizontal RB/FB TSCR FIRS	Vertical RB/FB TSCR FIRS	Horizontal CB TSCR FIRS	Vertical CB TSCR FIRS	Horizontal FWSC TSCR FIRS	Vertical FWSC TSCR FIRS
100.000	0.2662	0.2662	0.2589	0.2589	0.2676	0.2676
60.241	0.4473	0.5088	0.4406	0.5012	0.4611	0.5245
50.000	0.5291	0.5949	0.5404	0.6077	0.5593	0.6289
40.000	0.5655	0.5896	0.6252	0.6519	0.6978	0.7275
33.333	0.5599	0.5417	0.6189	0.5988	0.8482	0.8207
30.303	0.5717	0.5374	0.6128	0.5761	0.9105	0.8559
25.000	0.5961	0.5246	0.6006	0.5286	0.9413	0.8283
23.810	0.6011	0.5218	0.5991	0.5201	0.9156	0.7949
22.727	0.6059	0.5192	0.5976	0.5121	0.8918	0.7642
21.739	0.6105	0.5165	0.5962	0.5045	0.8697	0.7359
20.833	0.6149	0.5138	0.5949	0.4971	0.8490	0.7094
20.000	0.6192	0.5111	0.5937	0.4901	0.8296	0.6848
18.182	0.6293	0.5078	0.5922	0.4778	0.7861	0.6343
16.667	0.6387	0.5099	0.5908	0.4716	0.7483	0.5974
15.385	0.6260	0.4949	0.5895	0.4660	0.7305	0.5775
14.286	0.6228	0.4879	0.5831	0.4569	0.7151	0.5602
13.333	0.6206	0.4821	0.5817	0.4519	0.6996	0.5435
12.500	0.6186	0.4768	0.5803	0.4473	0.6854	0.5283
11.765	0.6166	0.4718	0.5791	0.4430	0.6729	0.5148
11.111	0.6149	0.4671	0.5779	0.4390	0.6623	0.5032
10.526	0.6132	0.4628	0.5768	0.4353	0.6525	0.4924
10.000	0.6116	0.4587	0.5757	0.4318	0.6433	0.4825
9.091	0.6047	0.4535	0.5700	0.4275	0.6224	0.4668
8.333	0.5984	0.4488	0.5649	0.4237	0.6040	0.4530
7.692	0.5928	0.4446	0.5602	0.4202	0.5876	0.4407
7.143	0.5876	0.4407	0.5559	0.4169	0.5727	0.4295
6.667	0.5828	0.4371	0.5519	0.4139	0.5592	0.4194
6.250	0.5783	0.4337	0.5482	0.4112	0.5469	0.4102
5.882	0.5741	0.4306	0.5448	0.4086	0.5356	0.4017
5.556	0.5703	0.4277	0.5416	0.4062	0.5251	0.3938
5.263	0.5666	0.4250	0.5385	0.4039	0.5154	0.3865
5.000	0.5632	0.4224	0.5357	0.4017	0.5063	0.3798
4.545	0.5438	0.4078	0.5280	0.3960	0.4878	0.3659
4.167	0.5176	0.3882	0.5182	0.3886	0.4715	0.3536
3.846	0.4805	0.3604	0.4894	0.3671	0.4569	0.3427
3.571	0.4378	0.3283	0.4556	0.3417	0.4439	0.3329
3.333	0.4004	0.3003	0.4235	0.3176	0.4320	0.3240
3.125	0.3611	0.2708	0.3884	0.2913	0.4109	0.3082
2.941	0.3285	0.2464	0.3544	0.2658	0.3886	0.2914
2.778	0.3000	0.2250	0.3217	0.2413	0.3614	0.2710
2.632	0.2780	0.2085	0.2955	0.2216	0.3379	0.2534
2.500	0.2564	0.1923	0.2717	0.2038	0.3114	0.2335
2.381	0.2368	0.1776	0.2501	0.1876	0.2863	0.2147
2.273	0.2205	0.1654	0.2316	0.1737	0.2641	0.1981
2.174	0.2062	0.1547	0.2152	0.1614	0.2433	0.1824
2.083	0.1950	0.1462	0.2032	0.1524	0.2286	0.1714

Table 6 RB/FB, CB, and FWSC TSCR FIRS for the Fermi 3 Site Based on the CEUS SSC Model and Modified CAV (Sheet 2 of 2)

Spectral Frequency (Hz)	5 Percent Damped Spectral Acceleration (g)					
	Horizontal RB/FB TSCR FIRS	Vertical RB/FB TSCR FIRS	Horizontal CB TSCR FIRS	Vertical CB TSCR FIRS	Horizontal FWSC TSCR FIRS	Vertical FWSC TSCR FIRS
2.000	0.1837	0.1378	0.1909	0.1432	0.2129	0.1597
1.818	0.1601	0.1201	0.1654	0.1241	0.1795	0.1346
1.667	0.1420	0.1065	0.1456	0.1092	0.1566	0.1175
1.538	0.1268	0.0951	0.1294	0.0970	0.1378	0.1033
1.429	0.1145	0.0859	0.1169	0.0877	0.1234	0.0925
1.333	0.1057	0.0792	0.1078	0.0809	0.1130	0.0848
1.250	0.0999	0.0749	0.1015	0.0761	0.1055	0.0792
1.176	0.0946	0.0709	0.0959	0.0719	0.0994	0.0746
1.111	0.0904	0.0678	0.0916	0.0687	0.0942	0.0707
1.053	0.0862	0.0647	0.0872	0.0654	0.0895	0.0671
1.000	0.0827	0.0620	0.0835	0.0627	0.0856	0.0642
0.909	0.0792	0.0594	0.0797	0.0598	0.0817	0.0613
0.833	0.0760	0.0570	0.0765	0.0574	0.0780	0.0585
0.769	0.0733	0.0550	0.0739	0.0554	0.0752	0.0564
0.714	0.0713	0.0534	0.0717	0.0538	0.0729	0.0546
0.667	0.0695	0.0522	0.0700	0.0525	0.0709	0.0532
0.625	0.0678	0.0509	0.0682	0.0512	0.0691	0.0519
0.588	0.0663	0.0497	0.0666	0.0500	0.0673	0.0505
0.556	0.0650	0.0488	0.0654	0.0490	0.0660	0.0495
0.526	0.0636	0.0477	0.0638	0.0479	0.0645	0.0484
0.500	0.0625	0.0469	0.0628	0.0471	0.0633	0.0474
0.455	0.0581	0.0436	0.0584	0.0438	0.0587	0.0440
0.417	0.0546	0.0409	0.0547	0.0410	0.0551	0.0413
0.385	0.0514	0.0386	0.0516	0.0387	0.0519	0.0389
0.357	0.0489	0.0367	0.0490	0.0368	0.0494	0.0370
0.333	0.0467	0.0350	0.0468	0.0351	0.0472	0.0354
0.313	0.0446	0.0335	0.0448	0.0336	0.0451	0.0339
0.294	0.0427	0.0320	0.0429	0.0322	0.0431	0.0324
0.278	0.0410	0.0308	0.0412	0.0309	0.0414	0.0311
0.263	0.0395	0.0296	0.0397	0.0298	0.0399	0.0299
0.250	0.0382	0.0286	0.0384	0.0288	0.0386	0.0290
0.238	0.0370	0.0277	0.0371	0.0278	0.0373	0.0280
0.227	0.0358	0.0269	0.0360	0.0270	0.0363	0.0272
0.217	0.0348	0.0261	0.0349	0.0262	0.0351	0.0264
0.208	0.0338	0.0253	0.0339	0.0254	0.0341	0.0256
0.200	0.0329	0.0247	0.0330	0.0248	0.0332	0.0249
0.182	0.0302	0.0227	0.0303	0.0227	0.0305	0.0228
0.167	0.0278	0.0209	0.0279	0.0209	0.0280	0.0210
0.154	0.0258	0.0193	0.0259	0.0194	0.0260	0.0195
0.143	0.0240	0.0180	0.0241	0.0181	0.0242	0.0182
0.133	0.0225	0.0169	0.0226	0.0169	0.0227	0.0170
0.125	0.0210	0.0158	0.0211	0.0158	0.0212	0.0159
0.118	0.0197	0.0148	0.0198	0.0149	0.0199	0.0149
0.111	0.0186	0.0140	0.0187	0.0140	0.0188	0.0141
0.100	0.0166	0.0125	0.0167	0.0125	0.0168	0.0126

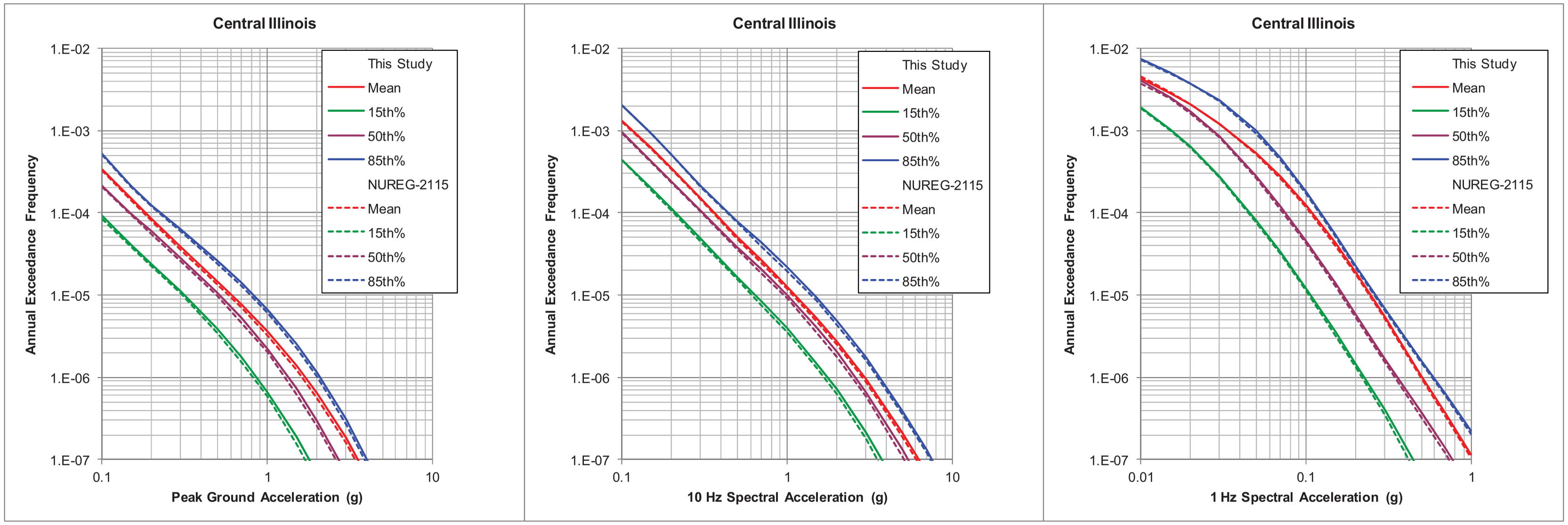


Figure 1: Comparison of hazard curves computed using Fermi 3 PSHA software with those listed in Chapter 8 of NUREG-2115 for the Central Illinois demonstration site

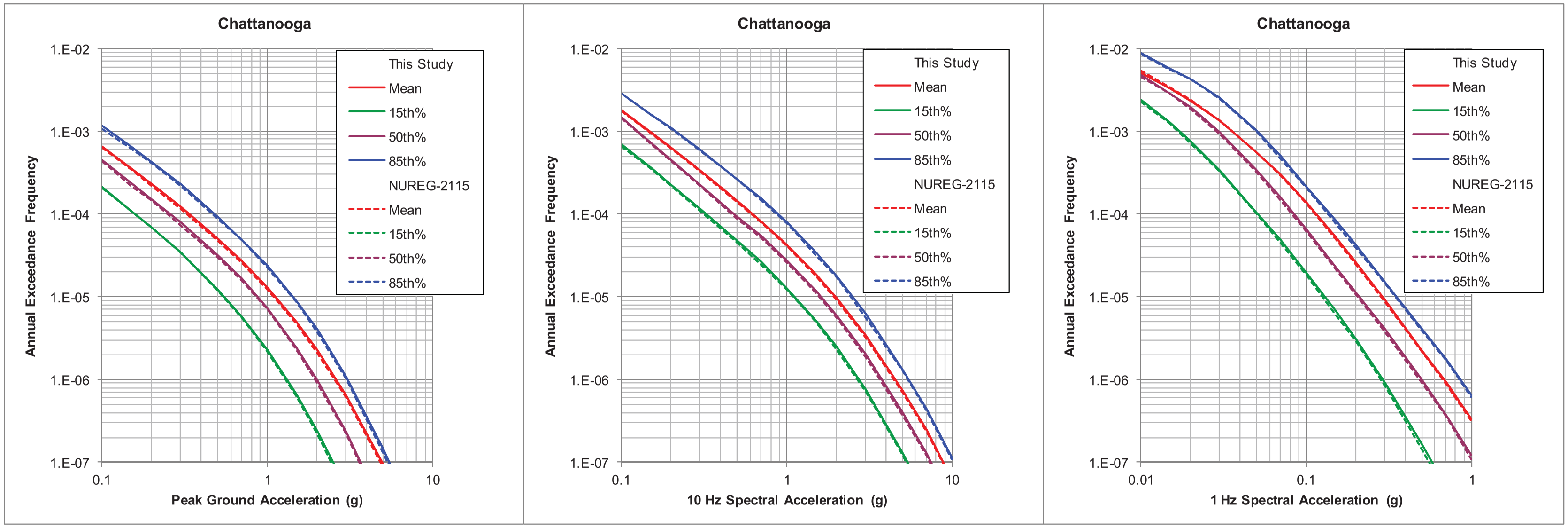


Figure 2: Comparison of hazard curves computed using Fermi 3 PSHA software with those listed in Chapter 8 of NUREG-2115 for the Chattanooga demonstration site

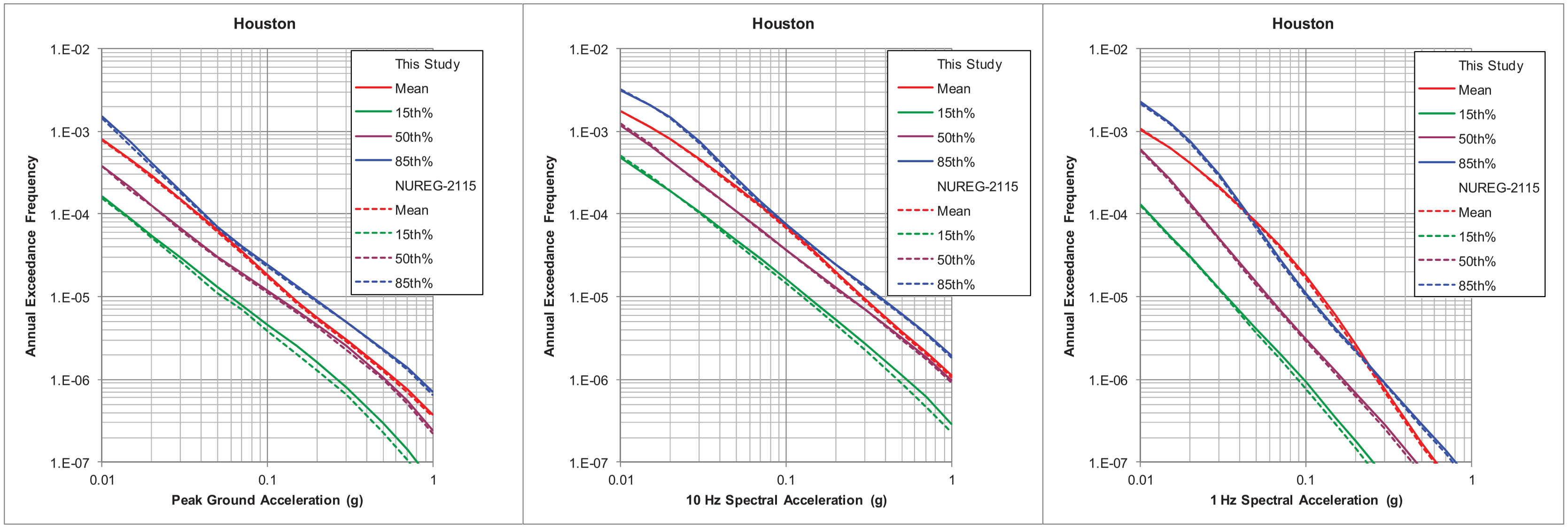


Figure 3: Comparison of hazard curves computed using Fermi 3 PSHA software with those listed in Chapter 8 of NUREG-2115 for the Houston demonstration site

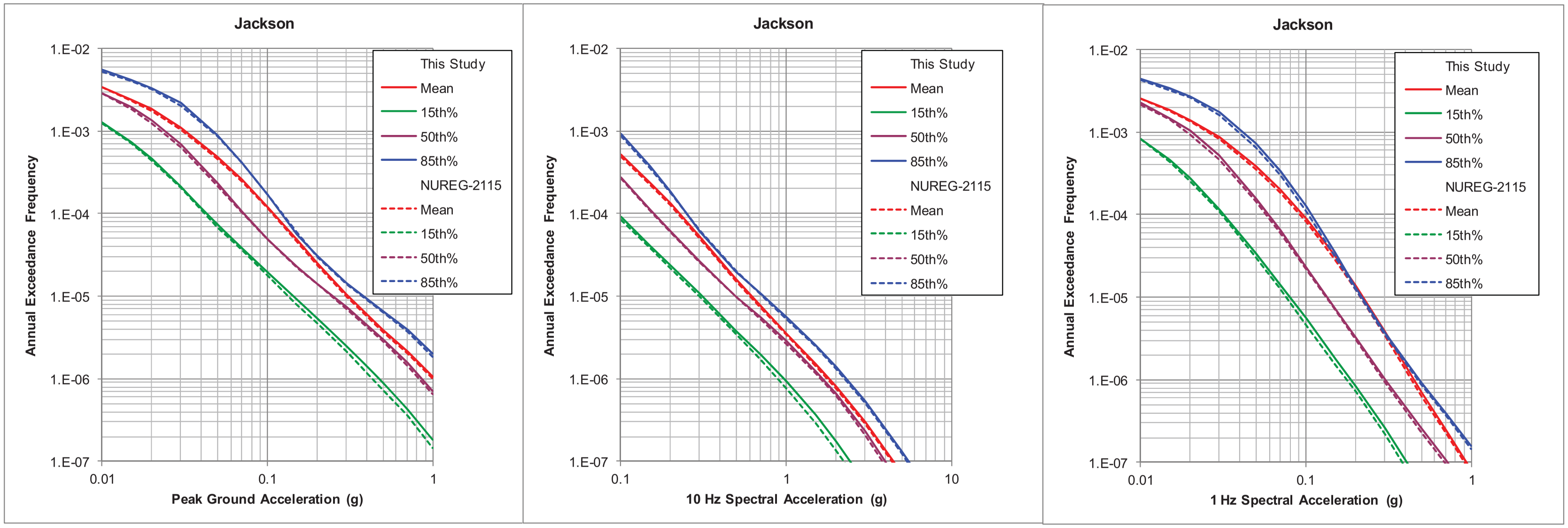


Figure 4: Comparison of hazard curves computed using Fermi 3 PSHA software with those listed in Chapter 8 of NUREG-2115 for the Jackson demonstration site

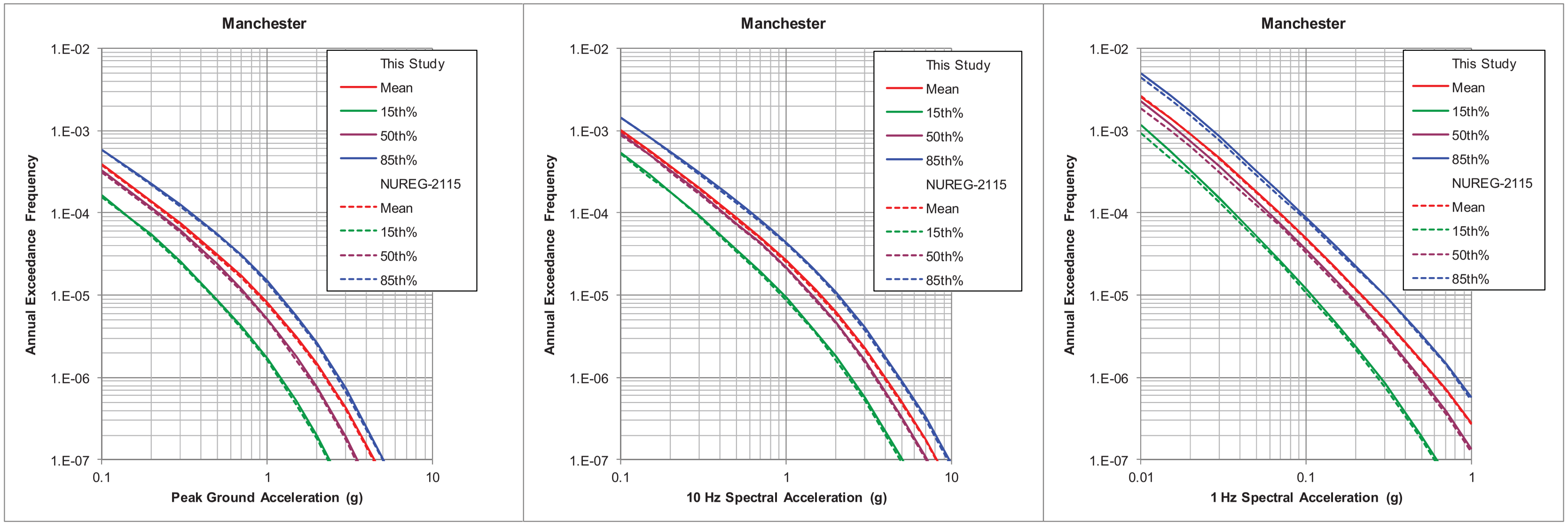


Figure 5: Comparison of hazard curves computed using Fermi 3 PSHA software with those listed in Chapter 8 of NUREG-2115 for the Manchester demonstration site

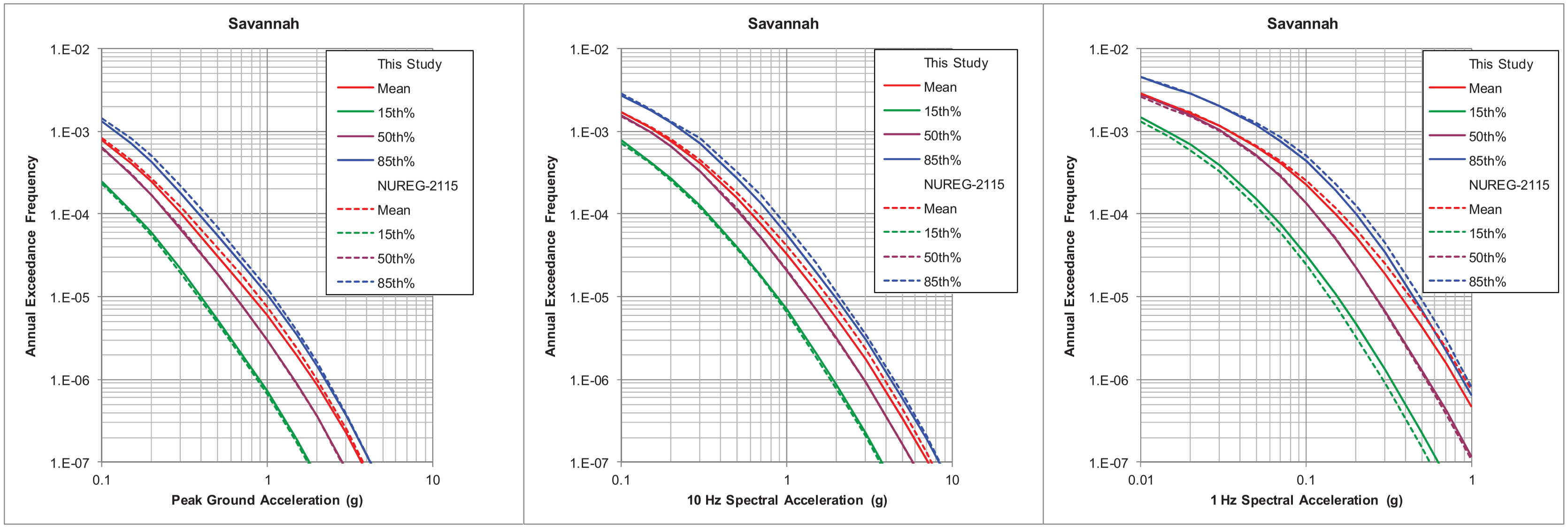


Figure 6: Comparison of hazard curves computed using Fermi 3 PSHA software with those listed in Chapter 8 of NUREG-2115 for the Savannah demonstration site

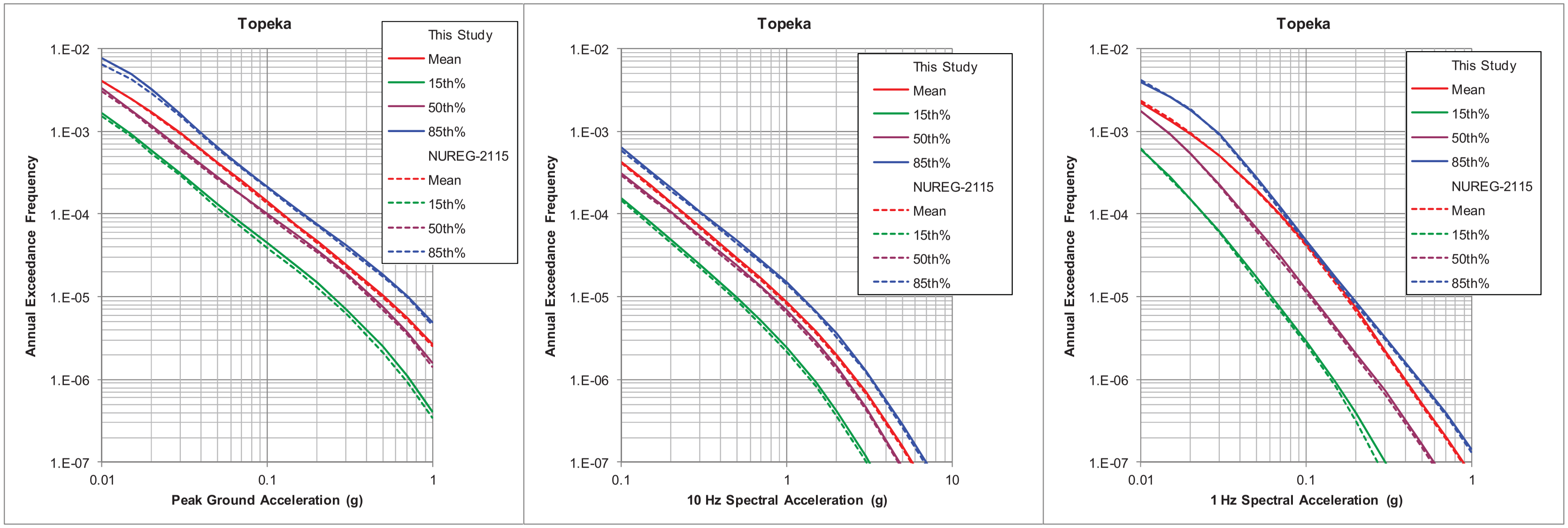


Figure 7: Comparison of hazard curves computed using Fermi 3 PSHA software with those listed in Chapter 8 of NUREG-2115 for the Topeka demonstration site

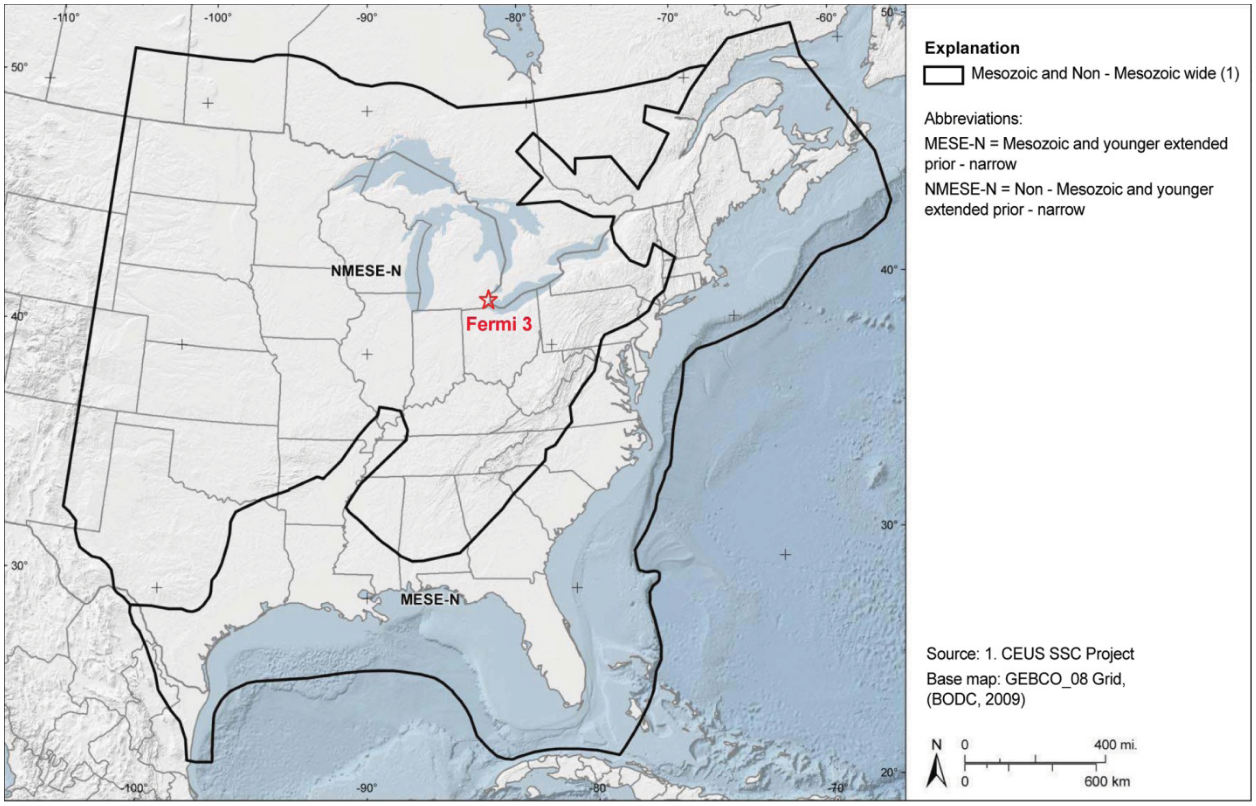


Figure 8: Mmax source zones from the CEUS SSC model for the "narrow" interpretation (Figure 4.2.3-2 of NUREG2115). Approximate location of the Fermi 3 site is shown by the red star.

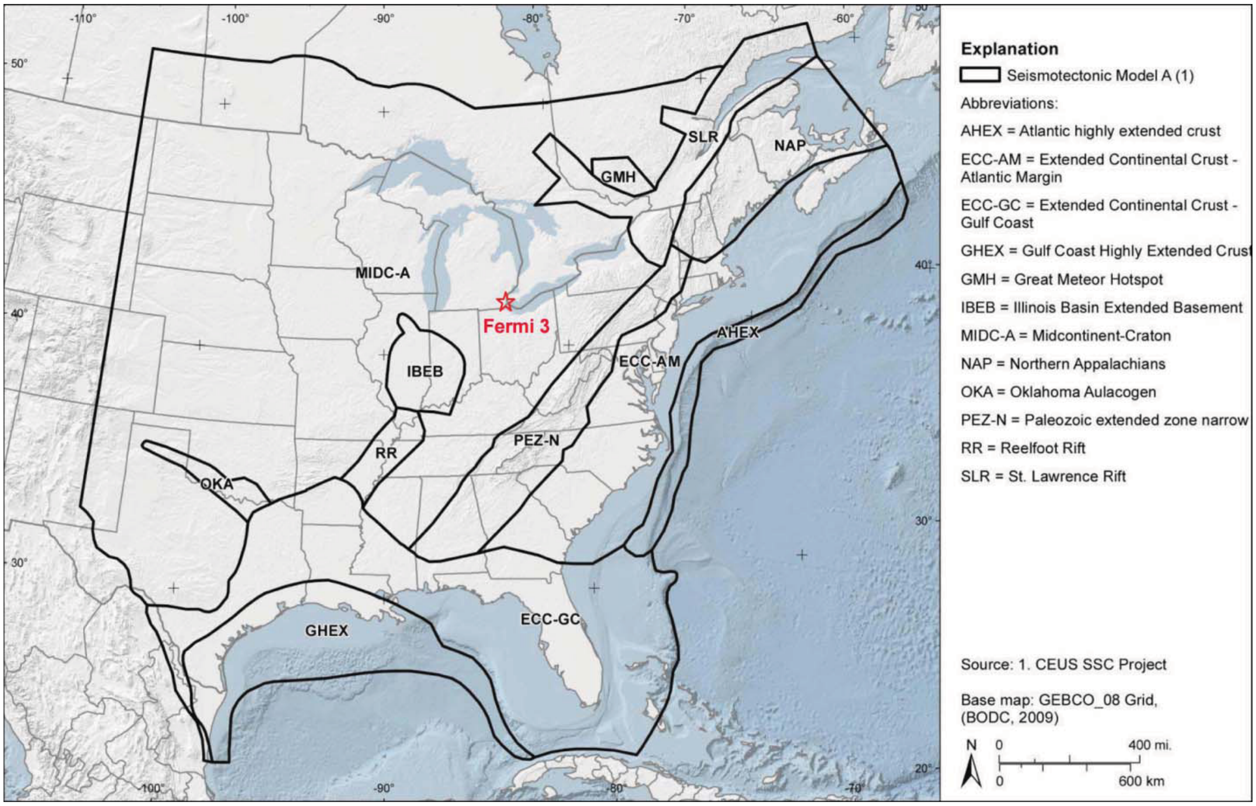


Figure 9: Seismotectonic source zones for the “narrow” interpretation of Paleozoic Extended Zone (PEZ) with the Rough Creek Graben not included as part of the Reelfoot Rift (RR) source (Figure 4.2.4-2 of NUREG-2115). Approximate location of the Fermi 3 site is shown by the red star.

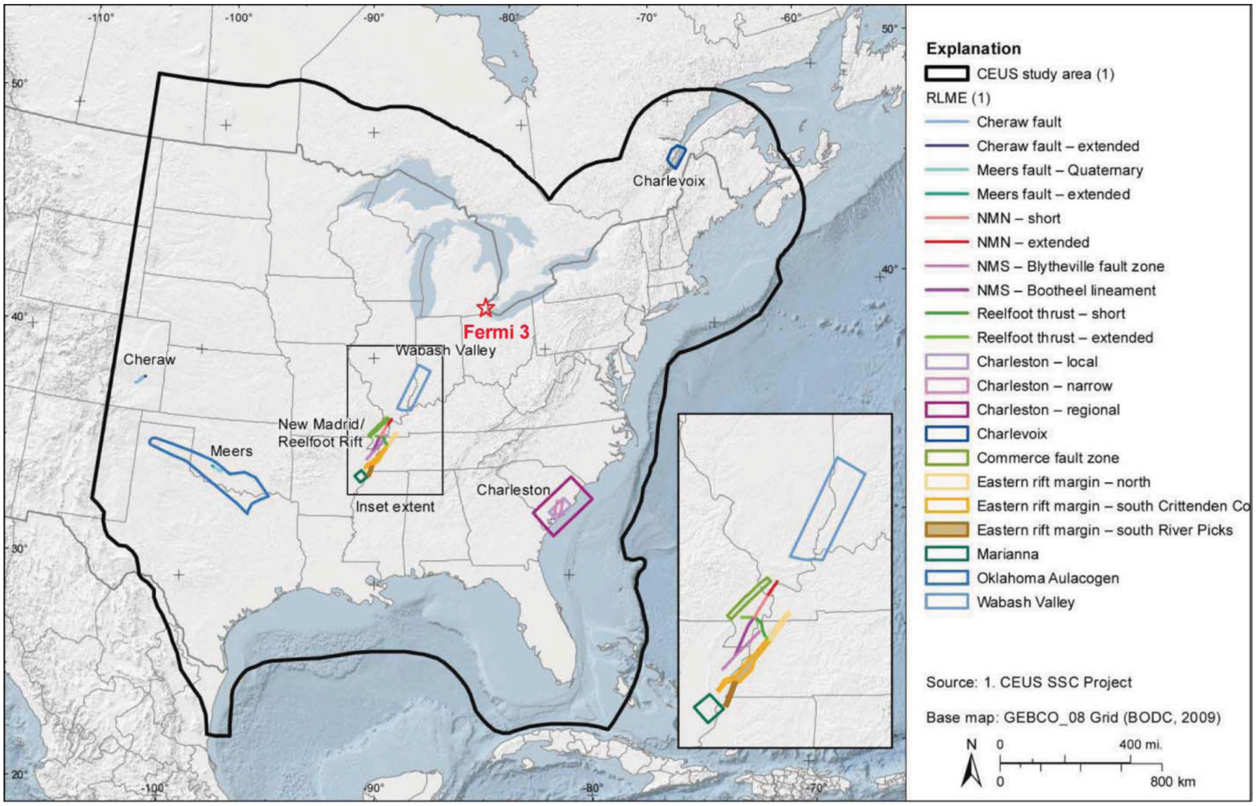


Figure 10: Location of the 10 RLME sources in the CEUS SSC model (Figure 4.2.2-2 of NUREG-2115). Approximate location of the Fermi 3 site is shown by the red star.

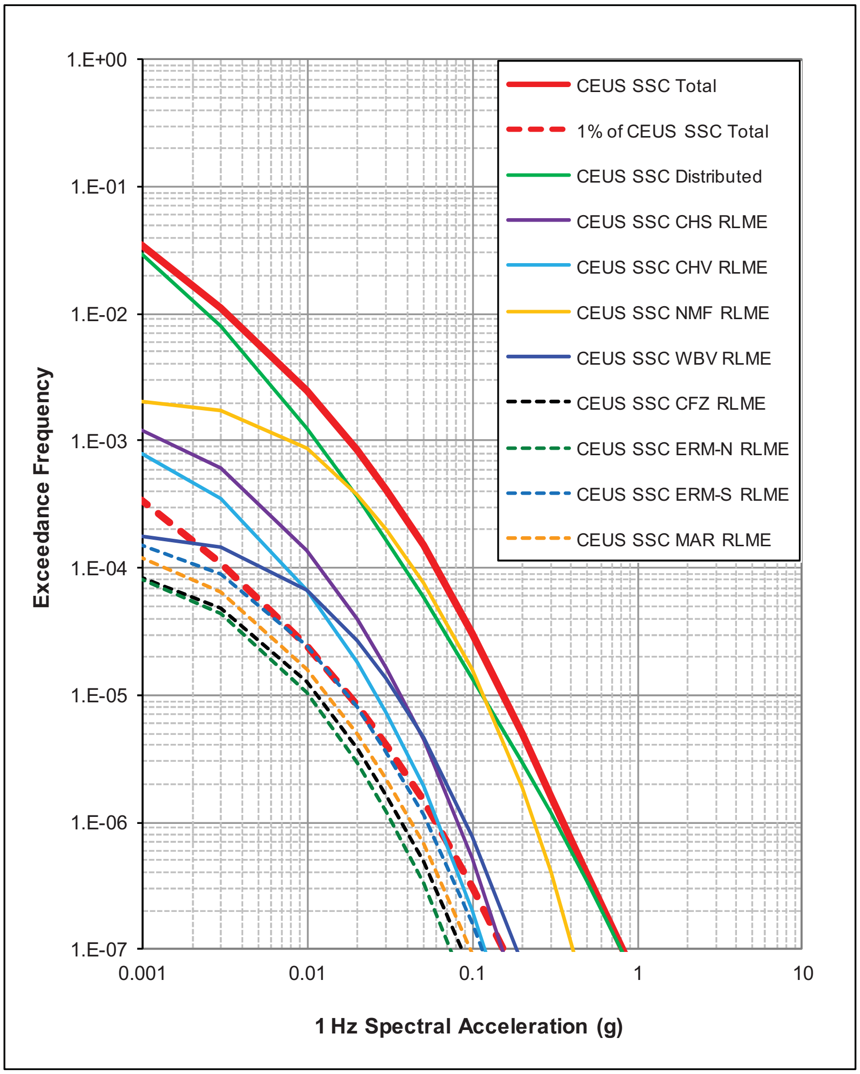


Figure 11: Contribution of distributed sources and the eight nearest RLMEs to the mean hazard for 1 Hz spectral acceleration at the Fermi 3 Site.

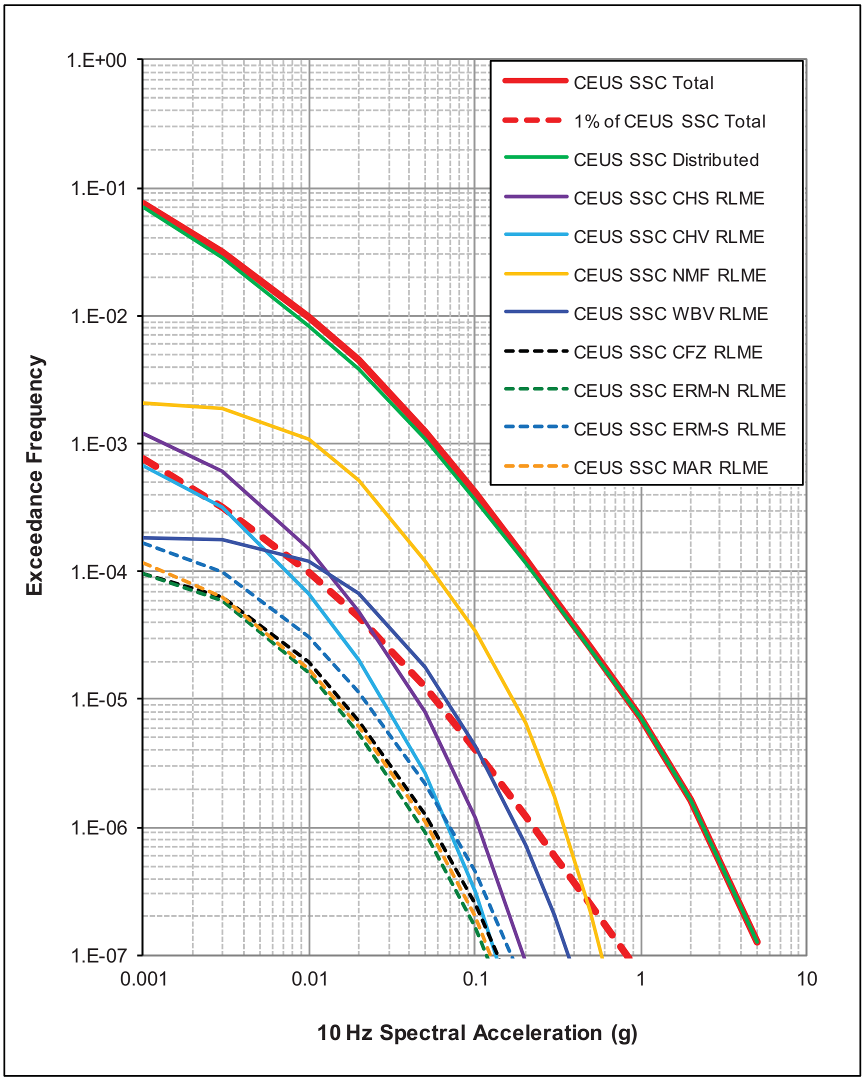


Figure 12: Contribution of distributed sources and the eight nearest RLMEs to the mean hazard for 10 Hz spectral acceleration at the Fermi 3 Site.

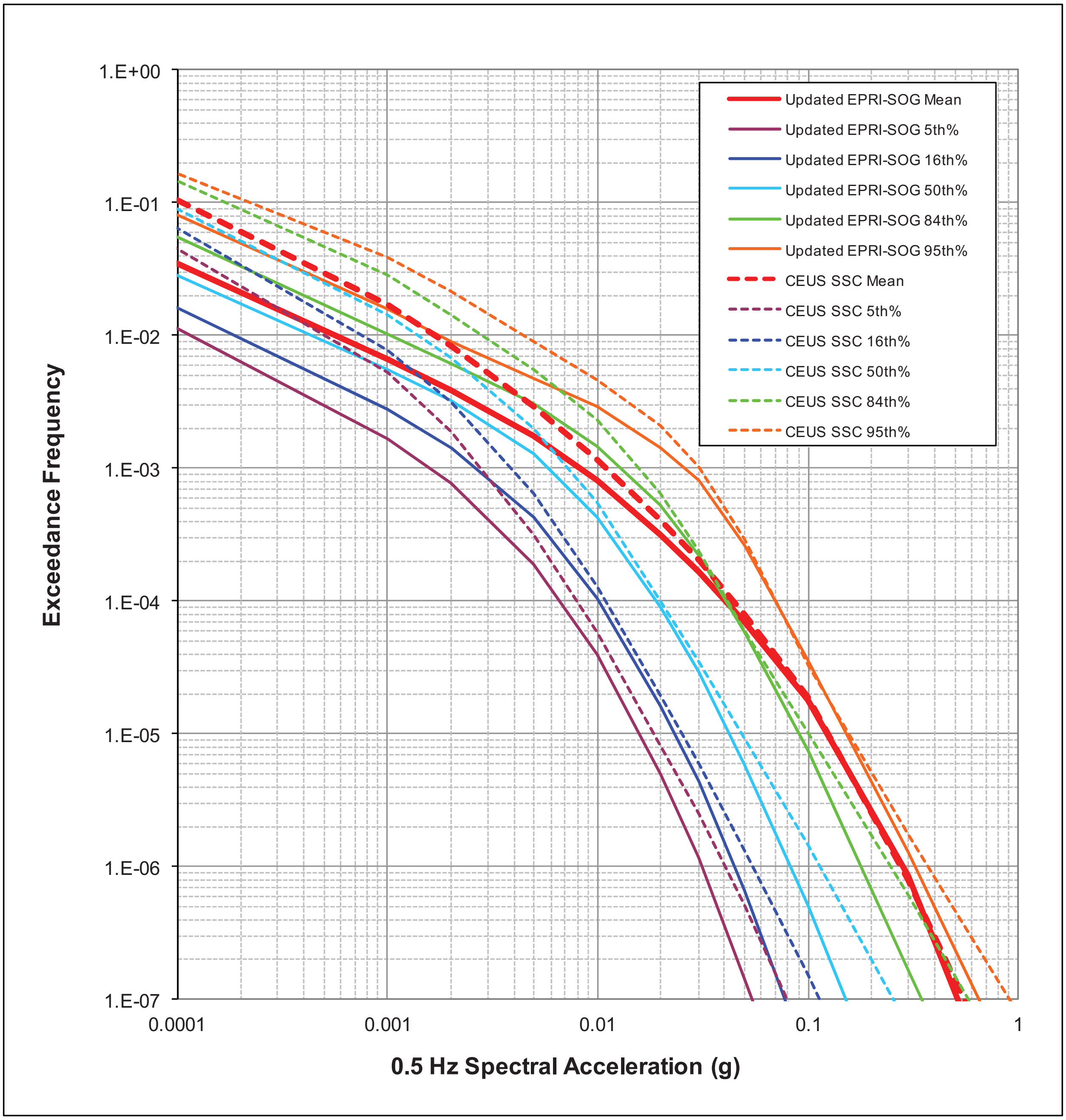


Figure 13: Generic CEUS Hard Rock Hazard Results for 0.5 Hz spectral acceleration for the Fermi 3 Site comparing results for the Updated EPRI-SOG model with those from the CEUS SSC model.

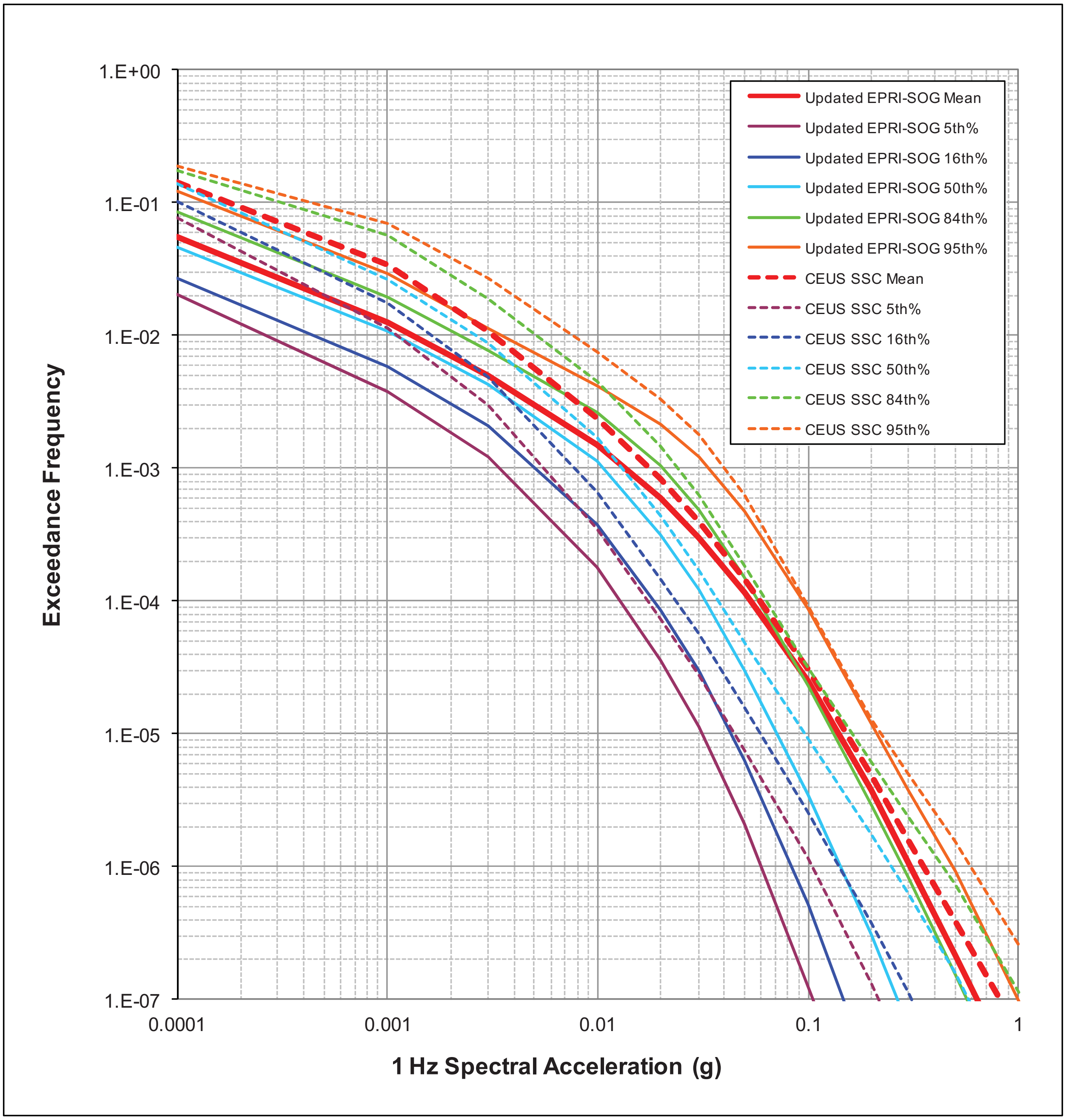


Figure 14: Generic CEUS Hard Rock Hazard Results for 1 Hz spectral acceleration for the Fermi 3 Site comparing results for the Updated EPRI-SOG model with those from the CEUS SSC model.

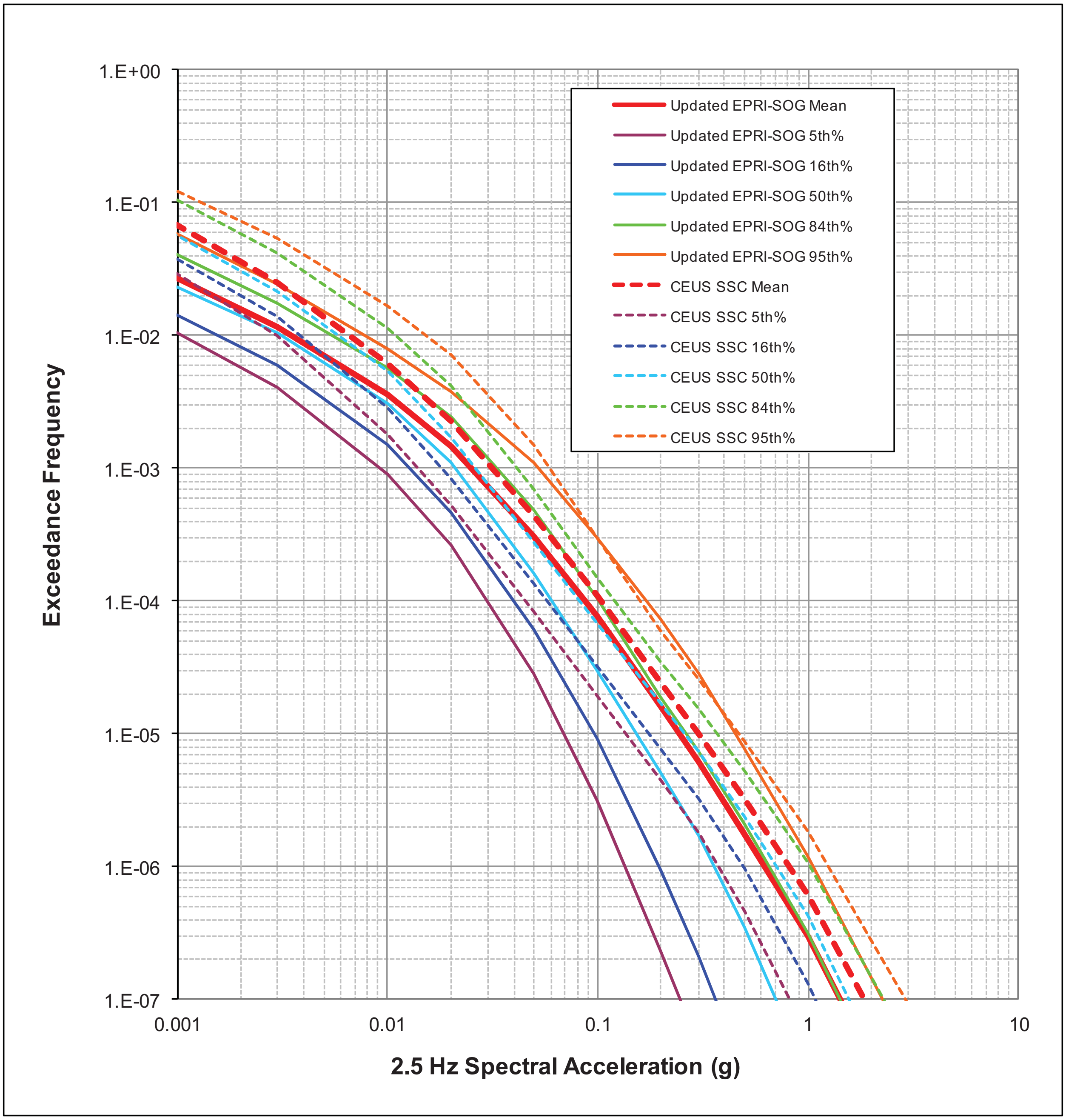


Figure 15: Generic CEUS Hard Rock Hazard Results for 2.5 Hz spectral acceleration for the Fermi 3 Site comparing results for the Updated EPRI-SOG model with those from the CEUS SSC model.

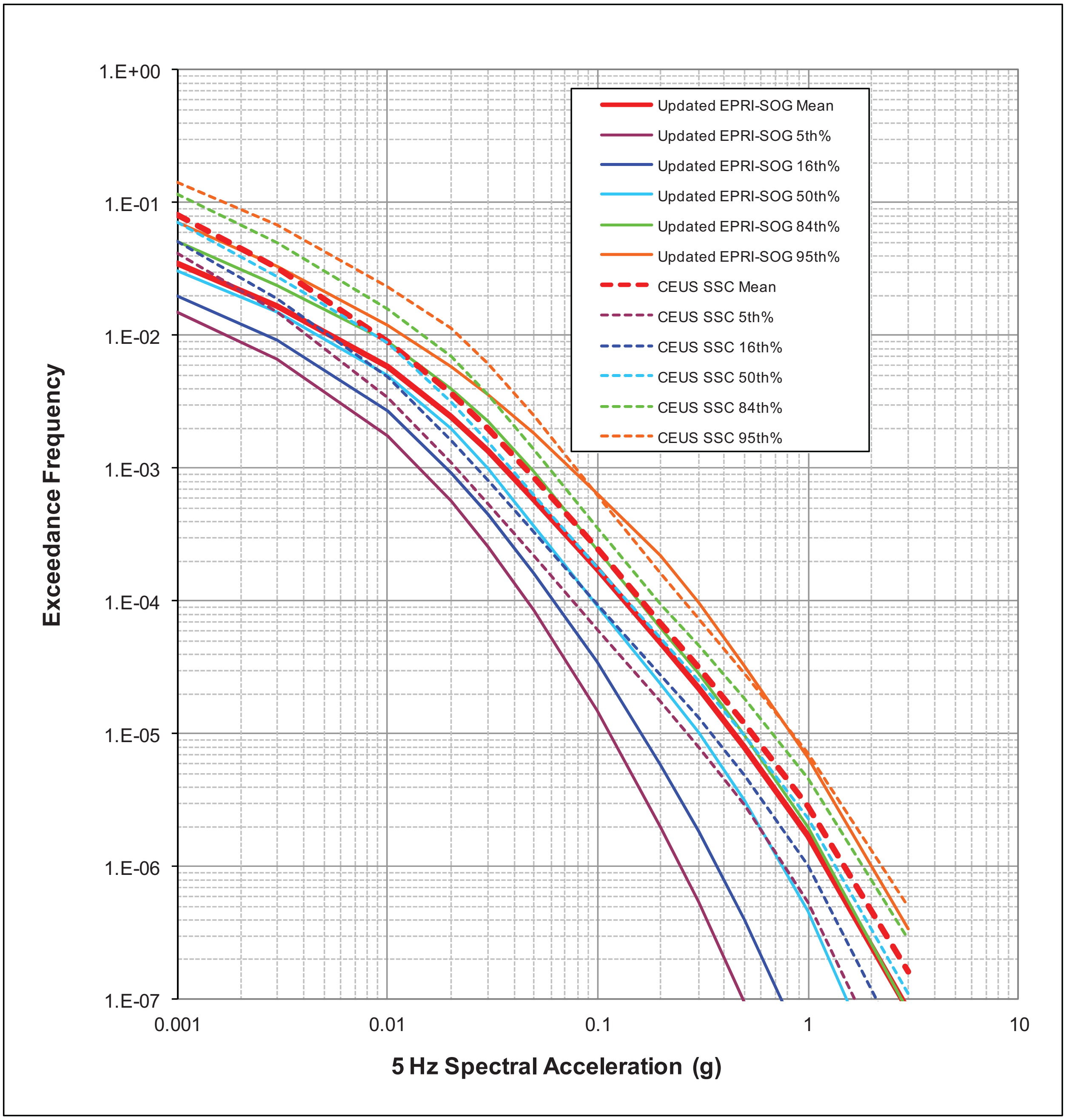


Figure 16: Generic CEUS Hard Rock Hazard Results for 5 Hz spectral acceleration for the Fermi 3 Site comparing results for the Updated EPRI-SOG model with those from the CEUS SSC model.

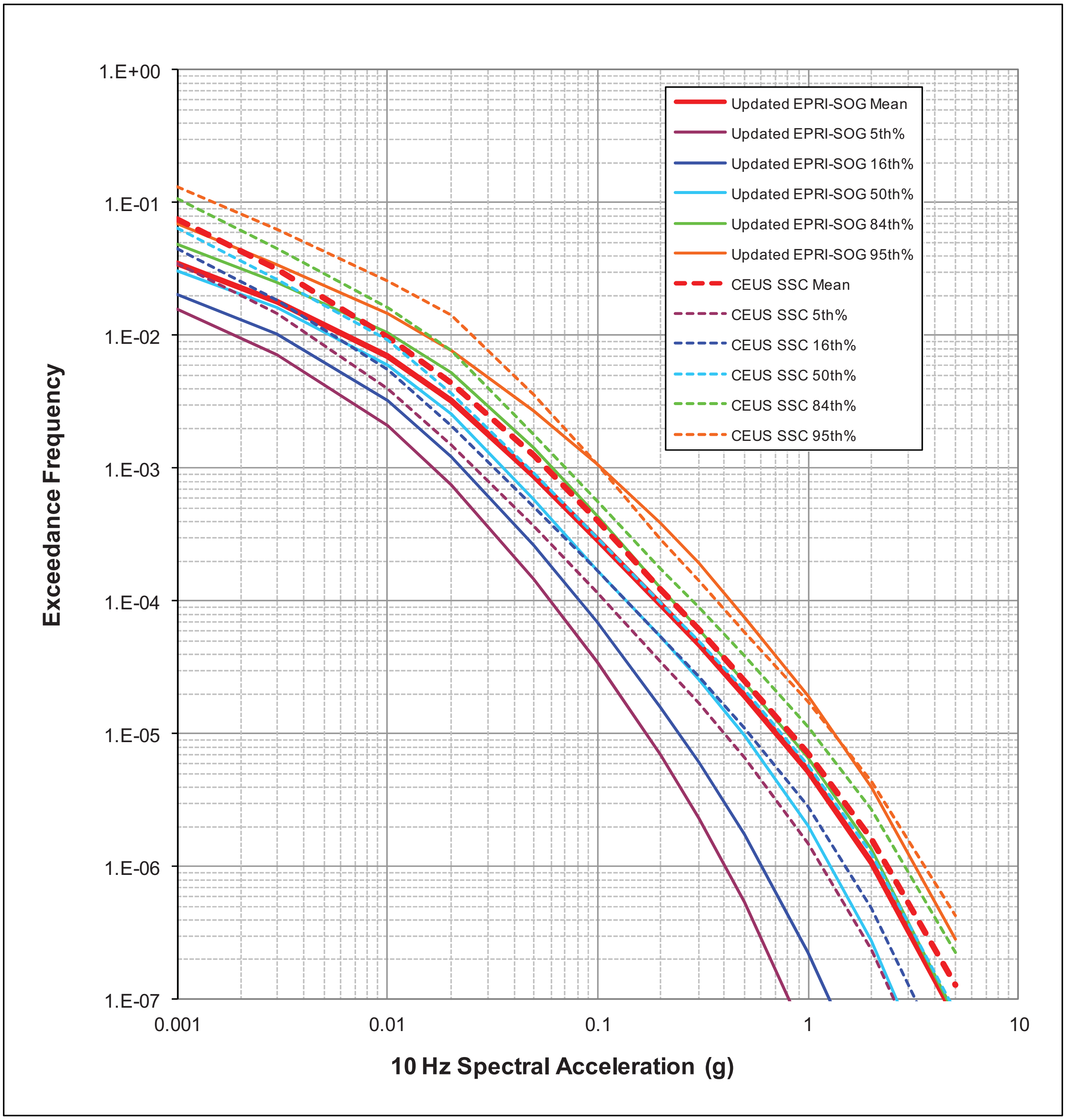


Figure 17: Generic CEUS Hard Rock Hazard Results for 10 Hz spectral acceleration for the Fermi 3 Site comparing results for the Updated EPRI-SOG model with those from the CEUS SSC model.

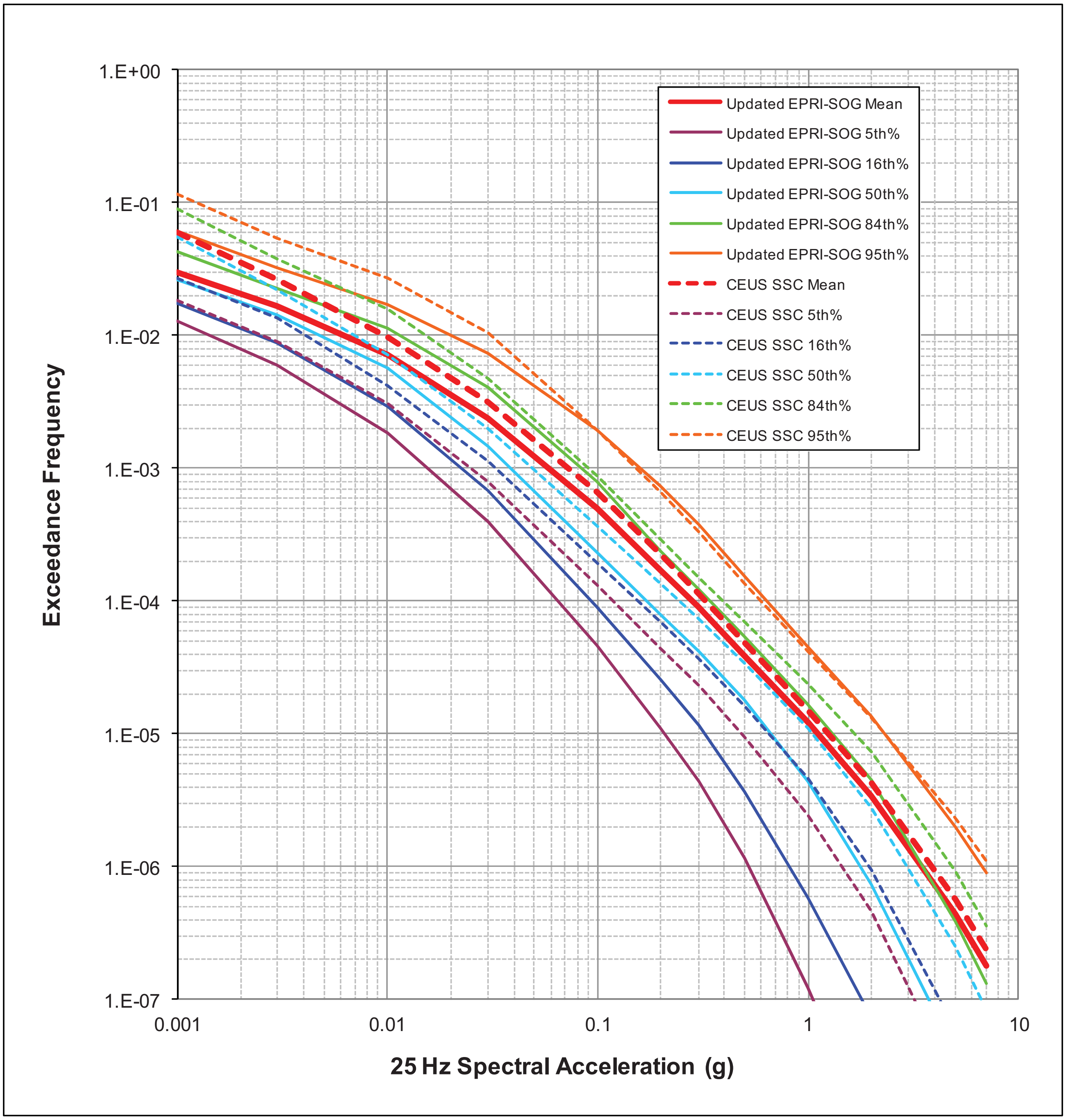


Figure 18: Generic CEUS Hard Rock Hazard Results for 25 Hz spectral acceleration for the Fermi 3 Site comparing results for the Updated EPRI-SOG model with those from the CEUS SSC model.

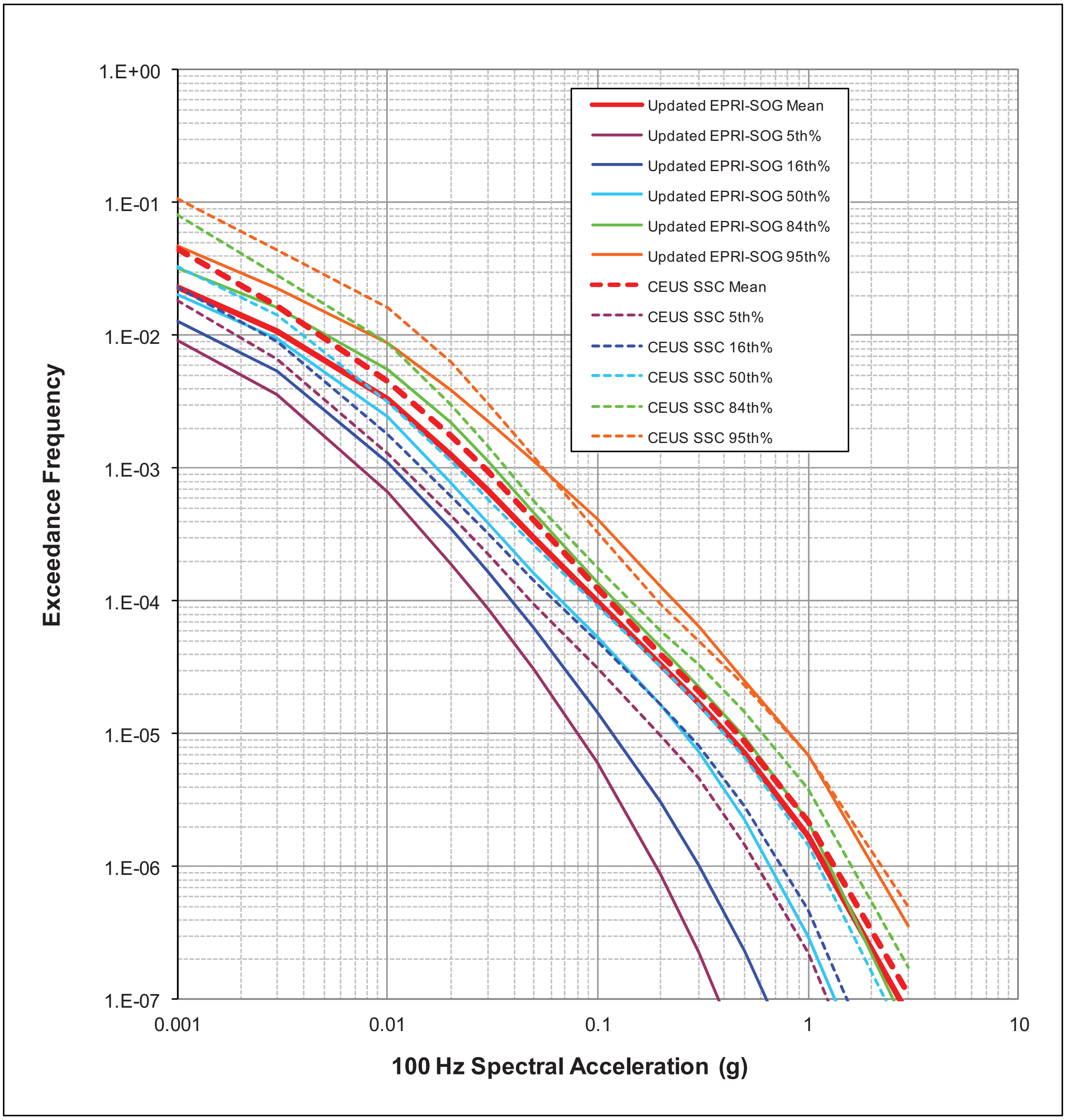


Figure 19: Generic CEUS Hard Rock Hazard Results for 100 Hz spectral acceleration (PGA) for the Fermi 3 Site comparing results for the Updated EPRI-SOG model with those from the CEUS SSC model.

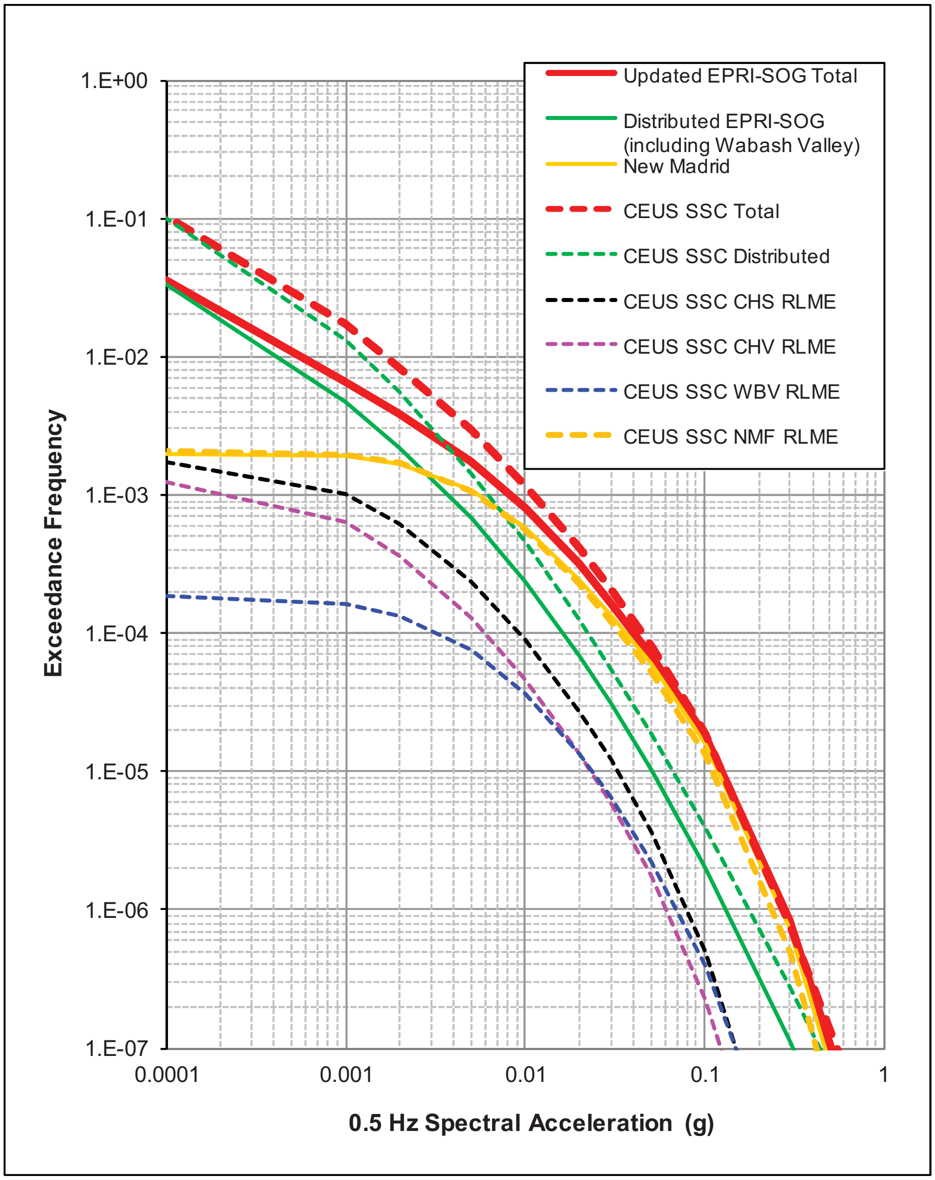


Figure 20: Contribution of the various source types to the total mean hazard for 0.5 Hz spectral acceleration from the Updated EPRI-SOG and CEUS SSC models at the Fermi 3 Site.

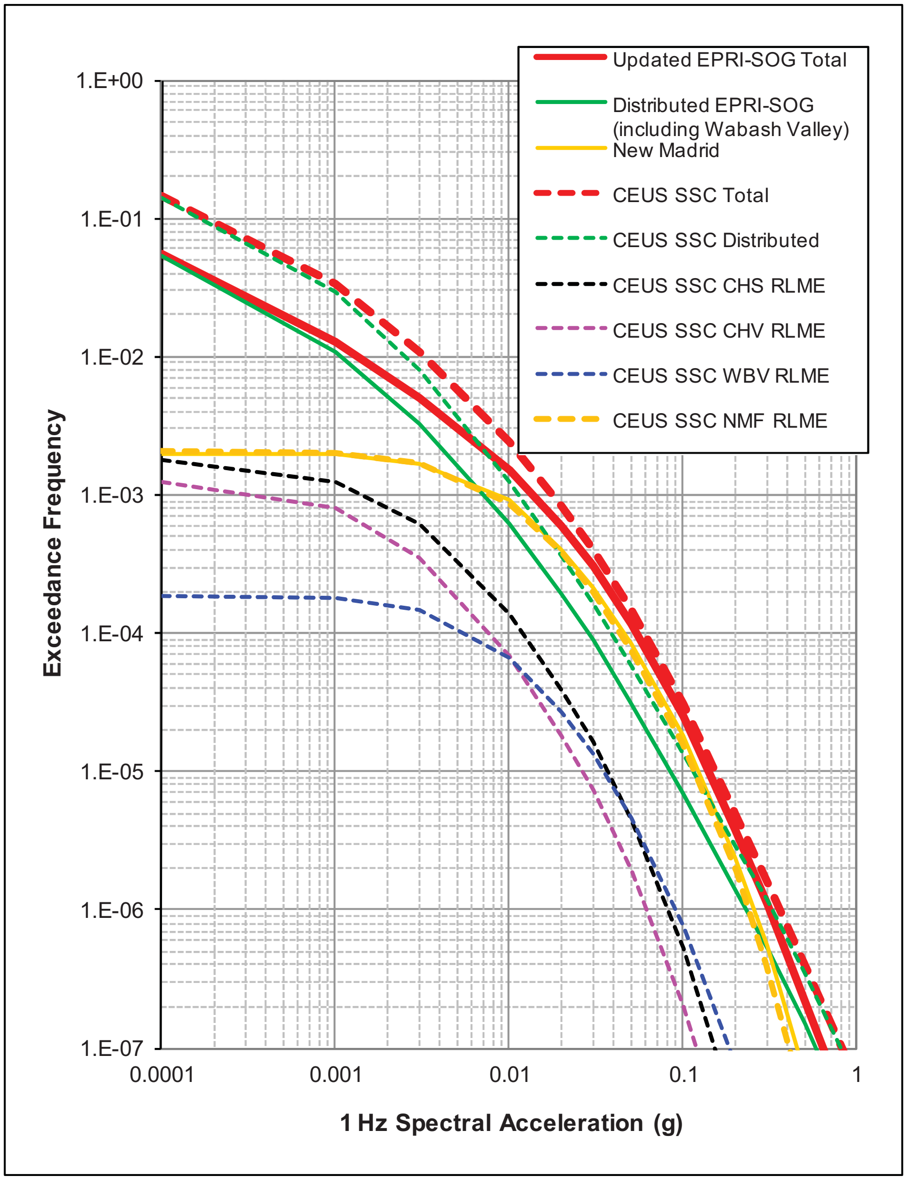


Figure 21: Contribution of the various source types to the total mean hazard for 1 Hz spectral acceleration from the Updated EPRI-SOG and CEUS SSC models at the Fermi 3 Site.

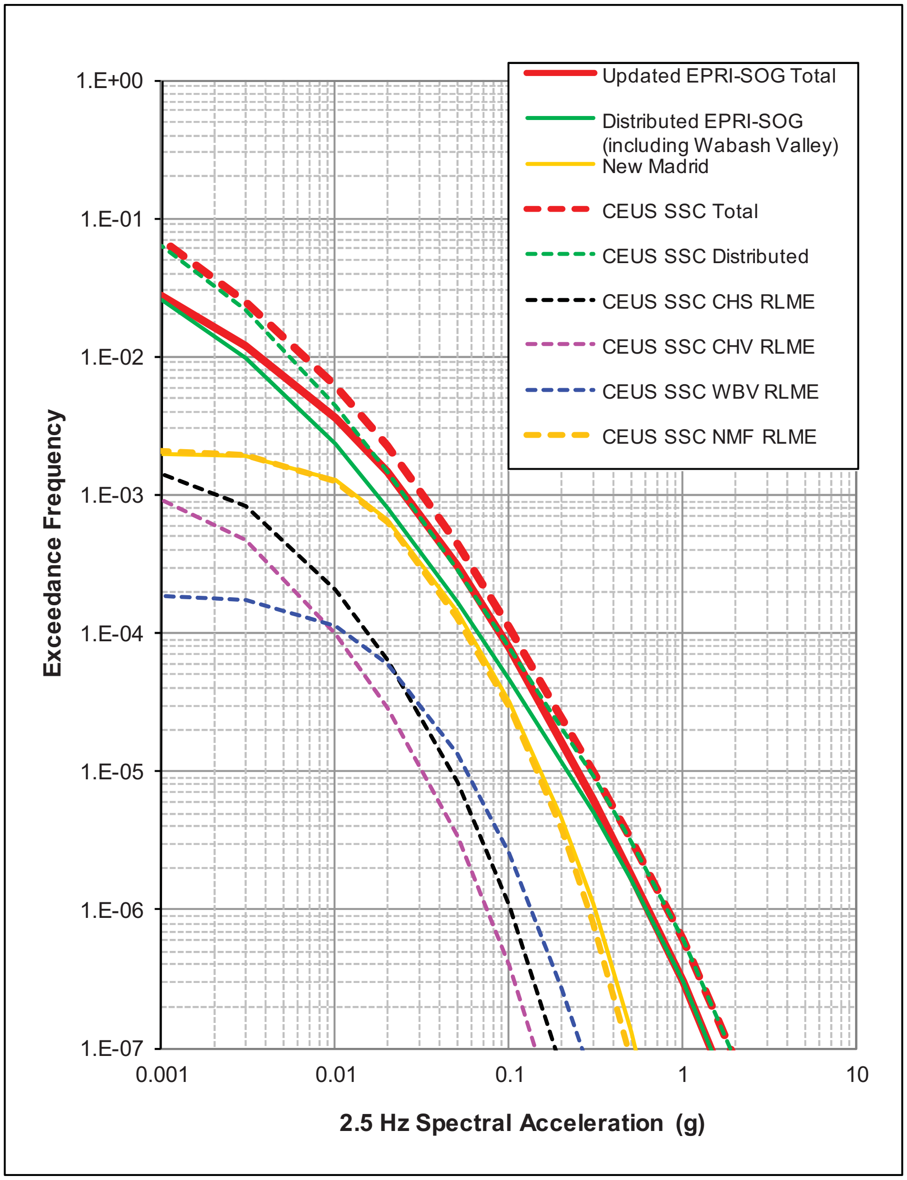


Figure 22: Contribution of the various source types to the total mean hazard for 2.5 Hz spectral acceleration from the Updated EPRI-SOG and CEUS SSC models at the Fermi 3 Site.

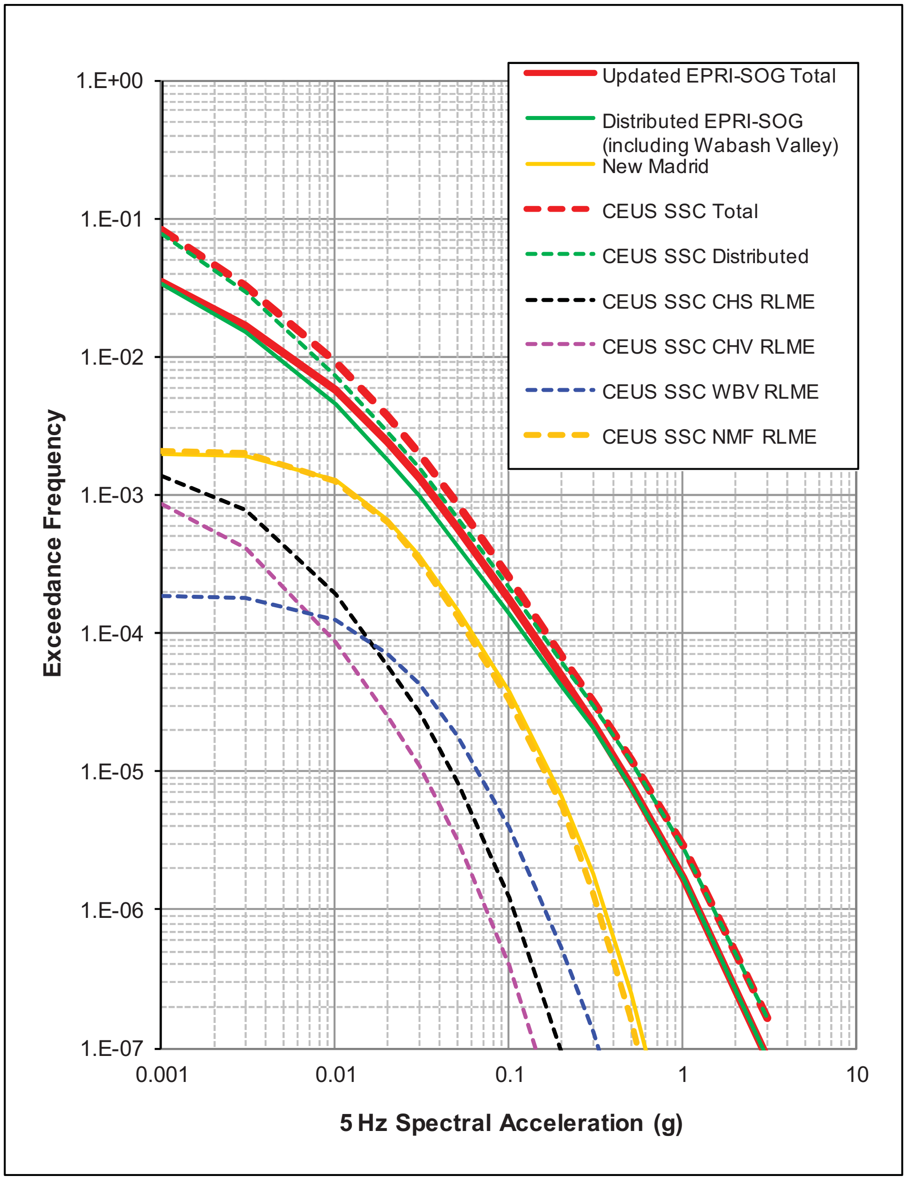


Figure 23: Contribution of the various source types to the total mean hazard for 5 Hz spectral acceleration from the Updated EPRI-SOG and CEUS SSC models at the Fermi 3 Site.

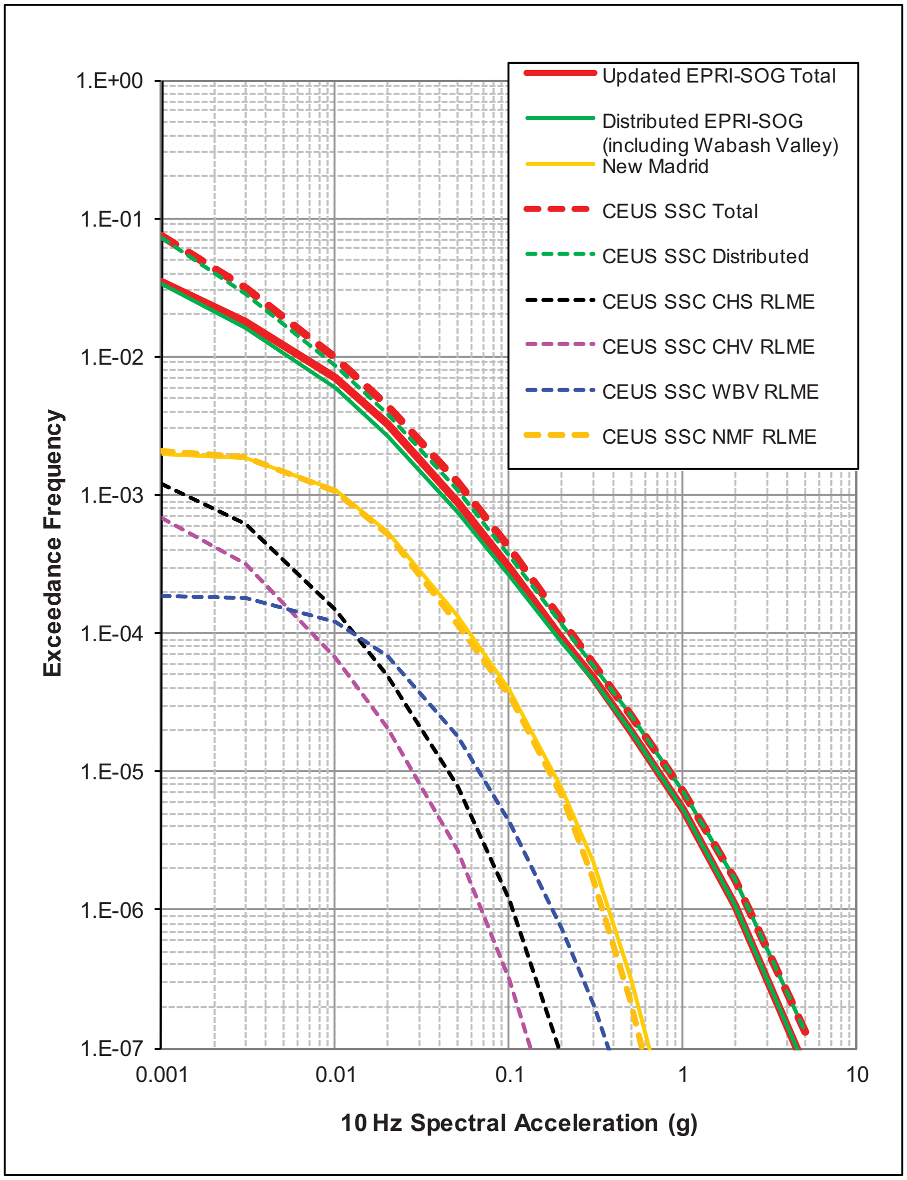


Figure 24: Contribution of the various source types to the total mean hazard for 10 Hz spectral acceleration from the Updated EPRI-SOG and CEUS SSC models at the Fermi 3 Site.

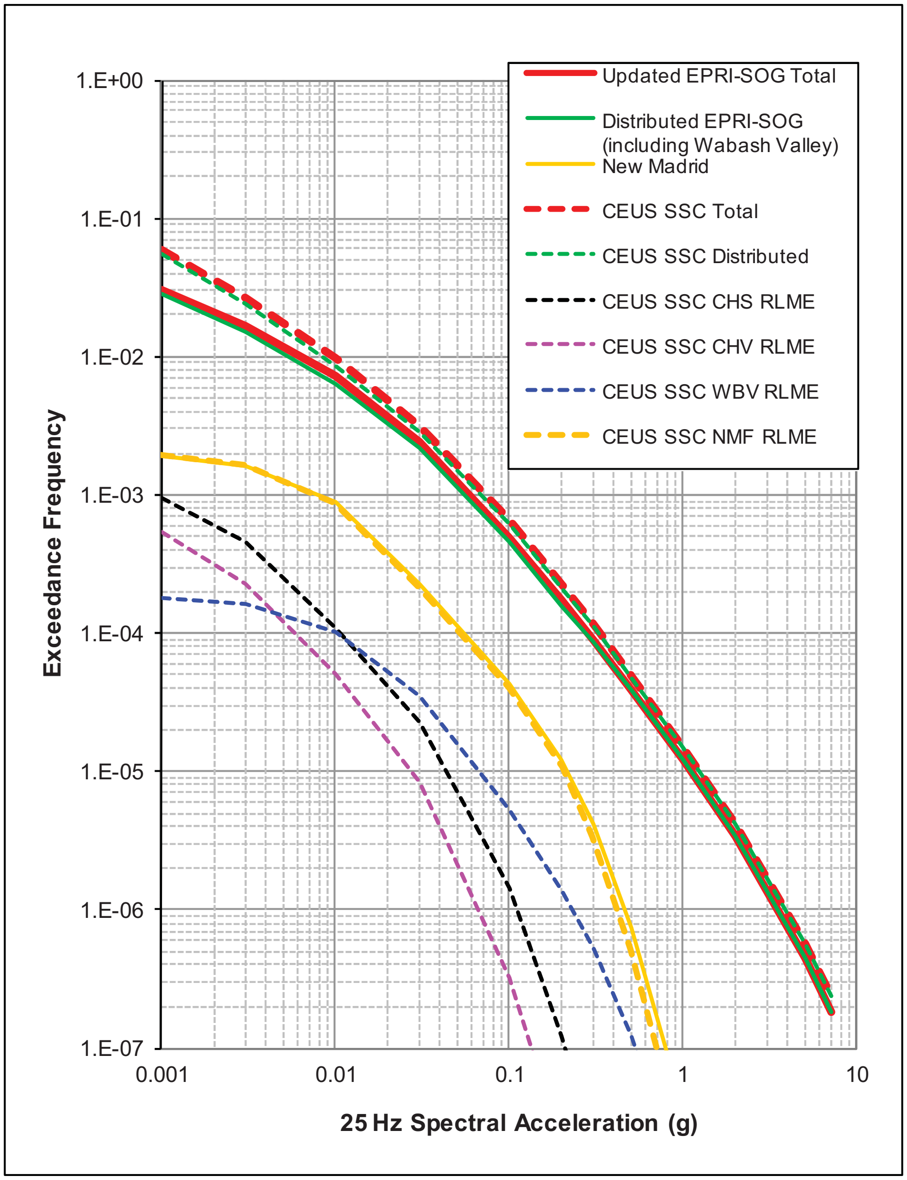


Figure 25: Contribution of the various source types to the total mean hazard for 25 Hz spectral acceleration from the Updated EPRI-SOG and CEUS SSC models at the Fermi 3 Site.

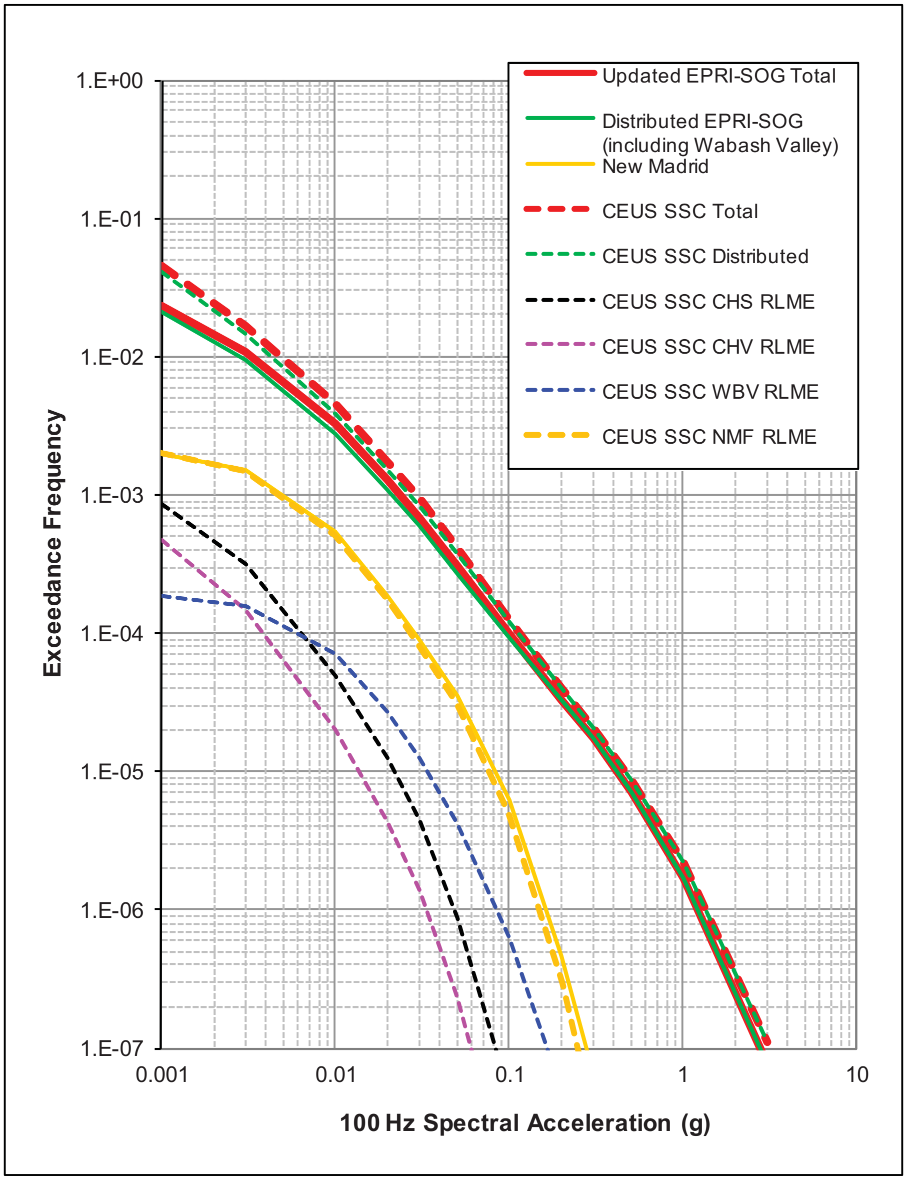


Figure 26: Contribution of the various source types to the total mean hazard for 100 Hz spectral acceleration (PGA) from the Updated EPRI-SOG and CEUS SSC models at the Fermi 3 Site.

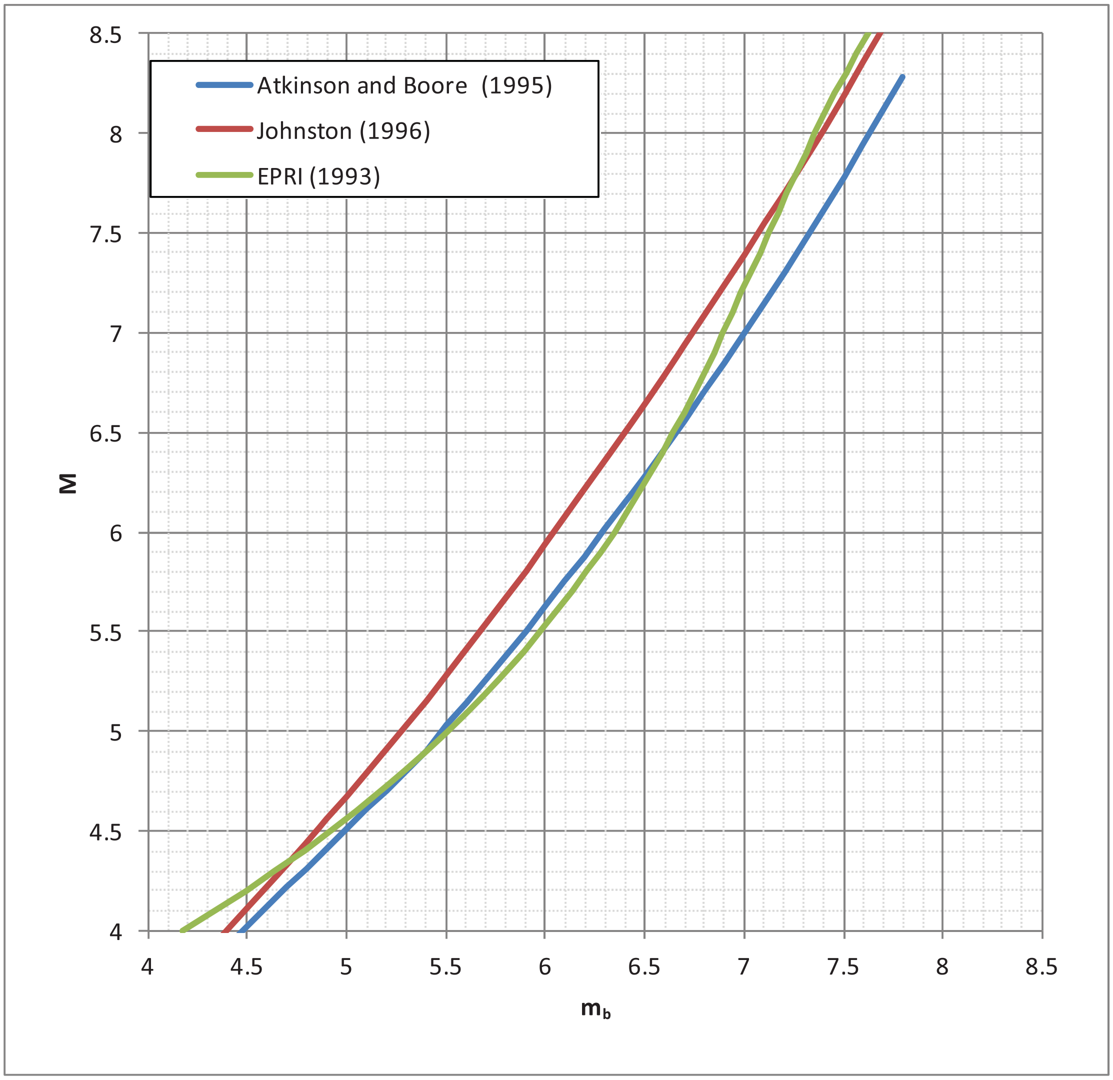


Figure 27: Magnitude conversion relationships used in Fermi 3 FSAR.

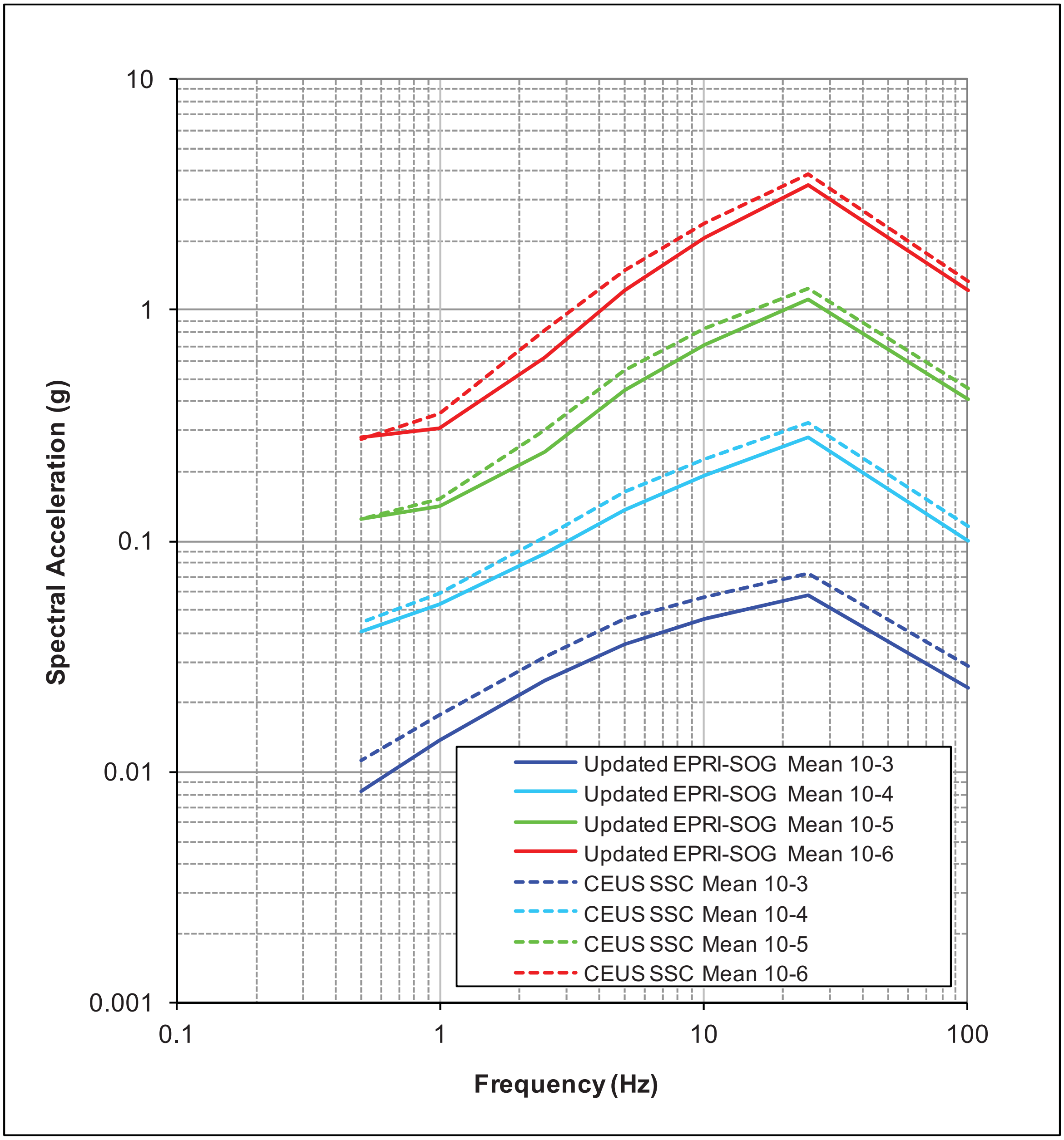


Figure 28: Comparison of hard rock UHRS in Fermi 3 FSAR (Updated EPRI-SOG model) with results computed using the CEUS SSC model.

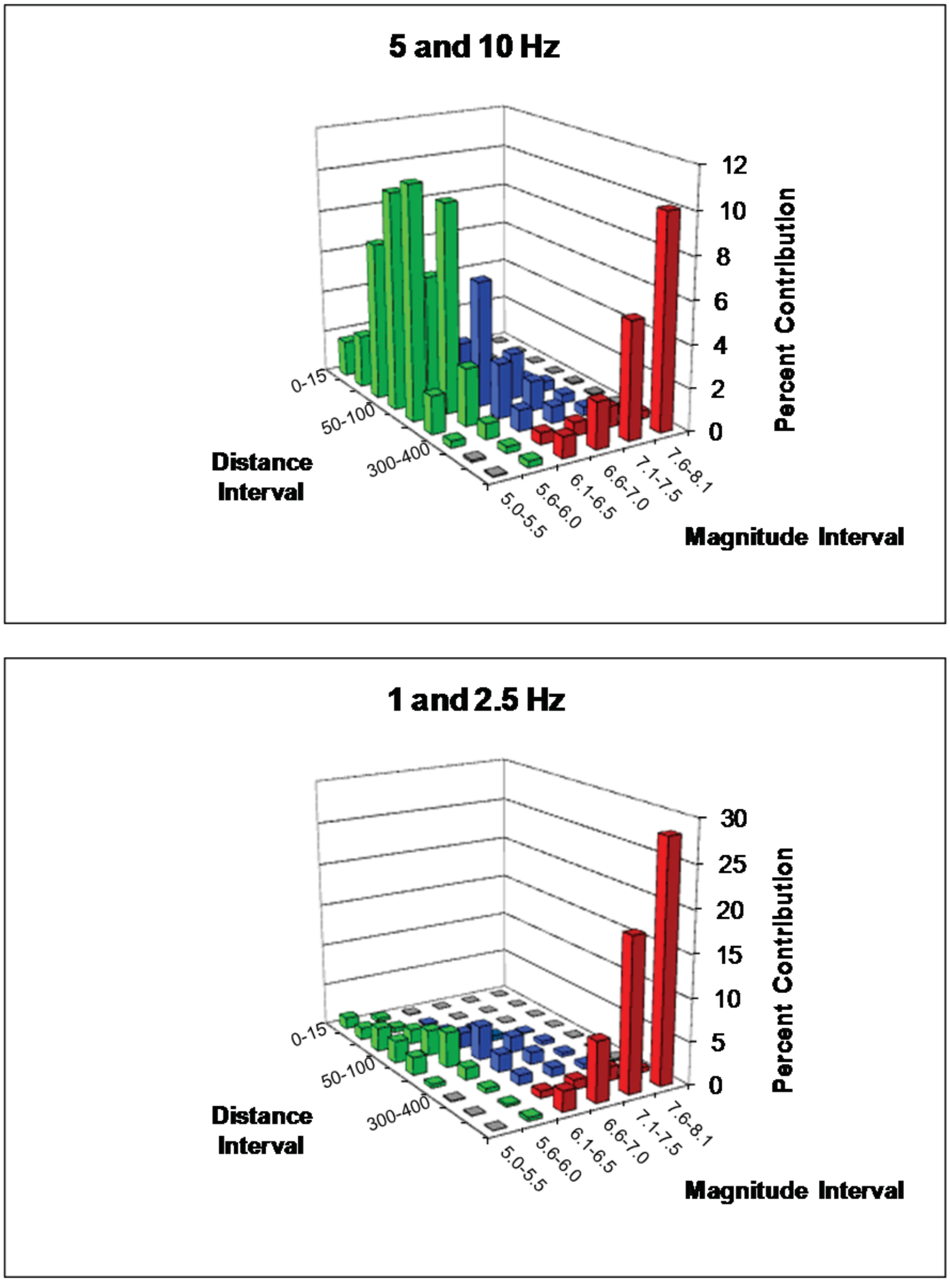
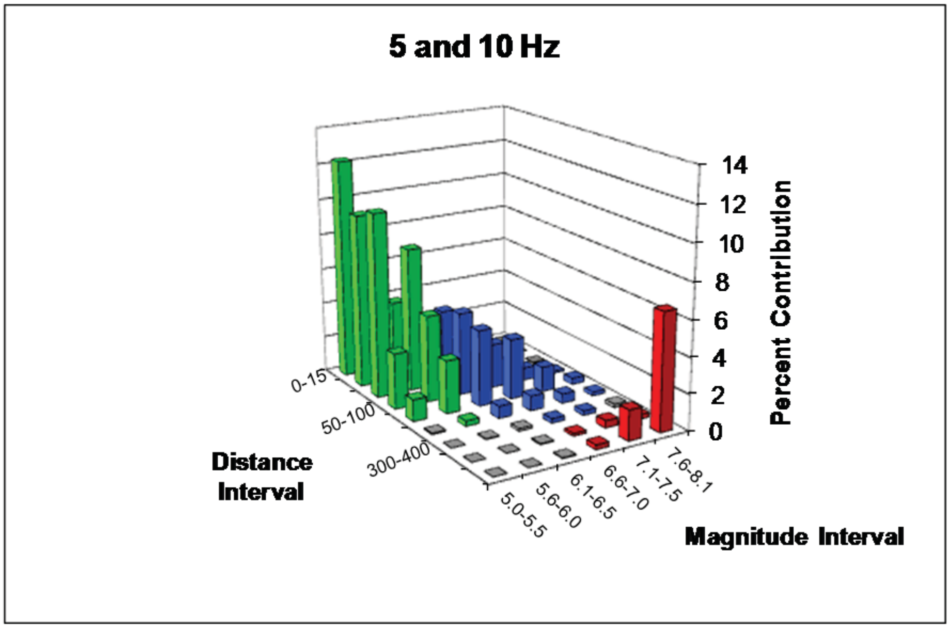


Figure 29: Deaggregation of mean 10^{-3} hazard from CEUS SSC model.



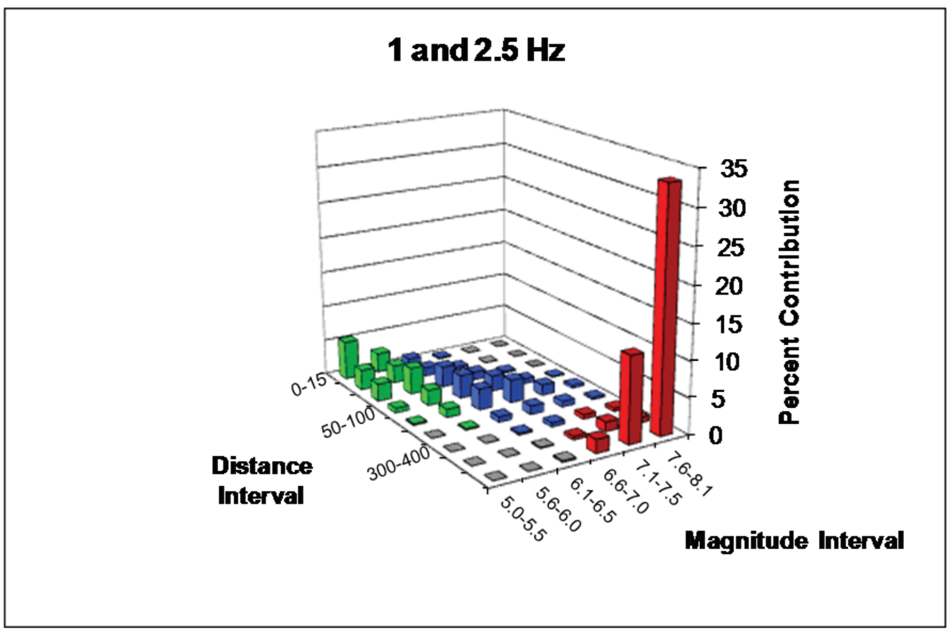
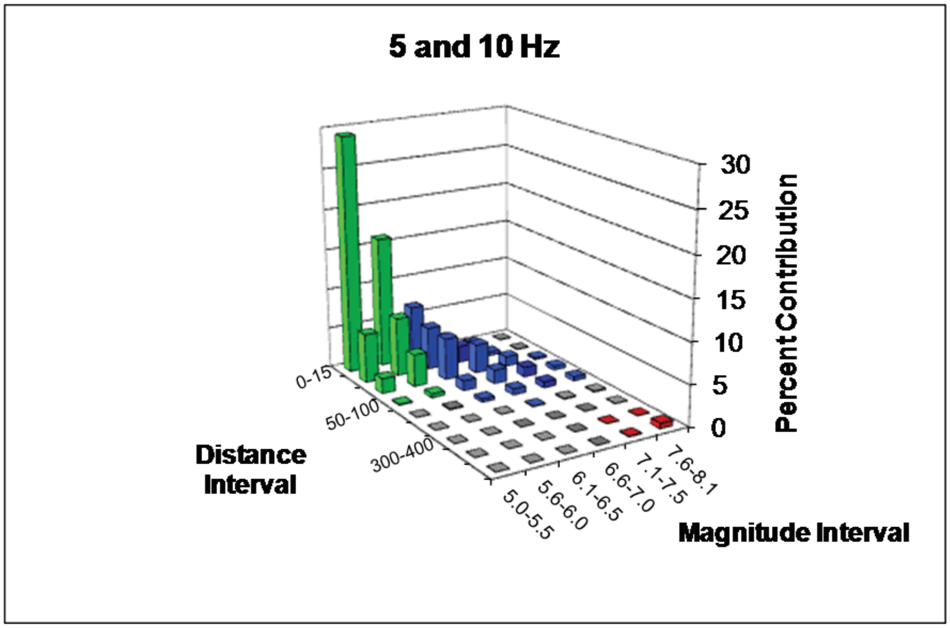


Figure 30: Deaggregation of mean 10^{-4} hazard from CEUS SSC model.



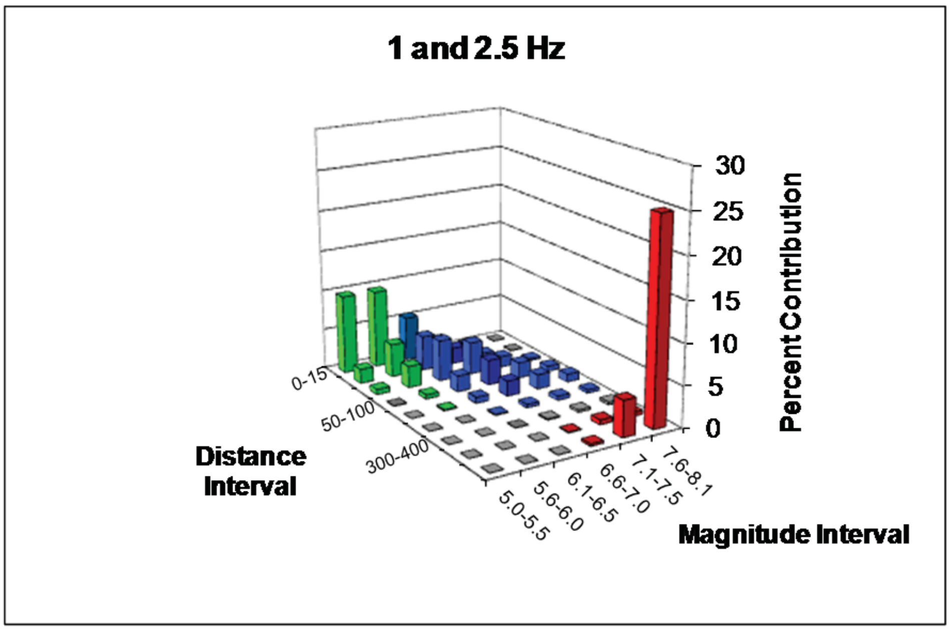
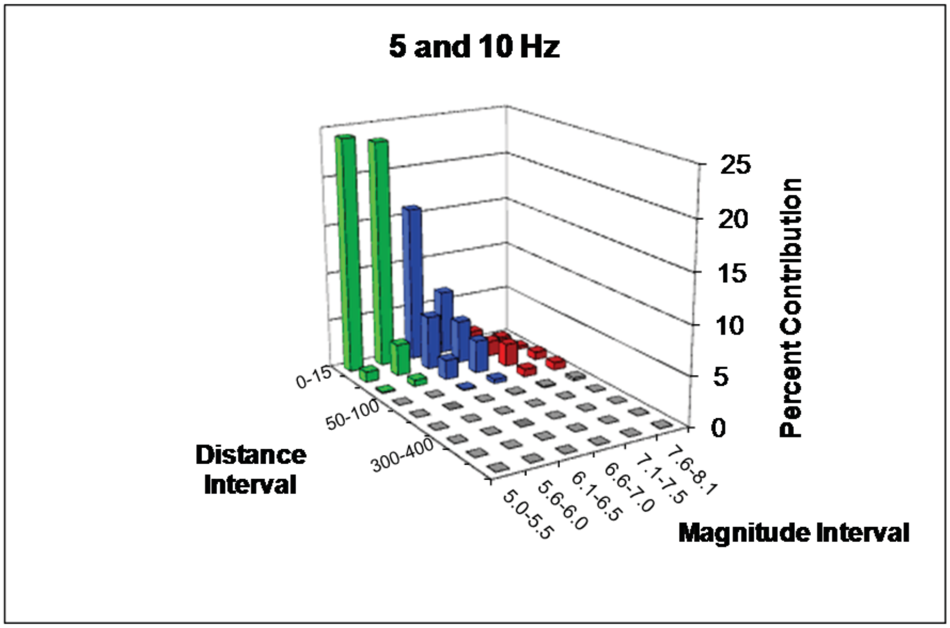


Figure 31: Deaggregation of mean 10^{-5} hazard from CEUS SSC model.



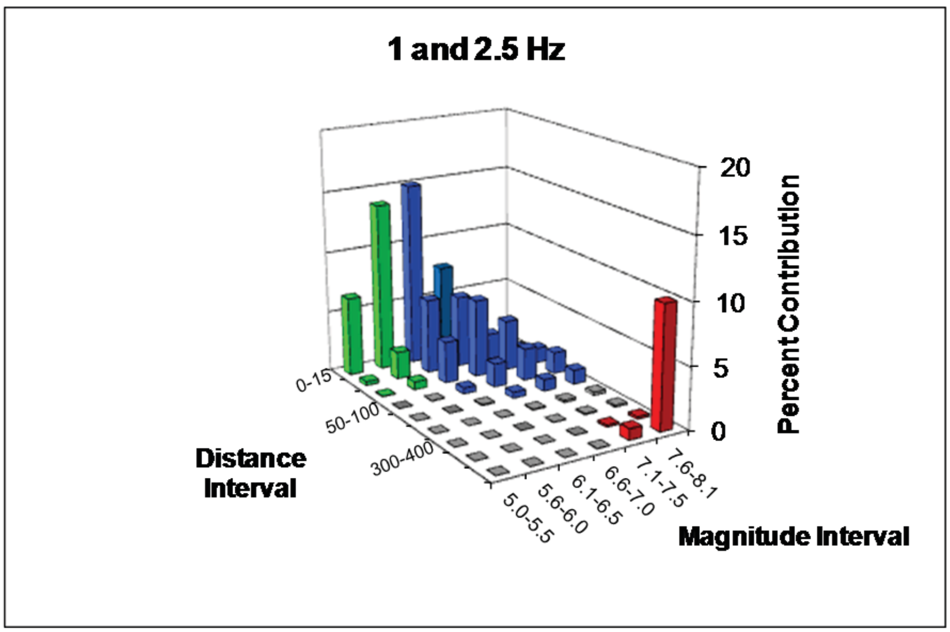


Figure 32: Deaggregation of mean 10^{-6} hazard from CEUS SSC model.

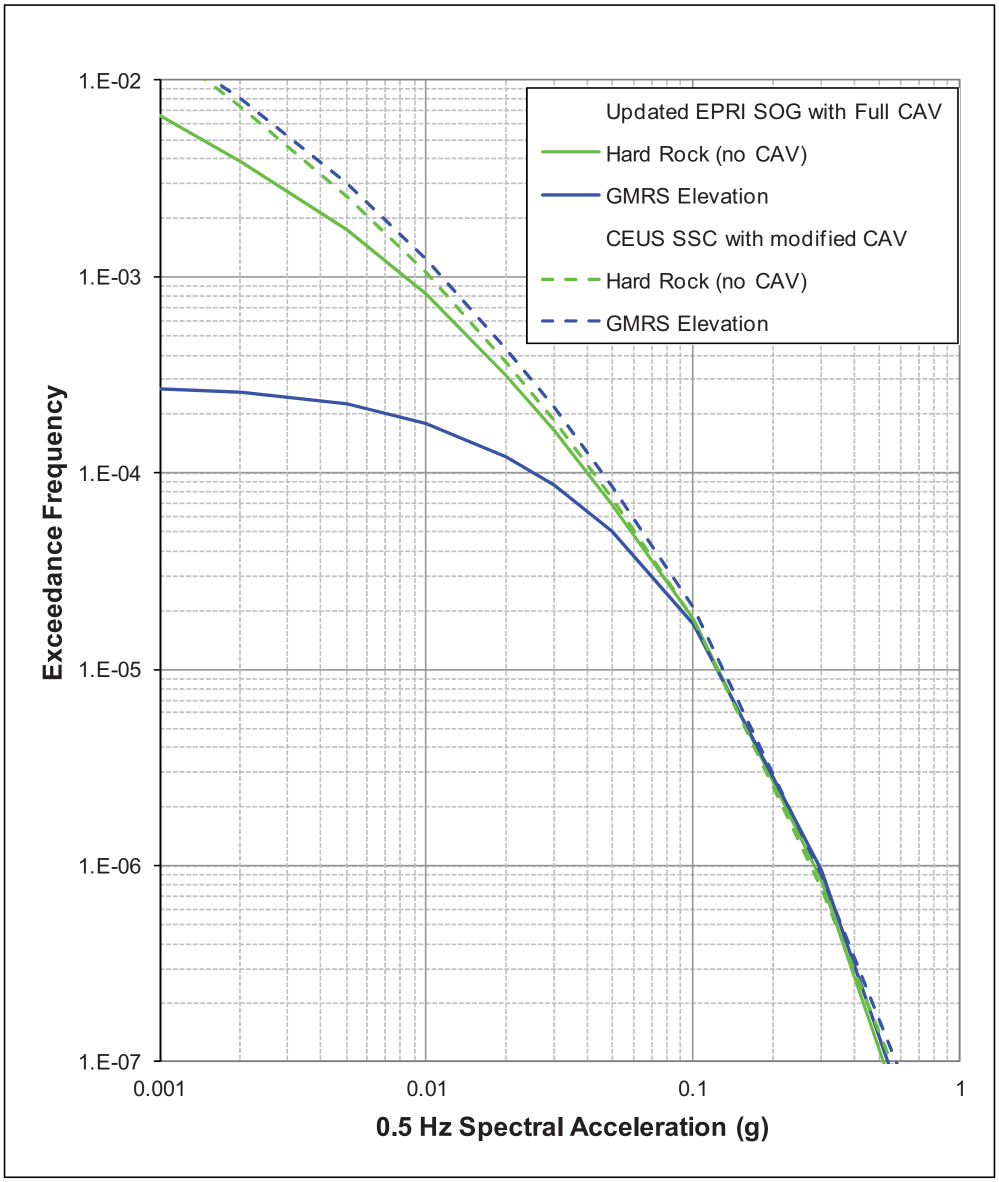


Figure 33: Comparison of mean hazard curves for 0.5 Hz spectral acceleration computed with CAV for the GMRS elevation to the hard rock hazard curves. Solid lines are the results for the Updated EPRI-SOG model with CAV applied to all magnitudes at the GMRS elevation and the dashed lines are for the CEUS SSC model with CAV applied only to magnitudes less than **M** 5.5 at the GMRS elevation.

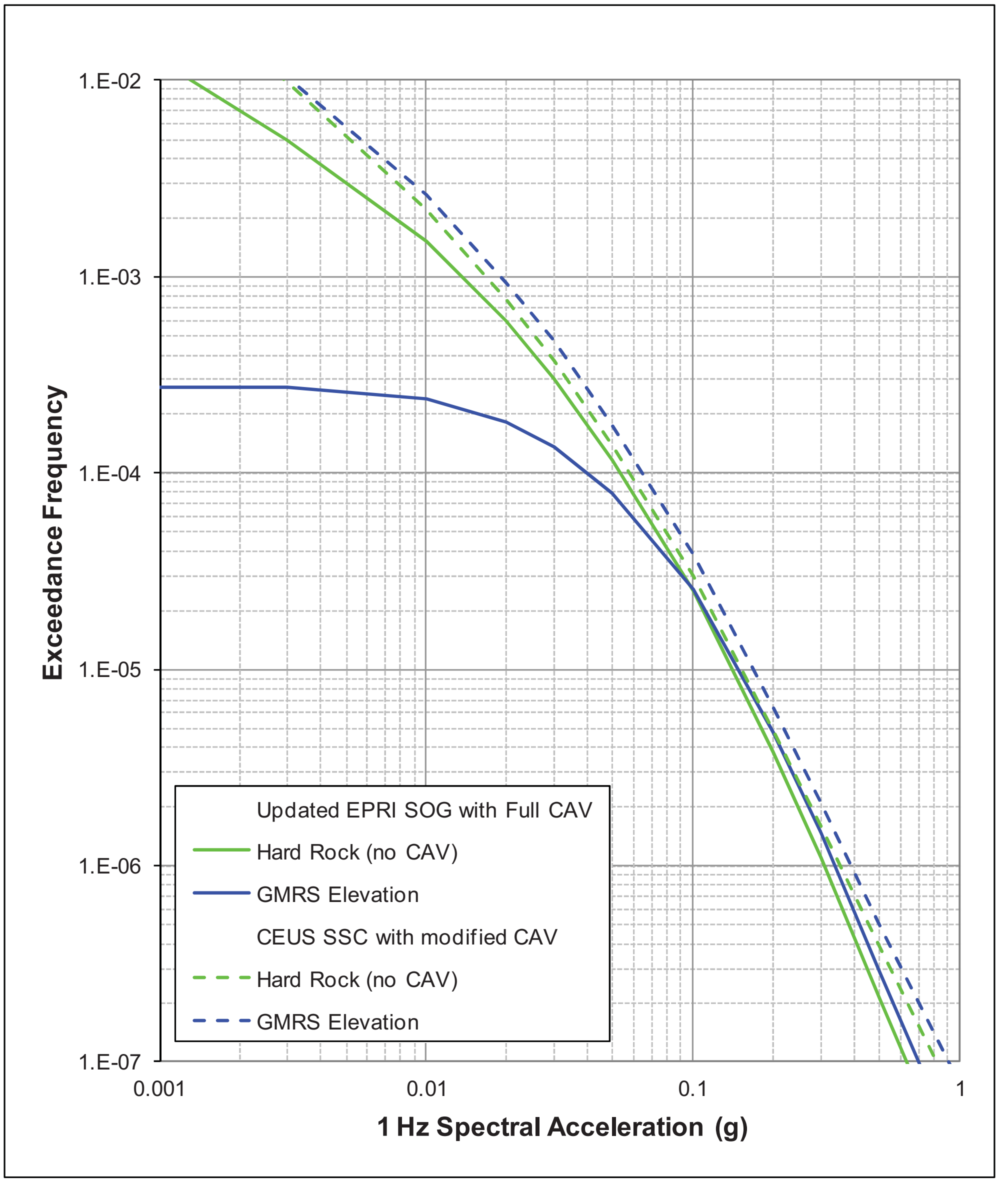


Figure 34: Comparison of mean hazard curves for 1 Hz spectral acceleration computed with CAV for the GMRS elevation to the hard rock hazard curves. Solid lines are the result for the Updated EPRI-SOG model with CAV applied to all magnitudes at the GMRS elevation and the dashed lines are for the CEUS SSC model with CAV applied only to magnitudes less than **M** 5.5 at the GMRS elevation.

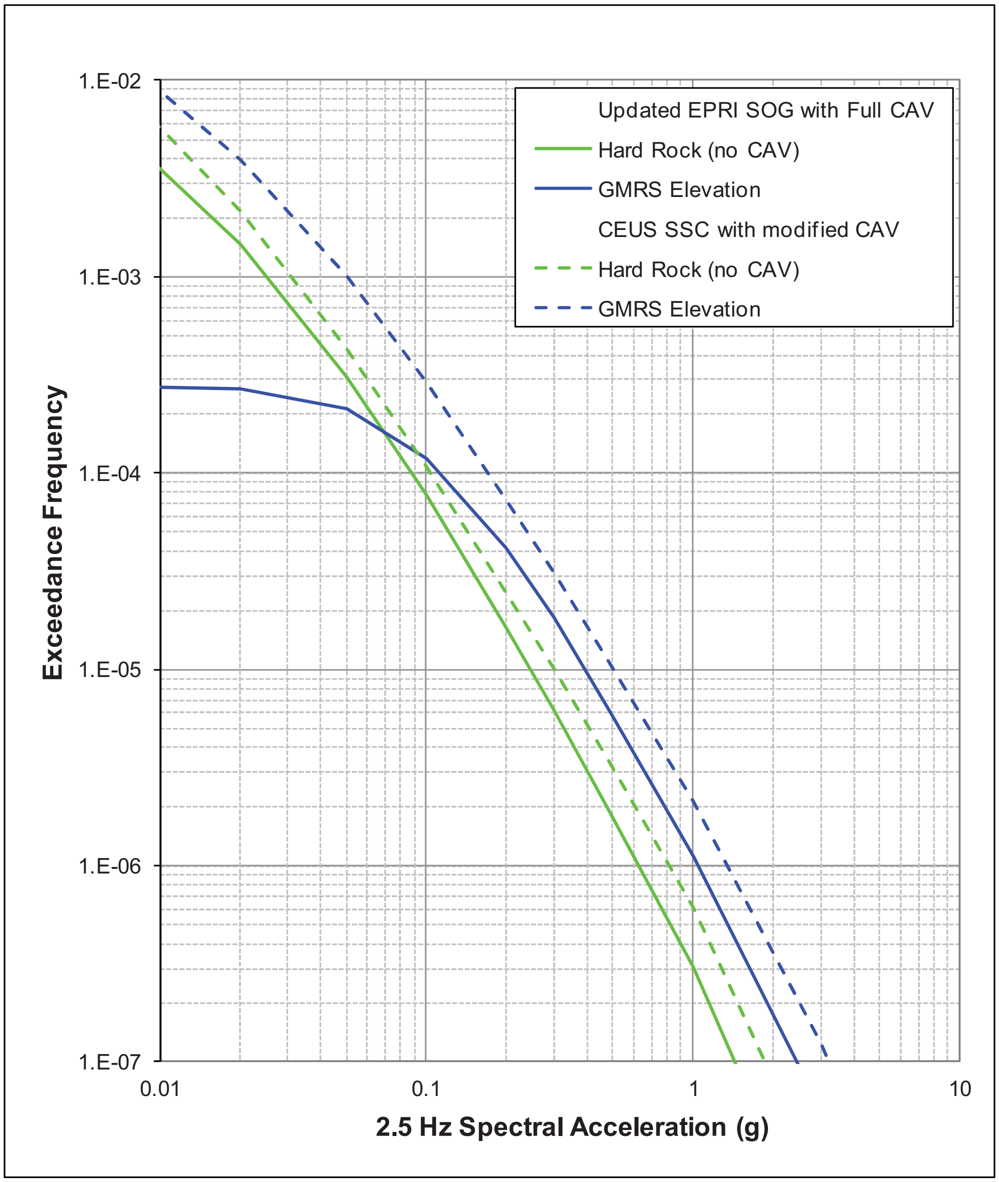


Figure 35: Comparison of mean hazard curves for 2.5 Hz spectral acceleration computed with CAV for the GMRS elevation to the hard rock hazard curves. Solid lines are the result for the Updated EPRI-SOG model with CAV applied to all magnitudes at the GMRS elevation and the dashed lines are for the CEUS SSC model with CAV applied only to magnitudes less than **M** 5.5 at the GMRS elevation.

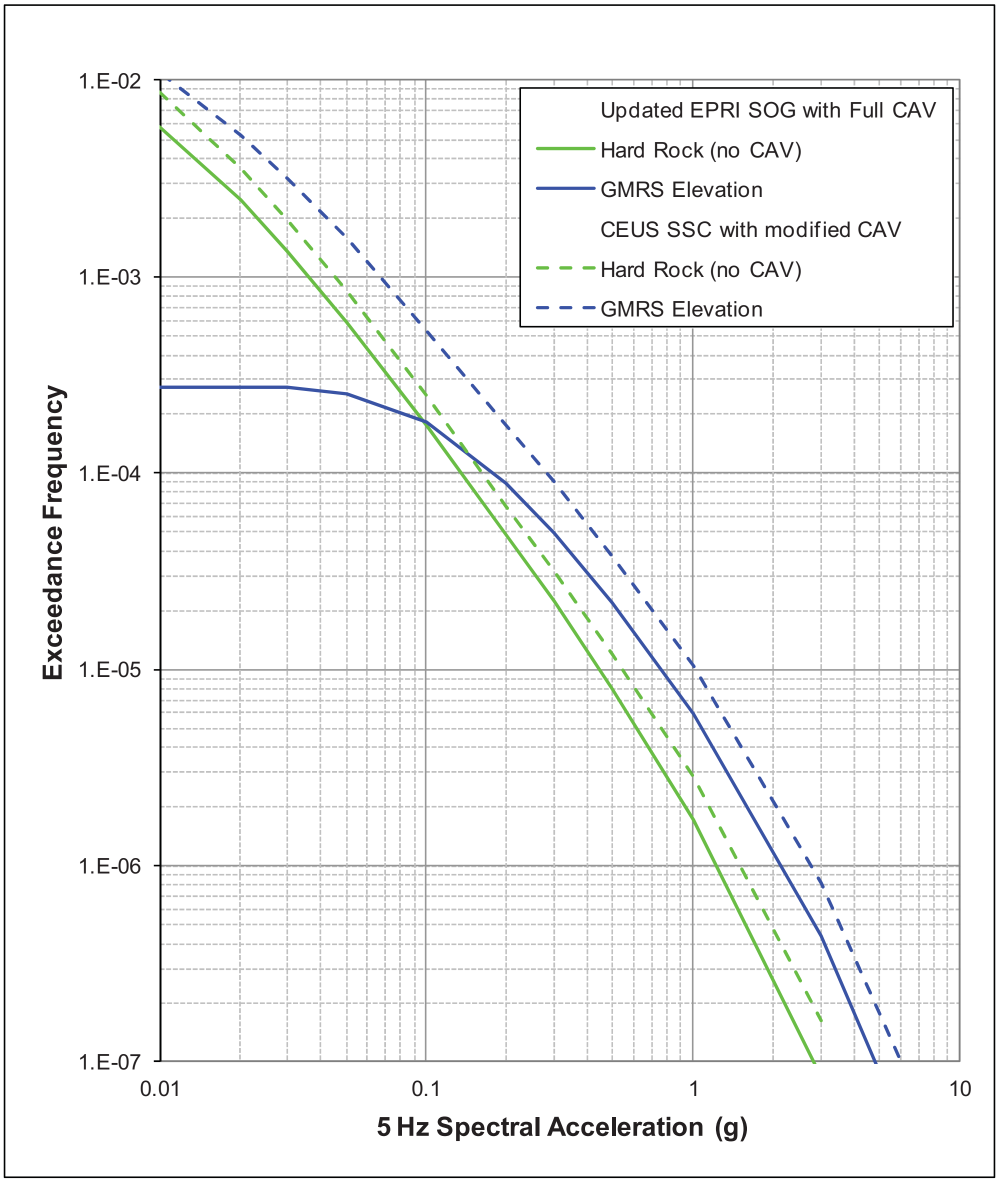


Figure 36: Comparison of mean hazard curves for 5 Hz spectral acceleration computed with CAV for the GMRS elevation to the hard rock hazard curves. Solid lines are the result for the Updated EPRI-SOG model with CAV applied to all magnitudes at the GMRS elevation and the dashed lines are for the CEUS SSC model with CAV applied only to magnitudes less than **M** 5.5 at the GMRS elevation.

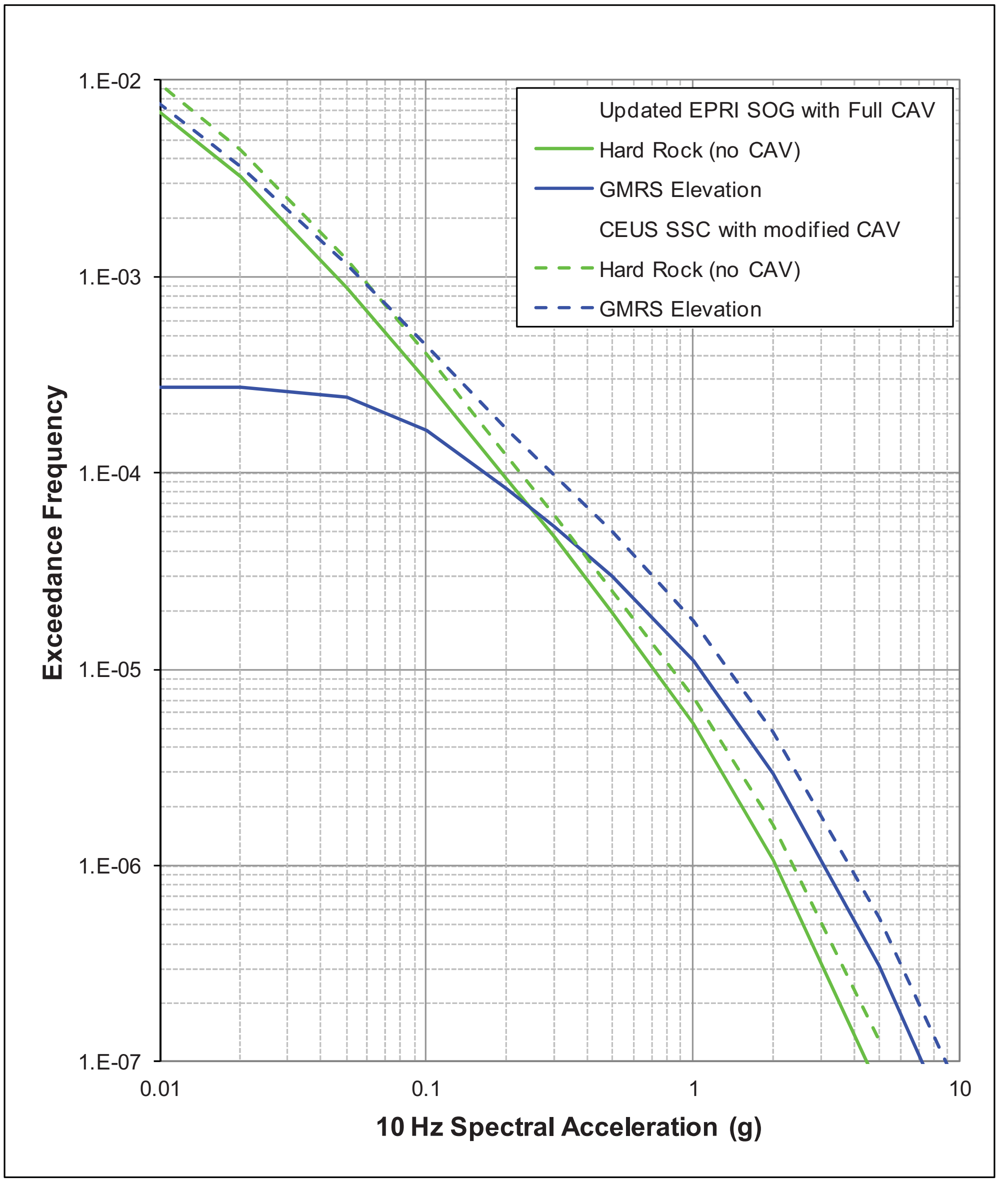


Figure 37: Comparison of mean hazard curves for 10 Hz spectral acceleration computed with CAV for the GMRS elevation to the hard rock hazard curves. Solid lines are the result for the Updated EPRI-SOG model with CAV applied to all magnitudes at the GMRS elevation and the dashed lines are for the CEUS SSC model with CAV applied only to magnitudes less than **M** 5.5 at the GMRS elevation.

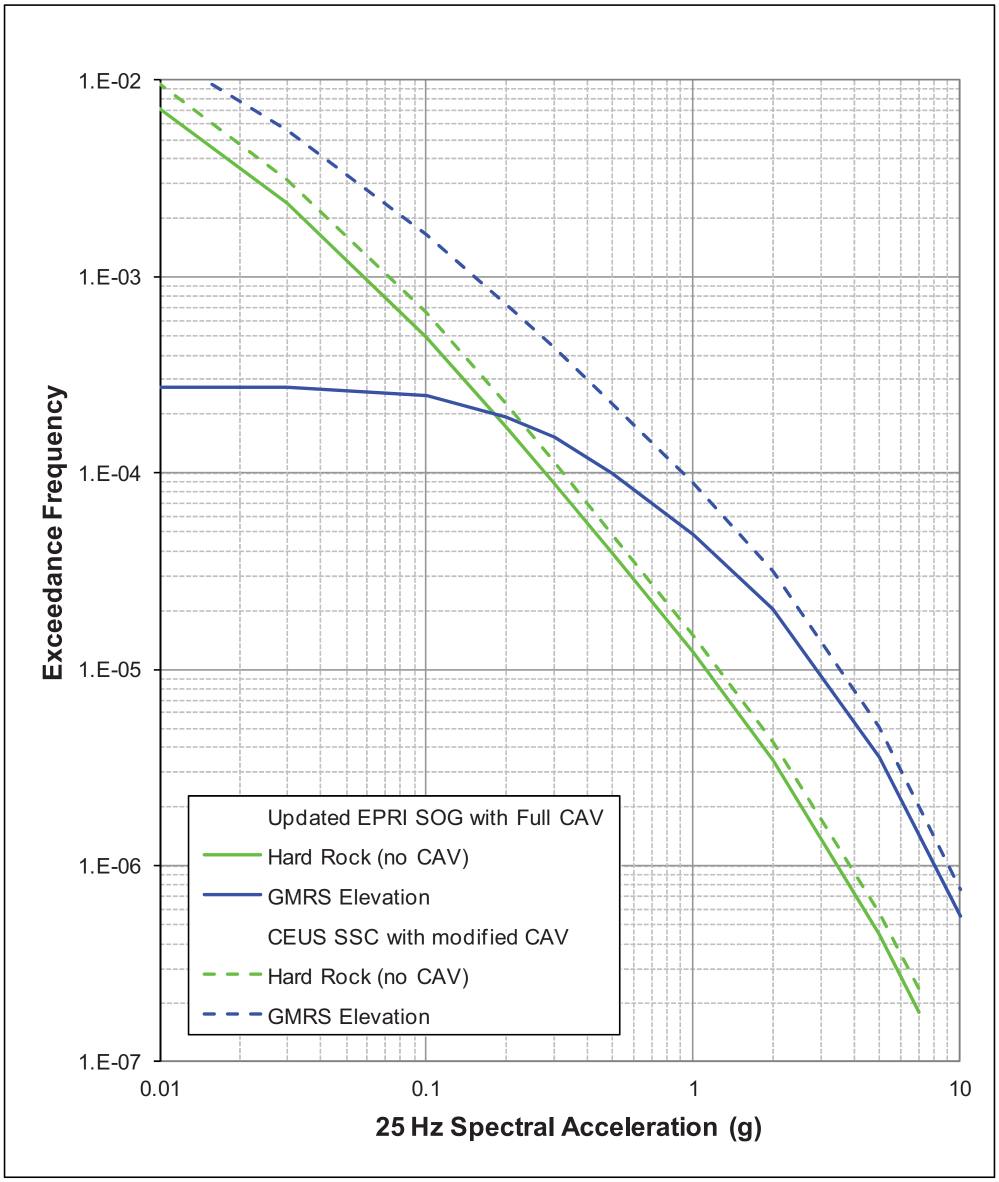


Figure 38: Comparison of mean hazard curves for 25 Hz spectral acceleration computed with CAV for the GMRS elevation to the hard rock hazard curves. Solid lines are the result for the Updated EPRI-SOG model with CAV applied to all magnitudes at the GMRS elevation and the dashed lines are for the CEUS SSC model with CAV applied only to magnitudes less than **M** 5.5 at the GMRS elevation.

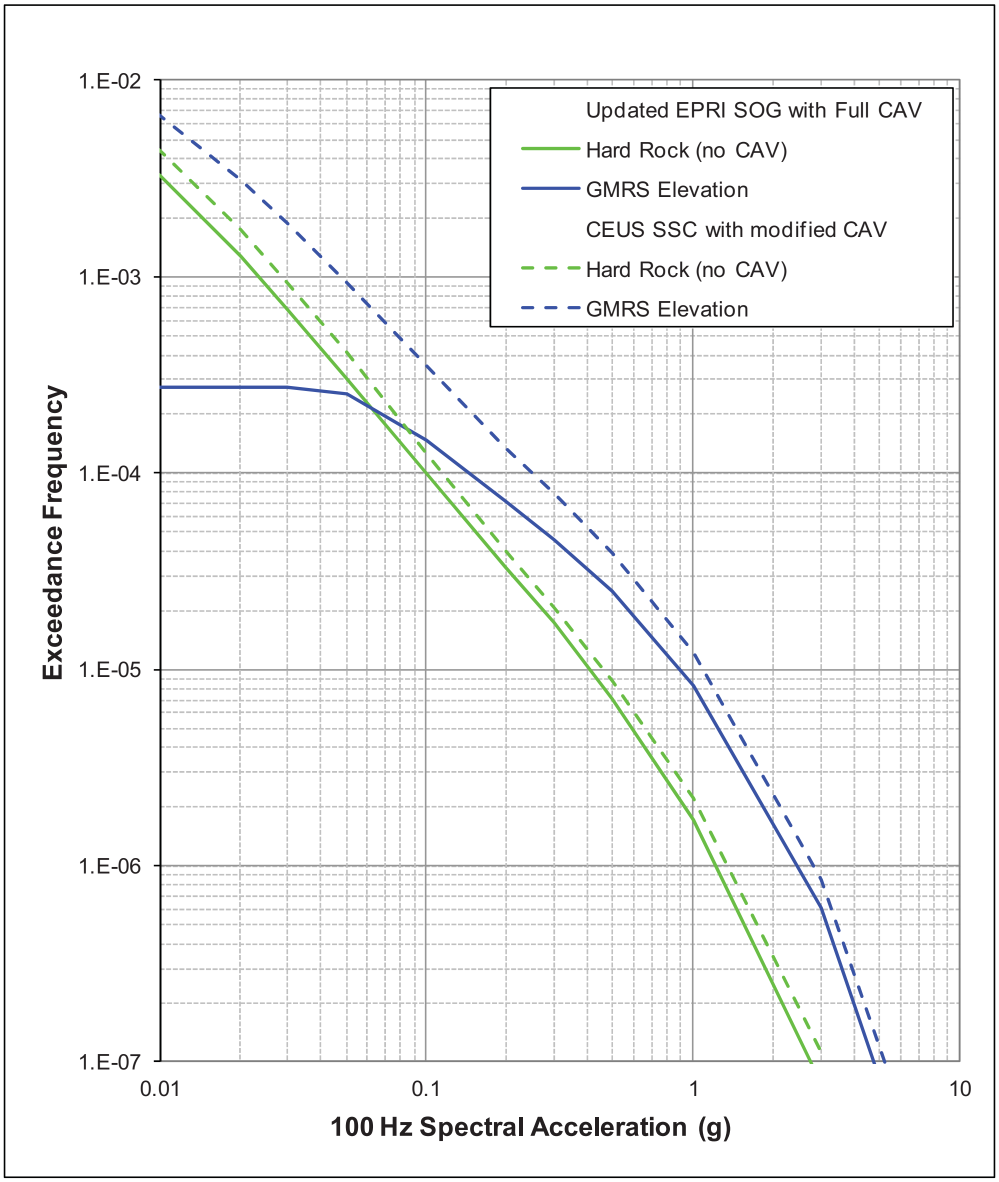


Figure 39: Comparison of mean hazard curves for 100 Hz spectral acceleration computed with CAV for the GMRS elevation to the hard rock hazard curves. Solid lines are the result for the Updated EPRI-SOG model with CAV applied to all magnitudes at the GMRS elevation and the dashed lines are for the CEUS SSC model with CAV applied only to magnitudes less than **M** 5.5 at the GMRS elevation.

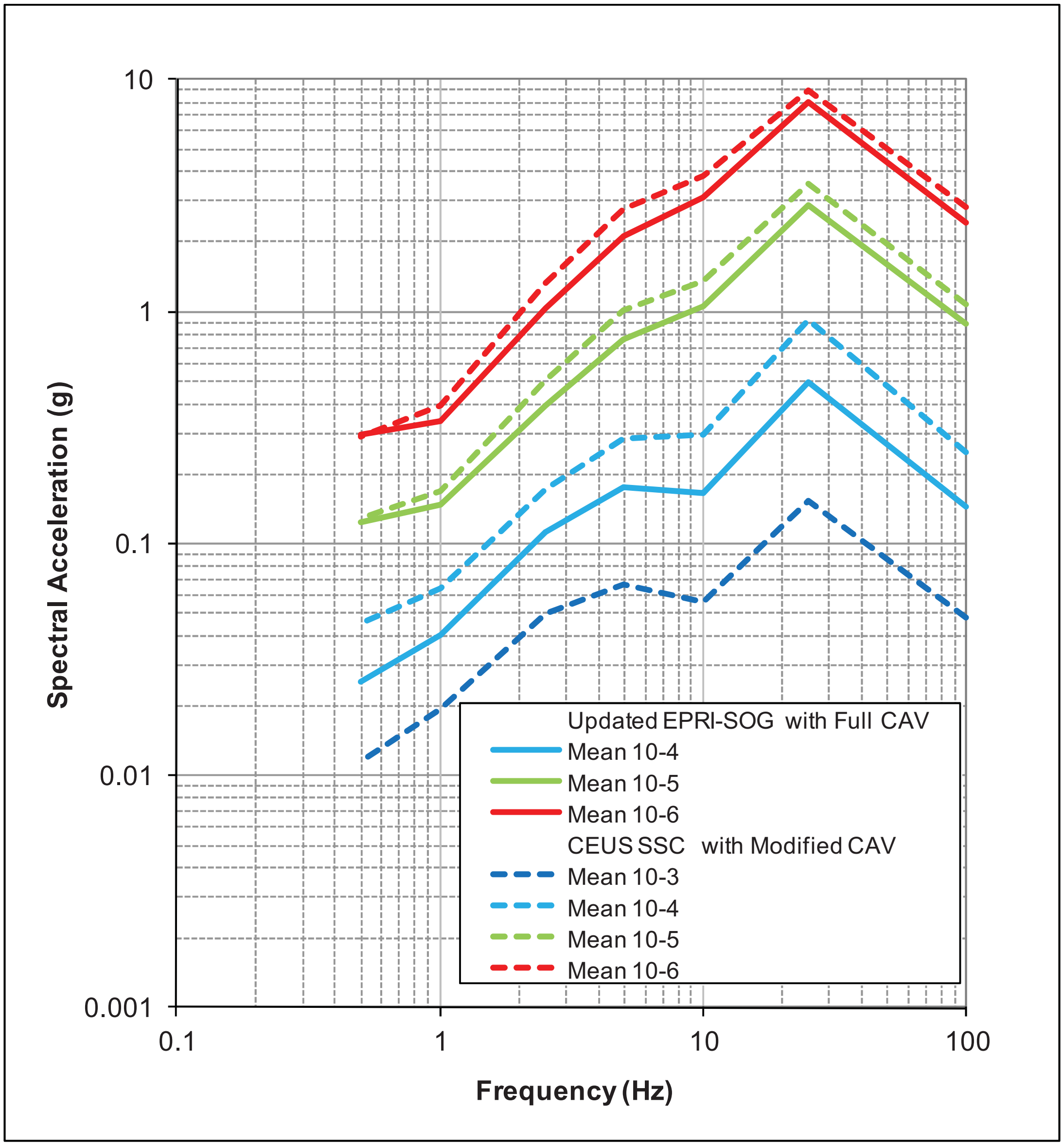


Figure 40: Comparison of UHRS at the GMRS elevation based on the Updated EPRI-SOG model with full CAV and the CEUS SSC model with modified CAV. Note that the 10^{-3} UHRS for the Updated EPRI-SOG model with full CAV is undefined and no spectrum is shown.

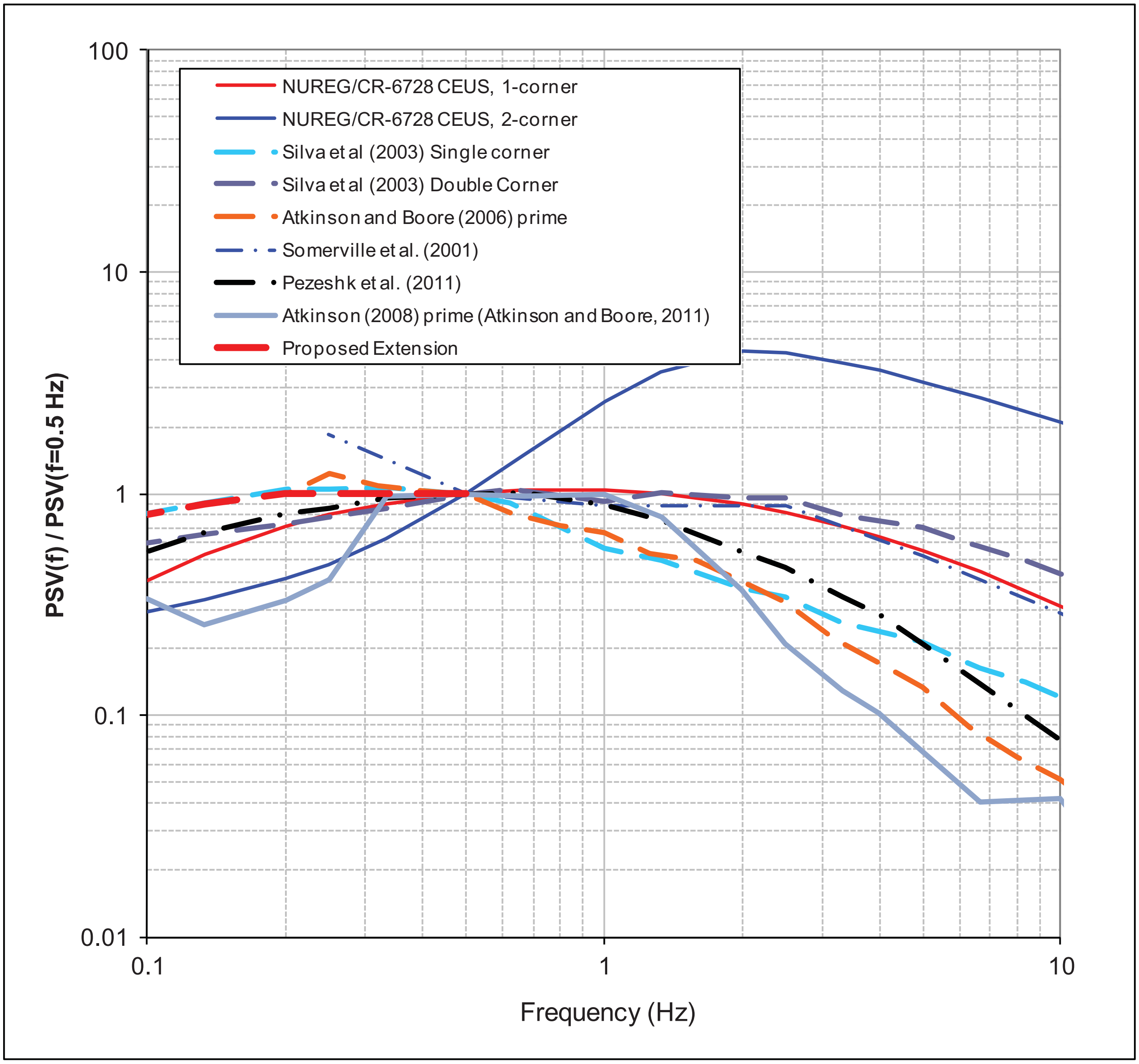


Figure 41: Spectral shapes used to extend hard rock UHRS from 0.5 Hz to 0.1 Hz for the CEUS SSC model.

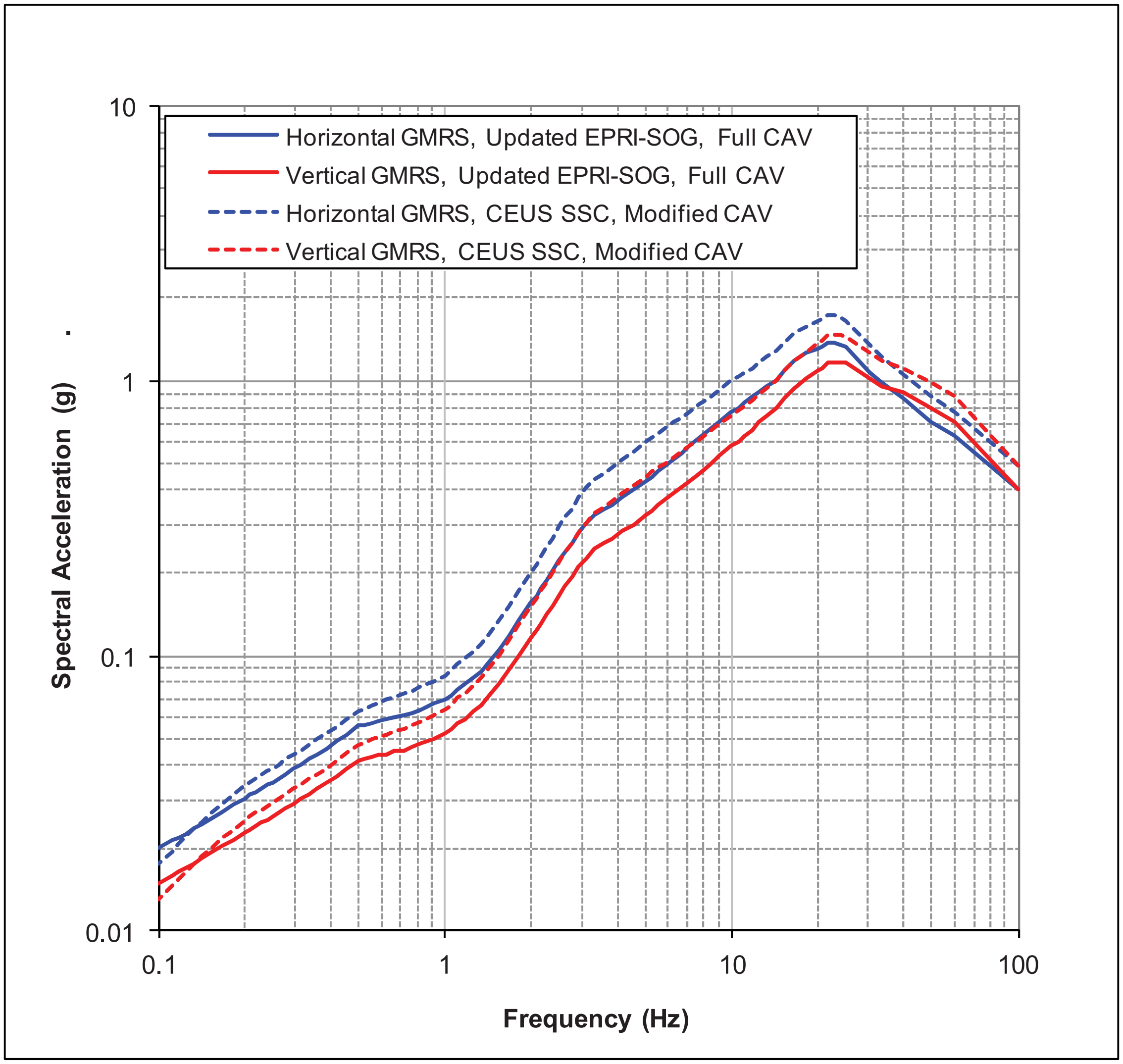


Figure 42: Comparison of the horizontal and vertical GMRS based on the Updated EPRI-SOG model with full CAV with the GMRS based on the CEUS SSC model with modified CAV.

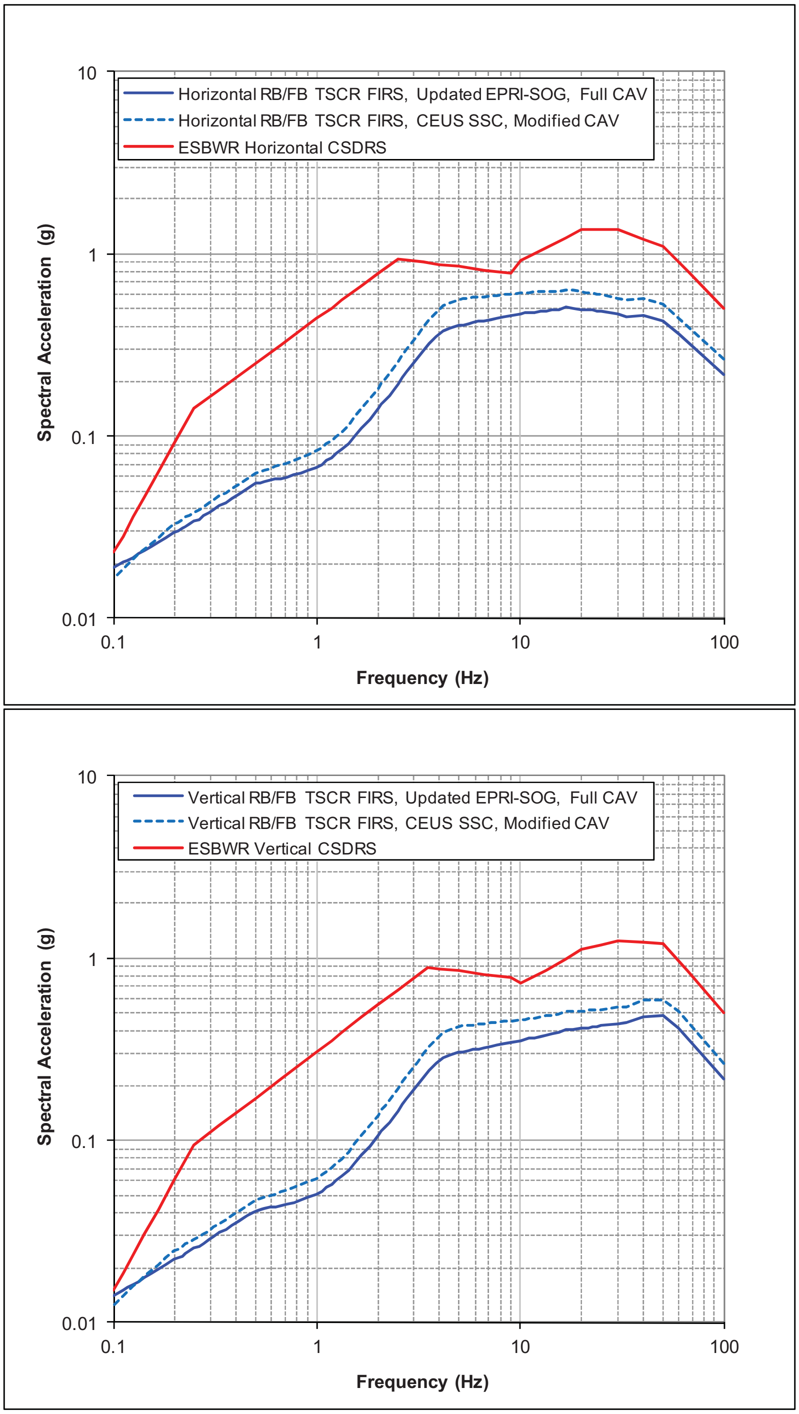


Figure 43: Comparison of the RB/FB FIRS based on the Updated EPRI-SOG model with full CAV and the CEUS SSC model with modified CAV.

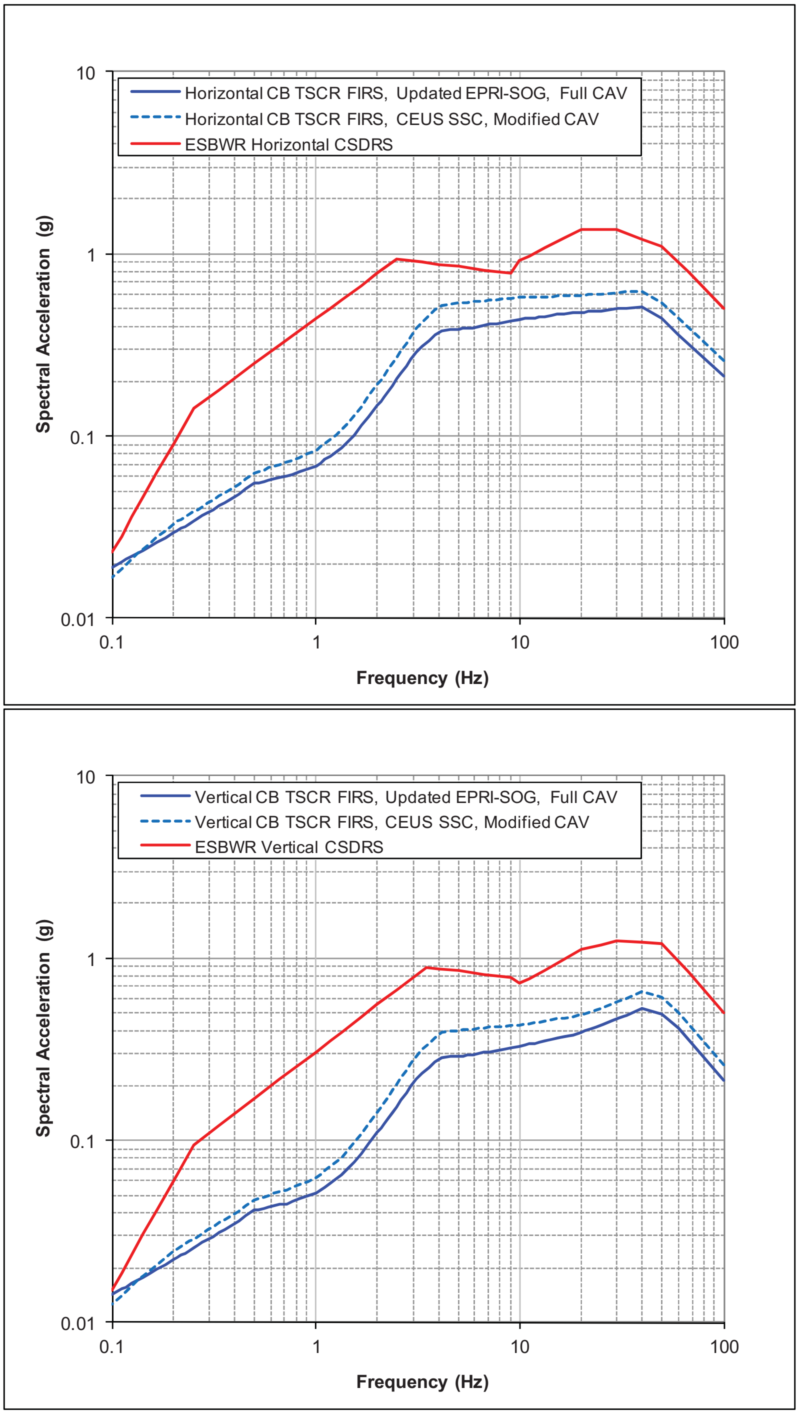


Figure 44: Comparison of the CB FIRS based on the Updated EPRI-SOG model with full CAV and the CEUS SSC model with modified CAV.

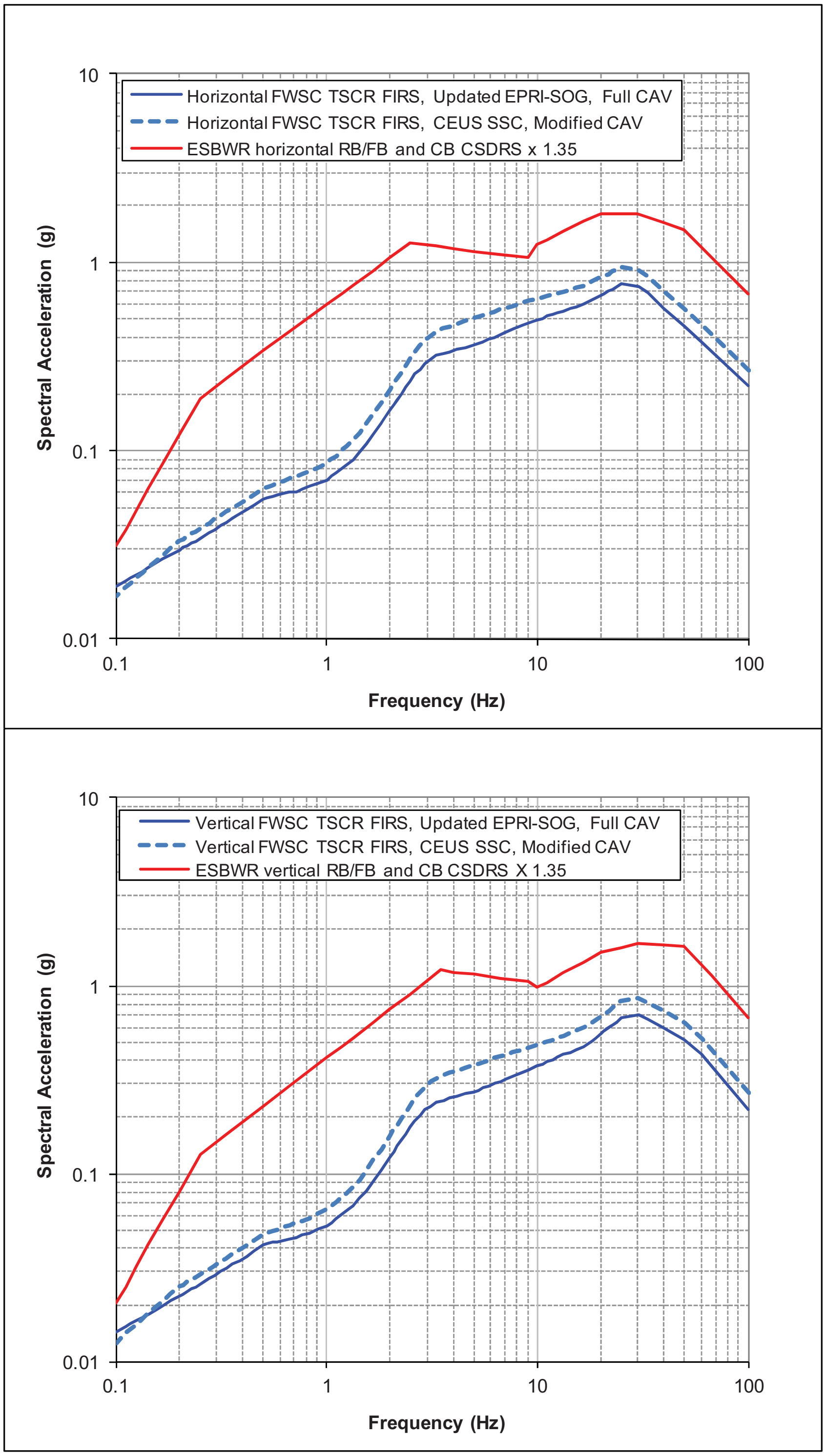


Figure 45: Comparison of the FWSC FIRS based on the Updated EPRI-SOG model with full CAV and the CEUS SSC model with modified CAV.

NRC3-12-0025
RAI Question No. 01.05-1

Enclosure 1

Supporting Calculations Data Files
(CD inventory and summary of data requests included on the following pages)

NRC Data Request 1

Excel spreadsheet containing the CEUS SSC rock hazard curve values (by seismic source) corresponding to the following structural frequencies: 0.5, 1, 2.5, 5, 10, and 25 Hz, and PGA.

Response

Excel file NRC_Data_Request_1.xlsx is provided. The file contains tabs for each of the six structural frequencies and for PGA. Each tab contains a table with the conditional mean hazard for each source, provided in two sets of columns. The first row of each table beneath the source name contains the weight assigned to each source in the CEUS SSC model. The sum of the exceedance frequency for each source multiplied by the corresponding weight equals the total mean hazard for the Fermi 3 site, listed in the last column of the table.

NRC Data Request 2

Excel spreadsheet containing the total rock hazard curve values (both original and CEUS SSC) corresponding to the following structural frequencies: 0.5, 1, 2.5, 5, 10, and 25 Hz, and PGA.

Detroit Edison Response

Excel file NRC_Data_Request_2.xlsx is provided. The file contains two tabs, one with the hard rock hazard based on the Updated EPRI-SOG model presented in Section 2.5.2.4 of the Fermi 3 FSAR and one with the hard rock hazard based on the CEUS SSC model. Each tab contains results for each of the six structural frequencies and for PGA. Column A contains the ground motion levels and indicates the structural frequency for each block. Column B contains the mean frequency of exceedance and Columns C, D, E, F, and G contain the 5th percentile, 16th percentile, 50th percentile, 84th percentile, and 95th percentile frequencies of exceedance, respectively.

NRC Data Request 3

Excel spreadsheet containing the rock UHRS (both original and CEUS SSC model).

Detroit Edison Response

Excel file NRC_Data_Request_3.xlsx is provided. The file contains the hard rock UHRS based on the updated EPRI-SOG model presented in Subsection 2.5.2.4 of the Fermi 3 FSAR and based on the CEUS SSC model.

NRC Data Request 4

Figures plotting the hazard deaggregation results corresponding to the CEUS SSC model.

Detroit Edison Response

The requested information is presented in Figures 29 through 32 of the response to RAI 01.05-1.

NRC Data Request 5

Table listing the magnitudes and distances of the controlling or deaggregation earthquakes corresponding the CEUS SSC results.

Detroit Edison Response

The requested information is provided in Table 4 of the response to RAI 01.05-1. For the Updated EPRI-SOG model, the corresponding magnitudes and distances of the controlling and deaggregation earthquakes are presented in Fermi 3 FSAR Table 2.5.2-219.

NRC Data Request 6

Summary of the results of software validation tests, which demonstrate that the software accurately calculates the hazard using the CEUS SSC model (including electronic data in an excel spreadsheet).

Detroit Edison Response

A discussion of the results of the validation test results is provided in the response to RAI 01.05 1. Excel file NRC_Data_Request_6.xlsx is provided containing the requested digital data. The file contains seven tabs that are each labeled with the name of one of the CEUS SSC demonstration sites. Columns A through E contain the results computed using the Fermi 3 project software and Columns G through K contain the data obtained from the indicated table in Chapter 8 of NUREG-2115. Rows 3 to 16 contain the results for PGA, rows 19 to 32 for 10 Hz pseudo-spectral acceleration (PSA), and rows 35 to 48 for 1 Hz PSA. The individual columns are labeled indicating mean, 15^{th} percentile, 50^{th} percentile, or 85^{th} percentile hazard.

NRC Data Request 7

If amplification functions are recalculated for the CEUS SSC results, an excel spreadsheet containing target response spectra values, amplification functions, and resulting soil UHRS.

Detroit Edison Response

The RAI 01.05-1 response provides discussion regarding why amplification functions were not recalculated for the GMRS profile.

NRC Data Request 8

Excel spreadsheet containing GMRS, FIRS, and PBSRS values (both original and updated curves), as well as the CSDRS.

Detroit Edison Response

Excel file NRC_Data_Request_8.xlsx is provided. The file contains tabs for the GMRS and TSCR FIRS for the RB/FB, CB, and FWSC. The FWSC FIRS are developed using the 4,500 psi fill concrete amplification functions and incorporate 2-dimensional effects developed in the response to RAI 03.07.01-4. On each tab, Column A contains spectral period and Column B contains spectral frequency. Columns C and D contain the spectral accelerations based on the updated EPRI-SOG model with full CAV presented in the Fermi 3 FSAR for horizontal and vertical motions, respectively. Columns E and F contain the spectral accelerations based on the CEUS SSC model with modified CAV for horizontal and vertical motions, respectively. An additional tab is included that contains the ESBWR CSDRS. The horizontal CSDRS is provided in Columns A, B, and C and the vertical CSDRS is provided in Columns E, F, and G. In accordance with the ESBWR DCD, the FWSC TSCR FIRS is compared to 1.35 times the CSDRS.

Supporting Calculations Data Files

Directory of D:\

08/23/2012	03:16 PM	54,112	NRC_Data_Request_1.xlsx
08/23/2012	03:16 PM	24,478	NRC_Data_Request_2.xlsx
08/23/2012	03:16 PM	12,668	NRC_Data_Request_3.xlsx
08/23/2012	03:16 PM	56,804	NRC_Data_Request_6.xlsx
08/23/2012	03:16 PM	54,203	NRC_Data_Request_8.xlsx

5 File(s) 24,272,896 bytes
0 Dir(s) 712,685,568 bytes free

Fermi 3 Hard Rock Hazard Individual Source Conditional Mean Hazard
PGA

Acceleration (g)	Individual Sources									
	AHEX	ECC-AM	GMH	IBB	MidC-A	MidC-B	MidC-C	MidC-D	MESE-N	MESE-W
	Weight									
	0.6	0.6	0.6	0.6	0.32	0.16	0.08	0.04	0.192	0.048
0.001	1.08E-06	2.25E-03	1.03E-03	7.24E-03	1.76E-02	1.72E-02	1.59E-02	1.57E-02	1.05E-02	2.36E-02
0.003	1.52E-07	4.38E-04	1.81E-04	2.17E-03	8.92E-03	8.78E-03	8.58E-03	8.60E-03	1.97E-03	5.73E-03
0.01	1.09E-08	3.79E-05	1.47E-05	2.88E-04	3.09E-03	3.07E-03	3.16E-03	3.20E-03	1.68E-04	6.54E-04
0.02	1.86E-09	6.95E-06	2.68E-06	6.37E-05	1.34E-03	1.34E-03	1.40E-03	1.41E-03	3.08E-05	1.36E-04
0.03	5.92E-10	2.31E-06	8.85E-07	2.34E-05	7.55E-04	7.55E-04	7.91E-04	8.02E-04	1.02E-05	4.83E-05
0.05	1.18E-10	4.99E-07	1.89E-07	5.80E-06	3.43E-04	3.45E-04	3.61E-04	3.67E-04	2.16E-06	1.13E-05
0.1	8.69E-12	4.42E-08	1.60E-08	6.53E-07	1.13E-04	1.14E-04	1.19E-04	1.22E-04	1.85E-07	1.17E-06
0.2	3.31E-13	2.28E-09	7.42E-10	4.73E-08	3.80E-05	3.85E-05	4.00E-05	4.10E-05	9.10E-09	7.77E-08
0.3	3.36E-14	2.94E-10	8.70E-11	7.92E-09	1.99E-05	2.02E-05	2.10E-05	2.15E-05	1.13E-09	1.26E-08
0.5	1.21E-15	1.52E-11	3.83E-12	6.13E-10	8.35E-06	8.48E-06	8.78E-06	9.04E-06	5.51E-11	9.69E-10
1	5.33E-18	1.27E-13	2.38E-14	1.05E-11	2.10E-06	2.13E-06	2.21E-06	2.27E-06	4.24E-13	1.79E-11
3	0.00E+00	2.42E-18	0.00E+00	3.57E-15	1.02E-07	1.04E-07	1.08E-07	1.11E-07	7.59E-18	8.32E-15

Acceleration (g)	Individual Sources									
	NEME-W	PEZ-N	PEZ-W	RR	RR-RCG	SLR	Study Region	Charleston RLME	Charlevoix RLME	Wabash Valley RLME
	Weight									
	0.048	0.48	0.12	0.4	0.2	0.6	0.16	1	1	1
0.001	1.58E-02	4.41E-03	6.48E-03	4.58E-03	4.54E-03	4.95E-03	3.91E-02	8.46E-04	4.73E-04	1.84E-04
0.003	8.70E-03	9.78E-04	1.77E-03	8.20E-04	7.99E-04	1.13E-03	1.44E-02	3.14E-04	1.47E-04	1.58E-04
0.01	3.25E-03	8.78E-05	2.12E-04	6.80E-05	6.35E-05	1.24E-04	3.99E-03	4.83E-05	1.99E-05	7.00E-05
0.02	1.44E-03	1.50E-05	4.23E-05	1.24E-05	1.12E-05	2.64E-05	1.63E-03	1.23E-05	4.35E-06	2.67E-05
0.03	8.21E-04	4.69E-06	1.43E-05	4.12E-06	3.64E-06	9.54E-06	8.96E-04	4.48E-06	1.38E-06	1.27E-05
0.05	3.77E-04	9.19E-07	3.08E-06	8.84E-07	7.58E-07	2.28E-06	3.95E-04	8.79E-07	2.27E-07	4.12E-06
0.1	1.25E-04	7.30E-08	2.83E-07	7.56E-08	6.32E-08	2.26E-07	1.23E-04	4.56E-08	9.32E-09	6.17E-07
0.2	4.23E-05	3.72E-09	1.73E-08	3.59E-09	3.03E-09	1.27E-08	3.91E-05	9.01E-10	1.45E-10	5.01E-08
0.3	2.22E-05	5.01E-10	2.72E-09	4.28E-10	3.70E-10	1.71E-09	2.02E-05	5.64E-11	7.81E-12	7.93E-09
0.5	9.33E-06	2.85E-11	2.05E-10	1.94E-11	1.75E-11	9.31E-11	8.53E-06	9.98E-13	1.09E-13	4.96E-10
1	2.35E-06	2.82E-13	3.56E-12	1.29E-13	1.24E-13	8.42E-13	2.23E-06	1.74E-16	0.00E+00	4.82E-12
3	1.14E-07	1.39E-17	1.11E-15	5.50E-20	4.85E-19	3.28E-17	1.20E-07	0.00E+00	0.00E+00	8.81E-17

NAP	NMESE-N
0.6	0.192
1.20E-04	2.95E-02
1.77E-05	1.26E-02
1.33E-06	3.80E-03
2.35E-07	1.59E-03
7.58E-08	8.86E-04
1.54E-08	4.00E-04
1.17E-09	1.29E-04
4.53E-11	4.25E-05
4.66E-12	2.22E-05
1.70E-13	9.38E-06
7.72E-16	2.43E-06
0.00E+00	1.27E-07

New Madrid RLME	Total
1	
2.02E-03	4.46E-02
1.51E-03	1.68E-02
5.15E-04	4.49E-03
1.69E-04	1.75E-03
8.08E-05	9.42E-04
3.13E-05	4.11E-04
5.04E-06	1.26E-04
2.98E-07	4.00E-05
3.51E-08	2.08E-05
1.41E-09	8.71E-06
6.83E-12	2.22E-06
0.00E+00	1.11E-07

Fermi 3 Hard Rock Hazard Individual Source Conditional Mean Hazard
0.5 Hz

Spectral Acceleration (g)	Individual Sources									
	AHEX	ECC-AM	GMH	IBB	MidC-A	MidC-B	MidC-C	MidC-D	MESE-N	MESE-W
	Weight									
	0.6	0.6	0.6	0.6	0.32	0.16	0.08	0.04	0.192	0.048
0.00001	1.69E-05	1.69E-02	8.24E-03	1.98E-02	4.57E-02	4.46E-02	4.11E-02	4.03E-02	8.09E-02	1.25E-01
0.0001	7.26E-06	8.52E-03	4.18E-03	1.32E-02	2.90E-02	2.82E-02	2.60E-02	2.55E-02	4.11E-02	6.84E-02
0.001	5.57E-07	8.31E-04	4.05E-04	1.97E-03	4.89E-03	4.79E-03	4.58E-03	4.55E-03	4.17E-03	7.87E-03
0.002	1.99E-07	3.13E-04	1.53E-04	8.28E-04	2.11E-03	2.08E-03	2.02E-03	2.01E-03	1.59E-03	3.10E-03
0.005	4.29E-08	7.18E-05	3.52E-05	2.19E-04	5.84E-04	5.76E-04	5.69E-04	5.69E-04	3.65E-04	7.50E-04
0.01	1.15E-08	2.00E-05	9.81E-06	6.71E-05	1.95E-04	1.92E-04	1.93E-04	1.93E-04	1.01E-04	2.15E-04
0.02	2.67E-09	4.74E-06	2.33E-06	1.72E-05	5.84E-05	5.79E-05	5.87E-05	5.90E-05	2.37E-05	5.18E-05
0.03	1.06E-09	1.88E-06	9.30E-07	7.05E-06	2.75E-05	2.74E-05	2.79E-05	2.80E-05	9.39E-06	2.06E-05
0.05	3.00E-10	5.34E-07	2.66E-07	2.05E-06	1.02E-05	1.01E-05	1.04E-05	1.05E-05	2.65E-06	5.77E-06
0.1	4.34E-11	7.73E-08	3.88E-08	3.05E-07	2.43E-06	2.43E-06	2.51E-06	2.53E-06	3.83E-07	8.15E-07
0.3	8.71E-13	1.61E-09	8.14E-10	6.87E-09	2.07E-07	2.08E-07	2.16E-07	2.18E-07	8.00E-09	1.68E-08
1	2.25E-15	4.56E-12	2.26E-12	2.28E-11	8.95E-09	9.00E-09	9.36E-09	9.42E-09	2.24E-11	5.09E-11

Spectral Acceleration (g)	Individual Sources									
	NEME-W	PEZ-N	PEZ-W	RR	RR-RCG	SLR	Study Region	Charleston RLME	Charlevoix RLME	Wabash Valley RLME
	Weight									
	0.048	0.48	0.12	0.4	0.2	0.6	0.16	1	1	1
0.00001	3.97E-02	2.21E-02	2.51E-02	3.85E-02	3.87E-02	2.76E-02	1.63E-01	1.84E-03	1.37E-03	1.86E-04
0.0001	2.54E-02	1.23E-02	1.47E-02	1.93E-02	1.93E-02	1.57E-02	9.31E-02	1.74E-03	1.24E-03	1.86E-04
0.001	4.61E-03	1.25E-03	1.66E-03	1.89E-03	1.82E-03	2.16E-03	1.28E-02	9.98E-04	6.32E-04	1.65E-04
0.002	2.05E-03	4.49E-04	6.10E-04	7.15E-04	6.73E-04	9.24E-04	5.44E-03	6.16E-04	3.66E-04	1.35E-04
0.005	5.81E-04	9.23E-05	1.30E-04	1.64E-04	1.50E-04	2.47E-04	1.48E-03	2.34E-04	1.29E-04	7.56E-05
0.01	1.97E-04	2.31E-05	3.32E-05	4.58E-05	4.06E-05	7.62E-05	4.81E-04	8.79E-05	4.62E-05	3.64E-05
0.02	6.03E-05	4.79E-06	7.04E-06	1.09E-05	9.44E-06	1.98E-05	1.38E-04	2.67E-05	1.34E-05	1.32E-05
0.03	2.87E-05	1.75E-06	2.58E-06	4.36E-06	3.71E-06	8.23E-06	6.31E-05	1.19E-05	5.82E-06	6.40E-06
0.05	1.07E-05	4.44E-07	6.57E-07	1.25E-06	1.04E-06	2.46E-06	2.22E-05	3.65E-06	1.73E-06	2.22E-06
0.1	2.57E-06	5.67E-08	8.33E-08	1.83E-07	1.50E-07	3.78E-07	4.92E-06	4.91E-07	2.25E-07	3.88E-07
0.3	2.19E-07	1.06E-09	1.59E-09	3.85E-09	3.20E-09	8.55E-09	3.88E-07	5.94E-09	2.65E-09	8.72E-09
1	9.19E-09	2.64E-12	4.51E-12	1.07E-11	9.43E-12	2.60E-11	1.70E-08	6.10E-12	2.63E-12	1.99E-11

NAP	NMESE-N
0.6	0.192
1.80E-03	8.50E-02
7.87E-04	5.38E-02
6.50E-05	8.80E-03
2.38E-05	3.86E-03
5.26E-06	1.09E-03
1.44E-06	3.66E-04
3.40E-07	1.08E-04
1.36E-07	5.03E-05
3.92E-08	1.81E-05
5.77E-09	4.18E-06
1.18E-10	3.49E-07
3.11E-13	1.48E-08

New Madrid RLME	Total
1	
2.10E-03	1.79E-01
2.10E-03	1.04E-01
1.93E-03	1.69E-02
1.68E-03	8.26E-03
1.06E-03	2.92E-03
5.57E-04	1.18E-03
2.31E-04	4.08E-04
1.24E-04	2.03E-04
5.33E-05	7.96E-05
1.38E-05	1.88E-05
4.87E-07	7.86E-07
1.59E-09	1.31E-08

Fermi 3 Hard Rock Hazard Individual Source Conditional Mean Hazard
1 Hz

Spectral Acceleration (g)	Individual Sources									
	AHEX	ECC-AM	GMH	IBB	MidC-A	MidC-B	MidC-C	MidC-D	MESE-N	MESE-W
	Weight									
	0.6	0.6	0.6	0.6	0.32	0.16	0.08	0.04	0.192	0.048
0.0001	1.13E-05	1.25E-02	6.17E-03	1.74E-02	3.81E-02	3.71E-02	3.40E-02	3.33E-02	6.03E-02	9.75E-02
0.001	1.25E-06	1.92E-03	9.30E-04	4.52E-03	1.12E-02	1.09E-02	1.03E-02	1.02E-02	9.42E-03	1.80E-02
0.003	2.29E-07	3.99E-04	1.91E-04	1.19E-03	3.54E-03	3.48E-03	3.39E-03	3.39E-03	1.99E-03	4.13E-03
0.01	2.33E-08	4.57E-05	2.18E-05	1.73E-04	6.52E-04	6.46E-04	6.49E-04	6.52E-04	2.28E-04	5.22E-04
0.02	4.91E-09	1.02E-05	4.82E-06	4.40E-05	2.08E-04	2.07E-04	2.11E-04	2.13E-04	5.01E-05	1.22E-04
0.03	1.79E-09	3.81E-06	1.80E-06	1.77E-05	1.02E-04	1.01E-04	1.04E-04	1.05E-04	1.86E-05	4.66E-05
0.05	4.45E-10	9.76E-07	4.61E-07	4.94E-06	3.94E-05	3.94E-05	4.07E-05	4.11E-05	4.73E-06	1.22E-05
0.1	5.18E-11	1.18E-07	5.57E-08	6.65E-07	1.01E-05	1.01E-05	1.05E-05	1.06E-05	5.66E-07	1.52E-06
0.2	4.02E-12	9.70E-09	4.55E-09	6.11E-08	2.34E-06	2.36E-06	2.45E-06	2.48E-06	4.61E-08	1.28E-07
0.3	7.10E-13	1.80E-09	8.34E-10	1.22E-08	9.47E-07	9.55E-07	9.92E-07	1.01E-06	8.49E-09	2.45E-08
0.5	5.97E-14	1.63E-10	7.42E-11	1.25E-09	2.81E-07	2.84E-07	2.95E-07	2.99E-07	7.61E-10	2.35E-09
1	1.16E-15	3.58E-12	1.57E-12	3.34E-11	4.47E-08	4.51E-08	4.69E-08	4.74E-08	1.64E-11	5.89E-11

Spectral Acceleration (g)	Individual Sources									
	NEME-W	PEZ-N	PEZ-W	RR	RR-RCG	SLR	Study Region	Charleston RLME	Charlevoix RLME	Wabash Valley RLME
	Weight									
	0.048	0.48	0.12	0.4	0.2	0.6	0.16	1	1	1
0.0001	3.30E-02	1.76E-02	2.05E-02	2.85E-02	2.85E-02	2.18E-02	1.29E-01	1.77E-03	1.25E-03	1.86E-04
0.001	1.03E-02	3.13E-03	4.16E-03	4.27E-03	4.19E-03	4.43E-03	2.84E-02	1.22E-03	7.99E-04	1.80E-04
0.003	3.44E-03	6.34E-04	9.09E-04	8.85E-04	8.40E-04	1.14E-03	7.84E-03	6.18E-04	3.51E-04	1.47E-04
0.01	6.67E-04	6.39E-05	9.90E-05	1.01E-04	9.13E-05	1.64E-04	1.31E-03	1.36E-04	6.74E-05	6.61E-05
0.02	2.18E-04	1.28E-05	2.07E-05	2.24E-05	1.97E-05	4.08E-05	3.94E-04	3.91E-05	1.82E-05	2.69E-05
0.03	1.08E-04	4.46E-06	7.43E-06	8.36E-06	7.24E-06	1.62E-05	1.85E-04	1.64E-05	7.28E-06	1.34E-05
0.05	4.23E-05	1.04E-06	1.79E-06	2.14E-06	1.82E-06	4.43E-06	6.76E-05	4.53E-06	1.91E-06	4.62E-06
0.1	1.09E-05	1.12E-07	2.02E-07	2.60E-07	2.16E-07	5.78E-07	1.61E-05	5.22E-07	2.04E-07	7.61E-07
0.2	2.55E-06	8.61E-09	1.62E-08	2.13E-08	1.75E-08	5.05E-08	3.63E-06	3.33E-08	1.22E-08	7.76E-08
0.3	1.03E-06	1.57E-09	3.06E-09	3.91E-09	3.23E-09	9.65E-09	1.48E-06	4.86E-09	1.71E-09	1.57E-08
0.5	3.05E-07	1.41E-10	2.95E-10	3.49E-10	2.91E-10	9.06E-10	4.56E-07	3.02E-10	1.02E-10	1.53E-09
1	4.79E-08	3.11E-12	7.57E-12	7.43E-12	6.37E-12	2.09E-11	7.72E-08	3.58E-12	1.12E-12	3.48E-11

NAP	NMESE-N
0.6	0.192
1.21E-03	7.13E-02
1.42E-04	1.95E-02
2.72E-05	5.90E-03
2.88E-06	1.07E-03
6.17E-07	3.35E-04
2.27E-07	1.61E-04
5.74E-08	6.09E-05
6.81E-09	1.51E-05
5.37E-10	3.53E-06
9.56E-11	1.46E-06
8.11E-12	4.46E-07
1.59E-13	7.35E-08

New Madrid RLME	Total
1	
2.10E-03	1.43E-01
2.02E-03	3.39E-02
1.71E-03	1.08E-02
8.78E-04	2.40E-03
3.81E-04	8.25E-04
2.00E-04	4.01E-04
7.70E-05	1.46E-04
1.58E-05	3.06E-05
1.89E-06	4.92E-06
4.00E-07	1.58E-06
3.98E-08	3.88E-07
9.07E-10	5.69E-08

Fermi 3 Hard Rock Hazard Individual Source Conditional Mean Hazard
2.5 Hz

Spectral Acceleration (g)	Individual Sources									
	AHEX	ECC-AM	GMH	IBB	MidC-A	MidC-B	MidC-C	MidC-D	MESE-N	MESE-W
	Weight									
	0.6	0.6	0.6	0.6	0.32	0.16	0.08	0.04	0.192	0.048
0.0001	1.57E-05	1.62E-02	7.97E-03	1.98E-02	4.47E-02	4.35E-02	4.01E-02	3.92E-02	7.78E-02	1.21E-01
0.001	2.97E-06	4.58E-03	2.22E-03	1.01E-02	2.19E-02	2.13E-02	1.95E-02	1.92E-02	2.20E-02	4.14E-02
0.003	5.61E-07	1.09E-03	5.05E-04	3.46E-03	9.96E-03	9.76E-03	9.30E-03	9.26E-03	5.23E-03	1.15E-02
0.01	5.43E-08	1.25E-04	5.63E-05	5.59E-04	2.73E-03	2.70E-03	2.71E-03	2.73E-03	6.03E-04	1.56E-03
0.02	1.11E-08	2.76E-05	1.22E-05	1.46E-04	1.02E-03	1.02E-03	1.04E-03	1.05E-03	1.32E-04	3.73E-04
0.05	9.80E-10	2.59E-06	1.14E-06	1.70E-05	2.26E-04	2.26E-04	2.35E-04	2.38E-04	1.22E-05	3.87E-05
0.1	1.13E-10	3.09E-07	1.35E-07	2.35E-06	6.61E-05	6.65E-05	6.92E-05	7.04E-05	1.43E-06	4.91E-06
0.2	8.77E-12	2.52E-08	1.10E-08	2.21E-07	1.83E-05	1.84E-05	1.92E-05	1.96E-05	1.16E-07	4.28E-07
0.3	1.55E-12	4.68E-09	2.03E-09	4.50E-08	8.22E-06	8.31E-06	8.63E-06	8.82E-06	2.14E-08	8.33E-08
0.5	1.29E-13	4.26E-10	1.80E-10	4.69E-09	2.78E-06	2.81E-06	2.92E-06	2.98E-06	1.92E-09	8.25E-09
1	2.43E-15	9.36E-12	3.77E-12	1.30E-10	5.25E-07	5.32E-07	5.51E-07	5.63E-07	4.11E-11	2.18E-10
3	7.30E-19	4.41E-15	1.50E-15	1.10E-13	1.98E-08	2.00E-08	2.07E-08	2.11E-08	1.80E-14	1.82E-13

Spectral Acceleration (g)	Individual Sources									
	NEME-W	PEZ-N	PEZ-W	RR	RR-RCG	SLR	Study Region	Charleston RLME	Charlevoix RLME	Wabash Valley RLME
	Weight									
	0.048	0.48	0.12	0.4	0.2	0.6	0.16	1	1	1
0.0001	3.88E-02	2.16E-02	2.47E-02	3.70E-02	3.71E-02	2.69E-02	1.59E-01	1.82E-03	1.31E-03	1.86E-04
0.001	1.93E-02	7.66E-03	9.91E-03	1.00E-02	9.95E-03	9.39E-03	6.04E-02	1.42E-03	9.28E-04	1.86E-04
0.003	9.37E-03	2.00E-03	2.95E-03	2.30E-03	2.24E-03	2.70E-03	2.10E-02	8.36E-04	4.67E-04	1.76E-04
0.01	2.78E-03	2.24E-04	3.88E-04	2.59E-04	2.42E-04	4.01E-04	4.51E-03	2.08E-04	9.83E-05	1.14E-04
0.02	1.07E-03	4.56E-05	8.60E-05	5.65E-05	5.11E-05	1.01E-04	1.55E-03	6.34E-05	2.84E-05	5.98E-05
0.05	2.45E-04	3.69E-06	7.76E-06	5.27E-06	4.59E-06	1.11E-05	3.15E-04	8.28E-06	3.39E-06	1.34E-05
0.1	7.25E-05	3.86E-07	8.82E-07	6.31E-07	5.33E-07	1.46E-06	8.62E-05	1.06E-06	3.95E-07	2.50E-06
0.2	2.02E-05	2.83E-08	7.04E-08	5.16E-08	4.28E-08	1.29E-07	2.25E-05	7.24E-08	2.47E-08	2.75E-07
0.3	9.11E-06	5.06E-09	1.33E-08	9.52E-09	7.87E-09	2.48E-08	1.01E-05	1.08E-08	3.50E-09	5.75E-08
0.5	3.08E-06	4.51E-10	1.30E-09	8.50E-10	7.09E-10	2.36E-09	3.49E-06	6.71E-10	2.04E-10	5.81E-09
1	5.80E-07	9.97E-12	3.44E-11	1.79E-11	1.53E-11	5.46E-11	7.19E-07	7.55E-12	2.08E-12	1.38E-10
3	2.14E-08	4.95E-15	2.83E-14	7.28E-15	6.69E-15	2.80E-14	3.20E-08	4.38E-19	0.00E+00	6.70E-14

NAP	NMESE-N
0.6	0.192
1.66E-03	8.35E-02
3.27E-04	3.96E-02
6.46E-05	1.61E-02
6.56E-06	3.91E-03
1.37E-06	1.41E-03
1.25E-07	3.02E-04
1.47E-08	8.58E-05
1.16E-09	2.32E-05
2.08E-10	1.05E-05
1.75E-11	3.66E-06
3.32E-13	7.45E-07
1.02E-16	3.11E-08

New Madrid RLME	Total
1	
2.10E-03	1.75E-01
2.09E-03	6.86E-02
1.96E-03	2.51E-02
1.26E-03	6.10E-03
6.23E-04	2.24E-03
1.32E-04	4.43E-04
2.83E-05	1.10E-04
3.74E-06	2.46E-05
8.31E-07	1.00E-05
8.60E-08	3.20E-06
1.96E-09	6.08E-07
7.58E-13	2.41E-08

Fermi 3 Hard Rock Hazard Individual Source Conditional Mean Hazard
5 Hz

Spectral Acceleration (g)	Individual Sources									
	AHEX	ECC-AM	GMH	IBB	MidC-A	MidC-B	MidC-C	MidC-D	MESE-N	MESE-W
	Weight									
	0.6	0.6	0.6	0.6	0.32	0.16	0.08	0.04	0.192	0.048
0.001	3.40E-06	5.63E-03	2.71E-03	1.27E-02	2.57E-02	2.49E-02	2.27E-02	2.22E-02	2.68E-02	5.13E-02
0.003	6.37E-07	1.43E-03	6.36E-04	5.08E-03	1.36E-02	1.33E-02	1.25E-02	1.24E-02	6.63E-03	1.57E-02
0.01	5.98E-08	1.67E-04	6.96E-05	9.07E-04	4.94E-03	4.88E-03	4.89E-03	4.92E-03	7.66E-04	2.32E-03
0.02	1.24E-08	3.69E-05	1.52E-05	2.44E-04	2.22E-03	2.21E-03	2.27E-03	2.29E-03	1.69E-04	5.76E-04
0.03	4.55E-09	1.40E-05	5.73E-06	1.02E-04	1.28E-03	1.28E-03	1.32E-03	1.34E-03	6.40E-05	2.31E-04
0.05	1.17E-09	3.70E-06	1.52E-06	3.01E-05	5.89E-04	5.88E-04	6.14E-04	6.22E-04	1.69E-05	6.51E-05
0.1	1.47E-10	4.90E-07	2.01E-07	4.59E-06	1.86E-04	1.87E-04	1.95E-04	1.99E-04	2.21E-06	9.27E-06
0.2	1.28E-11	4.66E-08	1.89E-08	5.09E-07	5.68E-05	5.73E-05	5.97E-05	6.10E-05	2.07E-07	9.53E-07
0.3	2.44E-12	9.64E-09	3.85E-09	1.17E-07	2.80E-05	2.83E-05	2.95E-05	3.01E-05	4.23E-08	2.10E-07
0.5	2.26E-13	1.03E-09	3.93E-10	1.48E-08	1.10E-05	1.11E-05	1.16E-05	1.19E-05	4.40E-09	2.50E-08
1	4.96E-15	2.89E-11	1.01E-11	5.59E-10	2.62E-06	2.66E-06	2.76E-06	2.83E-06	1.19E-10	8.98E-10
3	2.17E-18	2.32E-14	6.34E-15	8.82E-13	1.43E-07	1.45E-07	1.50E-07	1.53E-07	8.66E-14	1.45E-12

Spectral Acceleration (g)	Individual Sources									
	NEME-W	PEZ-N	PEZ-W	RR	RR-RCG	SLR	Study Region	Charleston RLME	Charlevoix RLME	Wabash Valley RLME
	Weight									
	0.048	0.48	0.12	0.4	0.2	0.6	0.16	1	1	1
0.001	2.23E-02	9.73E-03	1.25E-02	1.21E-02	1.21E-02	1.13E-02	7.30E-02	1.39E-03	8.56E-04	1.86E-04
0.003	1.25E-02	2.86E-03	4.36E-03	2.86E-03	2.82E-03	3.38E-03	2.81E-02	7.74E-04	4.11E-04	1.80E-04
0.01	4.99E-03	3.52E-04	6.85E-04	3.19E-04	3.03E-04	4.99E-04	7.41E-03	1.90E-04	8.53E-05	1.26E-04
0.02	2.34E-03	7.47E-05	1.65E-04	7.02E-05	6.48E-05	1.27E-04	3.02E-03	5.84E-05	2.48E-05	7.11E-05
0.03	1.37E-03	2.69E-05	6.35E-05	2.65E-05	2.41E-05	5.20E-05	1.67E-03	2.65E-05	1.08E-05	4.26E-05
0.05	6.37E-04	6.58E-06	1.66E-05	7.04E-06	6.24E-06	1.51E-05	7.44E-04	8.49E-06	3.18E-06	1.82E-05
0.1	2.04E-04	7.62E-07	2.10E-06	9.35E-07	8.02E-07	2.23E-06	2.25E-04	1.22E-06	3.91E-07	3.92E-06
0.2	6.29E-05	6.42E-08	1.93E-07	8.85E-08	7.40E-08	2.33E-07	6.48E-05	9.23E-08	2.53E-08	5.36E-07
0.3	3.11E-05	1.27E-08	4.04E-08	1.81E-08	1.50E-08	5.07E-08	3.11E-05	1.45E-08	3.64E-09	1.32E-07
0.5	1.23E-05	1.33E-09	4.63E-09	1.86E-09	1.56E-09	5.68E-09	1.21E-05	9.64E-10	2.16E-10	1.68E-08
1	2.92E-06	3.84E-11	1.63E-10	4.86E-11	4.17E-11	1.70E-10	3.00E-06	1.19E-11	2.26E-12	5.63E-10
3	1.58E-07	3.43E-14	2.50E-13	3.18E-14	2.92E-14	1.47E-13	1.91E-07	1.68E-16	0.00E+00	5.17E-13

NAP	NMESE-N
0.6	0.192
3.72E-04	4.77E-02
7.25E-05	2.20E-02
7.15E-06	6.69E-03
1.52E-06	2.83E-03
5.65E-07	1.60E-03
1.48E-07	7.26E-04
1.91E-08	2.27E-04
1.70E-09	6.76E-05
3.27E-10	3.30E-05
3.06E-11	1.30E-05
6.82E-13	3.23E-06
3.07E-16	1.99E-07

New Madrid RLME	Total
1	
2.09E-03	8.21E-02
1.99E-03	3.26E-02
1.26E-03	9.01E-03
6.24E-04	3.67E-03
3.43E-04	2.00E-03
1.36E-04	8.58E-04
3.34E-05	2.48E-04
5.50E-06	6.78E-05
1.38E-06	3.16E-05
1.65E-07	1.19E-05
4.55E-09	2.85E-06
2.54E-12	1.63E-07

Fermi 3 Hard Rock Hazard Individual Source Conditional Mean Hazard
10 Hz

Spectral Acceleration (g)	Individual Sources									
	AHEX	ECC-AM	GMH	IBB	MidC-A	MidC-B	MidC-C	MidC-D	MESE-N	MESE-W
	Weight									
	0.6	0.6	0.6	0.6	0.32	0.16	0.08	0.04	0.192	0.048
0.001	2.71E-06	4.87E-03	2.28E-03	1.24E-02	2.48E-02	2.41E-02	2.18E-02	2.14E-02	2.28E-02	4.62E-02
0.003	5.36E-07	1.26E-03	5.49E-04	4.97E-03	1.41E-02	1.38E-02	1.29E-02	1.29E-02	5.78E-03	1.46E-02
0.01	5.53E-08	1.66E-04	6.73E-05	9.71E-04	5.95E-03	5.88E-03	5.91E-03	5.95E-03	7.43E-04	2.41E-03
0.02	1.22E-08	3.96E-05	1.58E-05	2.80E-04	3.05E-03	3.03E-03	3.13E-03	3.16E-03	1.78E-04	6.53E-04
0.05	1.24E-09	4.46E-06	1.76E-06	3.86E-05	9.65E-04	9.64E-04	1.01E-03	1.02E-03	2.00E-05	8.35E-05
0.1	1.63E-10	6.51E-07	2.54E-07	6.55E-06	3.34E-04	3.35E-04	3.51E-04	3.56E-04	2.87E-06	1.33E-05
0.2	1.46E-11	6.83E-08	2.57E-08	8.34E-07	1.08E-04	1.09E-04	1.13E-04	1.16E-04	2.93E-07	1.55E-06
0.3	2.83E-12	1.50E-08	5.45E-09	2.11E-07	5.56E-05	5.62E-05	5.85E-05	5.98E-05	6.30E-08	3.73E-07
0.5	2.69E-13	1.73E-09	5.90E-10	3.02E-08	2.38E-05	2.41E-05	2.51E-05	2.57E-05	7.06E-09	5.02E-08
1	6.19E-15	5.58E-11	1.67E-11	1.39E-09	6.81E-06	6.91E-06	7.17E-06	7.36E-06	2.15E-10	2.19E-09
2	6.72E-17	9.26E-13	2.31E-13	3.61E-11	1.52E-06	1.54E-06	1.60E-06	1.64E-06	3.34E-12	5.73E-11
5	2.11E-20	1.16E-15	1.81E-16	1.12E-13	1.15E-07	1.17E-07	1.21E-07	1.24E-07	3.70E-15	2.00E-13

Spectral Acceleration (g)	Individual Sources									
	NEME-W	PEZ-N	PEZ-W	RR	RR-RCG	SLR	Study Region	Charleston RLME	Charlevoix RLME	Wabash Valley RLME
	Weight									
	0.048	0.48	0.12	0.4	0.2	0.6	0.16	1	1	1
0.001	2.15E-02	8.88E-03	1.18E-02	1.02E-02	1.02E-02	9.91E-03	6.71E-02	1.19E-03	6.73E-04	1.86E-04
0.003	1.30E-02	2.65E-03	4.26E-03	2.47E-03	2.44E-03	2.94E-03	2.74E-02	6.09E-04	3.19E-04	1.77E-04
0.01	6.04E-03	3.75E-04	7.70E-04	3.07E-04	2.95E-04	4.66E-04	8.51E-03	1.49E-04	6.69E-05	1.20E-04
0.02	3.21E-03	8.91E-05	2.08E-04	7.26E-05	6.82E-05	1.26E-04	3.95E-03	4.89E-05	2.05E-05	6.74E-05
0.05	1.04E-03	9.21E-06	2.47E-05	8.16E-06	7.36E-06	1.70E-05	1.17E-03	7.94E-06	2.67E-06	1.80E-05
0.1	3.66E-04	1.21E-06	3.54E-06	1.18E-06	1.03E-06	2.83E-06	3.88E-04	1.17E-06	3.13E-07	4.37E-06
0.2	1.19E-04	1.14E-07	3.70E-07	1.20E-07	1.02E-07	3.33E-07	1.19E-04	8.88E-08	1.89E-08	7.33E-07
0.3	6.17E-05	2.39E-08	8.38E-08	2.57E-08	2.16E-08	7.74E-08	5.95E-05	1.39E-08	2.60E-09	2.08E-07
0.5	2.65E-05	2.72E-09	1.07E-08	2.82E-09	2.37E-09	9.48E-09	2.49E-05	9.15E-10	1.45E-10	3.17E-08
1	7.61E-06	9.09E-11	4.43E-10	8.19E-11	7.07E-11	3.25E-10	7.17E-06	1.12E-11	1.40E-12	1.35E-09
2	1.70E-06	1.64E-12	1.11E-11	1.17E-12	1.06E-12	5.70E-12	1.69E-06	4.64E-14	3.16E-15	2.67E-11
5	1.28E-07	2.50E-15	3.31E-14	1.03E-15	1.05E-15	7.96E-15	1.45E-07	0.00E+00	0.00E+00	3.85E-14

NAP	NMESE-N
0.6	0.192
2.96E-04	4.56E-02
6.06E-05	2.22E-02
6.55E-06	7.81E-03
1.48E-06	3.75E-03
1.56E-07	1.14E-03
2.11E-08	3.92E-04
1.93E-09	1.24E-04
3.80E-10	6.34E-05
3.66E-11	2.70E-05
8.58E-13	7.84E-06
9.50E-15	1.83E-06
3.28E-18	1.52E-07

New Madrid RLME	Total
1	
2.09E-03	7.53E-02
1.89E-03	3.15E-02
1.07E-03	9.83E-03
5.16E-04	4.45E-03
1.20E-04	1.25E-03
3.45E-05	4.07E-04
6.48E-06	1.23E-04
1.72E-06	6.07E-05
2.18E-07	2.52E-05
6.41E-09	7.18E-06
8.04E-11	1.63E-06
2.68E-14	1.29E-07

Fermi 3 Hard Rock Hazard Individual Source Conditional Mean Hazard
25 Hz

Spectral Acceleration (g)	Individual Sources									
	AHEX	ECC-AM	GMH	IBB	MidC-A	MidC-B	MidC-C	MidC-D	MESE-N	MESE-W
	Weight									
	0.6	0.6	0.6	0.6	0.32	0.16	0.08	0.04	0.192	0.048
0.001	1.88E-06	3.50E-03	1.62E-03	9.84E-03	2.15E-02	2.09E-02	1.91E-02	1.88E-02	1.63E-02	3.45E-02
0.003	4.47E-07	1.01E-03	4.45E-04	3.95E-03	1.28E-02	1.25E-02	1.19E-02	1.19E-02	4.62E-03	1.17E-02
0.01	5.62E-08	1.79E-04	7.26E-05	9.70E-04	6.03E-03	5.96E-03	5.99E-03	6.03E-03	7.93E-04	2.48E-03
0.03	5.46E-09	2.24E-05	8.25E-06	1.75E-04	2.38E-03	2.37E-03	2.45E-03	2.47E-03	9.66E-05	3.94E-04
0.1	2.33E-10	1.22E-06	4.29E-07	1.41E-05	5.58E-04	5.59E-04	5.84E-04	5.93E-04	5.16E-06	2.85E-05
0.2	2.42E-11	1.58E-07	5.22E-08	2.34E-06	1.99E-04	2.00E-04	2.09E-04	2.13E-04	6.43E-07	4.39E-06
0.3	5.22E-12	4.04E-08	1.26E-08	7.13E-07	1.05E-04	1.05E-04	1.10E-04	1.12E-04	1.60E-07	1.27E-06
0.5	5.81E-13	5.85E-09	1.66E-09	1.34E-07	4.56E-05	4.61E-05	4.80E-05	4.91E-05	2.22E-08	2.26E-07
1	1.73E-14	2.74E-10	6.46E-11	9.66E-09	1.43E-05	1.45E-05	1.50E-05	1.55E-05	9.71E-10	1.54E-08
2	2.55E-16	7.21E-12	1.31E-12	4.36E-10	4.04E-06	4.11E-06	4.25E-06	4.38E-06	2.37E-11	6.94E-10
5	2.37E-19	2.13E-14	2.34E-15	3.37E-12	5.37E-07	5.46E-07	5.65E-07	5.82E-07	6.40E-14	5.91E-12
7	4.42E-21	1.75E-15	1.38E-16	4.50E-13	2.21E-07	2.25E-07	2.33E-07	2.40E-07	5.10E-15	8.44E-13

Spectral Acceleration (g)	Individual Sources									
	NEME-W	PEZ-N	PEZ-W	RR	RR-RCG	SLR	Study Region	Charleston RLME	Charlevoix RLME	Wabash Valley RLME
	Weight									
	0.048	0.48	0.12	0.4	0.2	0.6	0.16	1	1	1
0.001	1.89E-02	6.57E-03	9.14E-03	7.22E-03	7.20E-03	7.21E-03	5.29E-02	9.59E-04	5.32E-04	1.82E-04
0.003	1.20E-02	2.10E-03	3.44E-03	1.99E-03	1.97E-03	2.30E-03	2.34E-02	4.54E-04	2.25E-04	1.64E-04
0.01	6.11E-03	4.14E-04	7.99E-04	3.27E-04	3.20E-04	4.58E-04	8.62E-03	1.09E-04	5.08E-05	1.03E-04
0.03	2.52E-03	5.69E-05	1.36E-04	3.81E-05	3.62E-05	6.79E-05	2.95E-03	2.28E-05	8.42E-06	3.51E-05
0.1	6.07E-04	2.96E-06	9.68E-06	2.00E-06	1.79E-06	4.89E-06	6.42E-04	1.45E-06	3.20E-07	5.27E-06
0.2	2.19E-04	3.52E-07	1.39E-06	2.48E-07	2.13E-07	7.29E-07	2.21E-04	1.24E-07	2.02E-08	1.38E-06
0.3	1.15E-04	8.63E-08	3.80E-07	6.07E-08	5.16E-08	1.99E-07	1.13E-04	2.08E-08	2.86E-09	5.29E-07
0.5	5.06E-05	1.23E-08	6.24E-08	8.16E-09	6.94E-09	3.10E-08	4.80E-05	1.50E-09	1.65E-10	1.21E-07
1	1.59E-05	6.04E-10	3.88E-09	3.31E-10	2.91E-10	1.57E-09	1.47E-05	2.08E-11	1.67E-12	9.02E-09
2	4.52E-06	1.80E-11	1.62E-10	7.16E-12	6.67E-12	4.47E-11	4.19E-06	1.10E-13	4.50E-15	3.17E-10
5	6.01E-07	6.67E-14	1.20E-12	1.46E-14	1.53E-14	1.52E-13	5.80E-07	0.00E+00	0.00E+00	1.10E-12
7	2.47E-07	6.15E-15	1.55E-13	9.55E-16	1.09E-15	1.36E-14	2.43E-07	0.00E+00	0.00E+00	9.26E-14

NAP	NMESE-N
0.6	0.192
2.06E-04	3.78E-02
4.98E-05	1.93E-02
6.54E-06	7.87E-03
6.67E-07	2.84E-03
3.00E-08	6.41E-04
3.21E-09	2.27E-04
7.03E-10	1.18E-04
7.98E-11	5.13E-05
2.44E-12	1.60E-05
3.72E-14	4.59E-06
3.74E-17	6.30E-07
9.44E-19	2.63E-07

New Madrid RLME	Total
1	
1.96E-03	5.96E-02
1.63E-03	2.67E-02
8.65E-04	9.69E-03
2.14E-04	3.12E-03
4.05E-05	6.59E-04
1.07E-05	2.25E-04
3.40E-06	1.15E-04
5.26E-07	4.85E-05
2.02E-08	1.50E-05
3.31E-10	4.24E-06
3.01E-13	5.70E-07
2.62E-15	2.36E-07

Fermi 3 Hard Rock Hazard Results based on CEUS SSC model

PGA	Mean	5th%	16th%	50th%	84th%	95th%
1.00E-03	4.46E-02	1.86E-02	2.34E-02	3.31E-02	8.13E-02	1.07E-01
3.00E-03	1.68E-02	6.61E-03	9.12E-03	1.45E-02	2.88E-02	4.37E-02
1.00E-02	4.49E-03	1.29E-03	1.82E-03	3.16E-03	8.71E-03	1.62E-02
2.00E-02	1.75E-03	4.37E-04	6.17E-04	1.12E-03	3.02E-03	6.31E-03
3.00E-02	9.42E-04	2.24E-04	3.24E-04	5.89E-04	1.48E-03	3.09E-03
5.00E-02	4.11E-04	9.55E-05	1.45E-04	2.63E-04	5.75E-04	1.23E-03
1.00E-01	1.26E-04	3.16E-05	5.01E-05	9.33E-05	1.78E-04	3.31E-04
2.00E-01	4.00E-05	9.77E-06	1.66E-05	3.24E-05	6.03E-05	9.55E-05
3.00E-01	2.08E-05	4.57E-06	8.13E-06	1.66E-05	3.31E-05	5.01E-05
5.00E-01	8.71E-06	1.48E-06	2.82E-06	6.61E-06	1.45E-05	2.29E-05
1.00E+00	2.22E-06	2.24E-07	4.79E-07	1.45E-06	3.89E-06	6.92E-06
3.00E+00	1.11E-07	3.47E-09	8.71E-09	4.47E-08	1.74E-07	5.01E-07

25Hz PSA	Mean	5th%	16th%	50th%	84th%	95th%
1.00E-03	5.96E-02	1.86E-02	2.69E-02	5.50E-02	9.12E-02	1.18E-01
3.00E-03	2.67E-02	9.12E-03	1.35E-02	2.19E-02	3.80E-02	5.37E-02
1.00E-02	9.69E-03	3.09E-03	4.17E-03	7.24E-03	1.59E-02	2.69E-02
3.00E-02	3.12E-03	7.94E-04	1.12E-03	2.00E-03	4.79E-03	1.05E-02
1.00E-01	6.59E-04	1.32E-04	1.95E-04	3.72E-04	8.71E-04	1.95E-03
2.00E-01	2.25E-04	4.37E-05	6.92E-05	1.35E-04	2.88E-04	6.61E-04
3.00E-01	1.15E-04	2.29E-05	3.72E-05	7.41E-05	1.51E-04	3.31E-04
5.00E-01	4.85E-05	9.55E-06	1.62E-05	3.39E-05	6.92E-05	1.35E-04
1.00E+00	1.50E-05	2.46E-06	4.57E-06	1.10E-05	2.40E-05	4.17E-05
2.00E+00	4.24E-06	4.57E-07	9.55E-07	2.75E-06	7.41E-06	1.32E-05
5.00E+00	5.70E-07	2.29E-08	6.03E-08	2.51E-07	9.33E-07	2.34E-06
7.00E+00	2.36E-07	7.24E-09	1.74E-08	8.32E-08	3.55E-07	1.10E-06

10 Hz PSA	Mean	5th%	16th%	50th%	84th%	95th%
1.00E-03	7.53E-02	3.47E-02	4.57E-02	6.46E-02	1.07E-01	1.32E-01
3.00E-03	3.15E-02	1.48E-02	1.86E-02	2.63E-02	4.47E-02	6.31E-02
1.00E-02	9.83E-03	3.98E-03	5.50E-03	9.33E-03	1.62E-02	2.57E-02
2.00E-02	4.45E-03	1.51E-03	2.09E-03	3.72E-03	7.76E-03	1.41E-02
5.00E-02	1.25E-03	3.63E-04	5.13E-04	9.33E-04	1.82E-03	3.55E-03
1.00E-01	4.07E-04	1.15E-04	1.70E-04	3.02E-04	5.62E-04	1.07E-03
2.00E-01	1.23E-04	3.47E-05	5.37E-05	9.77E-05	1.74E-04	2.95E-04
3.00E-01	6.07E-05	1.70E-05	2.69E-05	5.01E-05	8.91E-05	1.41E-04
5.00E-01	2.52E-05	6.61E-06	1.10E-05	2.14E-05	3.89E-05	5.75E-05
1.00E+00	7.18E-06	1.51E-06	2.82E-06	5.89E-06	1.12E-05	1.74E-05
2.00E+00	1.63E-06	2.40E-07	4.90E-07	1.26E-06	2.69E-06	4.37E-06
5.00E+00	1.29E-07	9.33E-09	2.40E-08	8.13E-08	2.24E-07	4.27E-07

5 Hz PSA	Mean	5th%	16th%	50th%	84th%	95th%
1.00E-03	8.21E-02	4.17E-02	5.13E-02	7.08E-02	1.18E-01	1.41E-01
3.00E-03	3.26E-02	1.51E-02	1.91E-02	2.75E-02	5.01E-02	6.76E-02
1.00E-02	9.01E-03	3.39E-03	4.90E-03	8.71E-03	1.59E-02	2.34E-02
2.00E-02	3.67E-03	1.10E-03	1.62E-03	3.16E-03	6.92E-03	1.12E-02
3.00E-02	2.00E-03	5.37E-04	8.13E-04	1.59E-03	3.55E-03	6.17E-03
5.00E-02	8.58E-04	2.19E-04	3.31E-04	6.31E-04	1.38E-03	2.51E-03
1.00E-01	2.48E-04	6.17E-05	9.55E-05	1.78E-04	3.55E-04	6.31E-04
2.00E-01	6.78E-05	1.74E-05	2.75E-05	5.25E-05	9.55E-05	1.62E-04
3.00E-01	3.16E-05	7.94E-06	1.32E-05	2.51E-05	4.68E-05	7.41E-05
5.00E-01	1.19E-05	2.88E-06	4.90E-06	9.77E-06	1.86E-05	2.82E-05
1.00E+00	2.85E-06	5.37E-07	1.02E-06	2.29E-06	4.57E-06	7.08E-06
3.00E+00	1.63E-07	1.45E-08	3.39E-08	1.10E-07	2.82E-07	5.01E-07

2.5 Hz PSA	Mean	5th%	16th%	50th%	84th%	95th%
1.00E-04	1.75E-01	1.32E-01	1.48E-01	1.74E-01	1.91E-01	2.00E-01
1.00E-03	6.86E-02	2.95E-02	3.80E-02	5.75E-02	1.05E-01	1.23E-01
3.00E-03	2.51E-02	1.00E-02	1.38E-02	2.14E-02	4.17E-02	5.37E-02
1.00E-02	6.10E-03	1.82E-03	2.82E-03	5.37E-03	1.12E-02	1.66E-02
2.00E-02	2.24E-03	5.25E-04	8.32E-04	1.70E-03	4.17E-03	7.08E-03

5.00E-02	4.43E-04	8.32E-05	1.35E-04	2.75E-04	6.92E-04	1.51E-03
1.00E-01	1.10E-04	1.95E-05	3.24E-05	6.76E-05	1.51E-04	3.02E-04
2.00E-01	2.46E-05	4.47E-06	7.76E-06	1.70E-05	3.47E-05	6.03E-05
3.00E-01	1.00E-05	1.78E-06	3.24E-06	7.41E-06	1.55E-05	2.57E-05
5.00E-01	3.20E-06	4.68E-07	9.77E-07	2.40E-06	5.25E-06	8.71E-06
1.00E+00	6.08E-07	5.37E-08	1.32E-07	4.27E-07	1.07E-06	1.82E-06
3.00E+00	2.41E-08	1.45E-09	2.95E-09	1.23E-08	4.68E-08	9.33E-08

1 Hz PSA	1 Hz Mean	5th%	16th%	50th%	84th%	95th%
1.00E-04	1.43E-01	7.76E-02	1.02E-01	1.38E-01	1.74E-01	1.91E-01
1.00E-03	3.39E-02	1.15E-02	1.74E-02	2.63E-02	5.75E-02	6.92E-02
3.00E-03	1.08E-02	3.02E-03	4.90E-03	8.71E-03	1.91E-02	2.69E-02
1.00E-02	2.40E-03	3.47E-04	6.61E-04	1.70E-03	4.47E-03	7.59E-03
2.00E-02	8.25E-04	7.41E-05	1.48E-04	4.37E-04	1.48E-03	3.31E-03
3.00E-02	4.01E-04	2.75E-05	5.62E-05	1.70E-04	6.31E-04	1.78E-03
5.00E-02	1.46E-04	7.59E-06	1.59E-05	4.90E-05	1.82E-04	6.31E-04
1.00E-01	3.06E-05	1.18E-06	2.57E-06	9.12E-06	3.16E-05	9.12E-05
2.00E-01	4.92E-06	1.32E-07	3.80E-07	1.74E-06	6.17E-06	1.29E-05
3.00E-01	1.58E-06	3.24E-08	1.12E-07	6.31E-07	2.40E-06	5.01E-06
5.00E-01	3.88E-07	5.01E-09	2.00E-08	1.59E-07	7.24E-07	1.55E-06
1.00E+00	5.69E-08	1.18E-09	2.19E-09	1.74E-08	1.12E-07	2.57E-07

0.5 Hz PSA	Mean	5th%	16th%	50th%	84th%	95th%
1.00E-05	1.79E-01	1.35E-01	1.55E-01	1.78E-01	1.95E-01	2.04E-01
1.00E-04	1.04E-01	4.47E-02	6.46E-02	8.91E-02	1.48E-01	1.66E-01
1.00E-03	1.69E-02	5.25E-03	7.76E-03	1.41E-02	2.82E-02	3.89E-02
2.00E-03	8.26E-03	1.91E-03	3.16E-03	6.76E-03	1.45E-02	2.14E-02
5.00E-03	2.92E-03	3.16E-04	6.46E-04	2.00E-03	5.50E-03	9.12E-03
1.00E-02	1.18E-03	5.75E-05	1.29E-04	5.50E-04	2.34E-03	4.68E-03
2.00E-02	4.08E-04	8.13E-06	1.95E-05	1.00E-04	6.46E-04	2.09E-03
3.00E-02	2.03E-04	2.51E-06	6.03E-06	3.47E-05	2.40E-04	1.02E-03
5.00E-02	7.96E-05	5.13E-07	1.32E-06	9.12E-06	6.03E-05	2.88E-04
1.00E-01	1.88E-05	4.47E-08	1.55E-07	1.48E-06	1.02E-05	3.31E-05
3.00E-01	7.86E-07	1.38E-09	3.72E-09	6.31E-08	6.17E-07	1.74E-06
1.00E+00	1.31E-08	0.00E+00	5.01E-10	1.74E-09	2.19E-08	7.76E-08

Fermi 3 Hard Rock Hazard Results based on Updated EPRI-SOG model

PGA	Mean	5th %	16th%	50th%	84th%	95th%
1.00E-03	2.32E-02	9.33E-03	1.29E-02	2.04E-02	3.24E-02	4.79E-02
3.00E-03	1.09E-02	3.55E-03	5.37E-03	9.55E-03	1.62E-02	2.29E-02
1.00E-02	3.28E-03	6.61E-04	1.10E-03	2.46E-03	5.50E-03	8.71E-03
2.00E-02	1.26E-03	1.91E-04	3.47E-04	7.76E-04	2.19E-03	3.89E-03
3.00E-02	6.78E-04	8.71E-05	1.66E-04	3.89E-04	1.15E-03	2.29E-03
5.00E-02	3.03E-04	3.09E-05	6.31E-05	1.62E-04	4.68E-04	1.15E-03
1.00E-01	9.96E-05	6.17E-06	1.48E-05	5.37E-05	1.38E-04	4.17E-04
2.00E-01	3.32E-05	8.71E-07	3.09E-06	1.66E-05	4.47E-05	1.29E-04
3.00E-01	1.72E-05	2.24E-07	1.02E-06	7.24E-06	2.24E-05	6.46E-05
5.00E-01	7.08E-06	3.39E-08	2.29E-07	2.24E-06	9.55E-06	2.51E-05
1.00E+00	1.71E-06	3.24E-09	2.04E-08	3.02E-07	2.19E-06	6.92E-06
3.00E+00	7.71E-08	0.00E+00	1.32E-09	5.13E-09	5.75E-08	3.55E-07

25Hz PSA	Mean	5th %	16th%	50th%	84th%	95th%
1.00E-03	3.04E-02	1.29E-02	1.74E-02	2.63E-02	4.27E-02	6.17E-02
3.00E-03	1.65E-02	6.03E-03	8.71E-03	1.45E-02	2.29E-02	3.24E-02
1.00E-02	7.17E-03	1.86E-03	2.95E-03	5.75E-03	1.12E-02	1.70E-02
3.00E-02	2.39E-03	3.98E-04	6.76E-04	1.48E-03	4.07E-03	7.41E-03
1.00E-01	4.94E-04	4.68E-05	8.91E-05	2.34E-04	7.94E-04	1.95E-03
2.00E-01	1.72E-04	1.10E-05	2.57E-05	7.94E-05	2.40E-04	7.41E-04
3.00E-01	8.95E-05	4.37E-06	1.15E-05	4.17E-05	1.23E-04	3.80E-04
5.00E-01	3.90E-05	1.18E-06	3.72E-06	1.78E-05	5.37E-05	1.55E-04
1.00E+00	1.23E-05	1.23E-07	5.75E-07	4.37E-06	1.66E-05	4.47E-05
2.00E+00	3.43E-06	9.33E-09	7.41E-08	7.41E-07	4.47E-06	1.35E-05
5.00E+00	4.44E-07	1.38E-09	3.09E-09	3.98E-08	3.89E-07	2.00E-06
7.00E+00	1.80E-07	1.12E-09	1.62E-09	1.07E-08	1.32E-07	8.91E-07

10 Hz PSA	Mean	5th %	16th%	50th%	84th%	95th%
1.00E-03	3.50E-02	1.59E-02	2.04E-02	3.09E-02	4.90E-02	6.92E-02
3.00E-03	1.79E-02	7.24E-03	1.02E-02	1.62E-02	2.51E-02	3.39E-02
1.00E-02	6.93E-03	2.09E-03	3.24E-03	6.03E-03	1.05E-02	1.48E-02
2.00E-02	3.23E-03	7.59E-04	1.23E-03	2.57E-03	5.25E-03	7.76E-03
5.00E-02	8.83E-04	1.48E-04	2.63E-04	5.89E-04	1.45E-03	2.69E-03
1.00E-01	2.94E-04	3.47E-05	6.92E-05	1.70E-04	4.37E-04	1.07E-03
2.00E-01	9.36E-05	6.92E-06	1.59E-05	5.37E-05	1.26E-04	3.89E-04
3.00E-01	4.73E-05	2.34E-06	6.17E-06	2.57E-05	6.17E-05	1.95E-04
5.00E-01	1.96E-05	5.37E-07	1.74E-06	9.77E-06	2.46E-05	7.59E-05
1.00E+00	5.23E-06	4.90E-08	2.24E-07	2.04E-06	6.61E-06	1.95E-05
2.00E+00	1.07E-06	4.79E-09	2.04E-08	2.75E-07	1.35E-06	3.98E-06
5.00E+00	7.27E-08	1.12E-09	1.74E-09	9.12E-09	7.59E-08	2.82E-07

5 Hz PSA	Mean	5th %	16th%	50th%	84th%	95th%
1.00E-03	3.52E-02	1.51E-02	2.00E-02	3.09E-02	5.13E-02	7.08E-02
3.00E-03	1.69E-02	6.61E-03	9.33E-03	1.51E-02	2.40E-02	3.31E-02
1.00E-02	5.77E-03	1.74E-03	2.69E-03	5.01E-03	8.91E-03	1.20E-02
2.00E-02	2.45E-03	5.62E-04	9.33E-04	2.00E-03	3.98E-03	5.89E-03
3.00E-02	1.34E-03	2.57E-04	4.47E-04	1.00E-03	2.24E-03	3.63E-03
5.00E-02	5.82E-04	8.51E-05	1.62E-04	3.72E-04	9.55E-04	1.86E-03
1.00E-01	1.74E-04	1.51E-05	3.47E-05	9.33E-05	2.46E-04	6.46E-04
2.00E-01	4.86E-05	2.00E-06	5.89E-06	2.40E-05	6.31E-05	2.19E-04
3.00E-01	2.22E-05	5.37E-07	1.86E-06	1.02E-05	2.82E-05	9.77E-05
5.00E-01	7.95E-06	9.55E-08	3.98E-07	3.16E-06	9.77E-06	3.24E-05
1.00E+00	1.71E-06	8.71E-09	3.63E-08	4.57E-07	2.00E-06	6.61E-06
3.00E+00	8.37E-08	1.12E-09	1.70E-09	8.71E-09	8.13E-08	3.39E-07

2.5 Hz PSA	Mean	5th %	16th%	50th%	84th%	95th%
1.00E-04	8.03E-02	2.88E-02	3.89E-02	6.92E-02	1.23E-01	1.66E-01
1.00E-03	2.74E-02	1.05E-02	1.45E-02	2.34E-02	4.07E-02	5.89E-02
3.00E-03	1.18E-02	4.07E-03	6.03E-03	1.05E-02	1.74E-02	2.46E-02
1.00E-02	3.58E-03	9.12E-04	1.51E-03	3.09E-03	5.62E-03	7.94E-03
2.00E-02	1.45E-03	2.63E-04	4.68E-04	1.10E-03	2.46E-03	3.80E-03

5.00E-02	3.09E-04	2.82E-05	6.17E-05	1.62E-04	4.90E-04	1.10E-03
1.00E-01	7.75E-05	3.16E-06	9.33E-06	3.02E-05	1.05E-04	3.02E-04
2.00E-01	1.62E-05	2.34E-07	9.55E-07	5.13E-06	1.91E-05	7.24E-05
3.00E-01	6.14E-06	4.47E-08	2.09E-07	1.70E-06	7.24E-06	2.82E-05
5.00E-01	1.77E-06	6.92E-09	2.75E-08	3.47E-07	2.09E-06	7.76E-06
1.00E+00	3.01E-07	1.59E-09	2.95E-09	2.75E-08	3.16E-07	1.20E-06
3.00E+00	9.95E-09	0.00E+00	0.00E+00	1.41E-09	8.71E-09	4.27E-08

1 Hz PSA	Mean	5th %	16th%	50th%	84th%	95th%
1.00E-04	5.55E-02	2.04E-02	2.69E-02	4.68E-02	8.51E-02	1.23E-01
1.00E-03	1.27E-02	3.80E-03	5.89E-03	1.07E-02	1.95E-02	2.95E-02
3.00E-03	4.96E-03	1.23E-03	2.09E-03	4.27E-03	7.76E-03	1.12E-02
1.00E-02	1.52E-03	1.78E-04	3.80E-04	1.12E-03	2.63E-03	4.17E-03
2.00E-02	5.93E-04	3.55E-05	8.51E-05	3.16E-04	1.05E-03	2.14E-03
3.00E-02	3.03E-04	1.12E-05	3.02E-05	1.23E-04	4.90E-04	1.23E-03
5.00E-02	1.16E-04	2.09E-06	6.31E-06	3.02E-05	1.51E-04	4.79E-04
1.00E-01	2.49E-05	1.26E-07	5.25E-07	3.47E-06	2.29E-05	8.71E-05
2.00E-01	3.79E-06	7.08E-09	2.69E-08	3.09E-07	2.95E-06	1.20E-05
3.00E-01	1.09E-06	2.46E-09	5.62E-09	6.31E-08	8.32E-07	3.80E-06
5.00E-01	2.12E-07	9.12E-10	1.78E-09	8.71E-09	1.55E-07	9.12E-07
1.00E+00	2.30E-08	0.00E+00	0.00E+00	1.59E-09	1.45E-08	9.77E-08

0.5 Hz PSA	Mean	5th %	16th%	50th%	84th%	95th%
1.00E-05	8.52E-02	2.88E-02	3.98E-02	7.08E-02	1.32E-01	1.78E-01
1.00E-04	3.54E-02	1.15E-02	1.62E-02	2.88E-02	5.50E-02	8.13E-02
1.00E-03	6.62E-03	1.66E-03	2.75E-03	5.50E-03	1.02E-02	1.59E-02
2.00E-03	3.86E-03	7.76E-04	1.45E-03	3.24E-03	6.17E-03	9.12E-03
5.00E-03	1.75E-03	1.91E-04	4.27E-04	1.29E-03	3.09E-03	4.79E-03
1.00E-02	8.14E-04	3.98E-05	1.05E-04	4.27E-04	1.48E-03	2.95E-03
2.00E-02	3.13E-04	5.01E-06	1.62E-05	8.91E-05	5.25E-04	1.45E-03
3.00E-02	1.65E-04	1.18E-06	4.37E-06	2.88E-05	2.19E-04	8.13E-04
5.00E-02	6.91E-05	1.41E-07	6.61E-07	5.75E-06	5.89E-05	2.63E-04
1.00E-01	1.80E-05	7.59E-09	3.39E-08	5.13E-07	7.59E-06	3.55E-05
3.00E-01	8.52E-07	0.00E+00	1.32E-09	6.76E-09	1.66E-07	1.29E-06
1.00E+00	7.08E-09	0.00E+00	0.00E+00	0.00E+00	2.63E-09	2.34E-08

Fermi 3 Hard Rock UHRS

Spectral Period (sec)	Spectral Frequency (Hz)	Spectral Acceleration (g) for: Updated EPRI-SOG Mean 10-3	Updated EPRI-SOG Mean 10-4	Updated EPRI-SOG Mean 10-5	Updated EPRI-SOG Mean 10-6	CEUS SSC Mean 10-3	CEUS SSC Mean 10-4	CEUS SSC Mean 10-5	CEUS SSC Mean 10-6
0.01	100	0.0233	0.0997	0.4101	1.2088	0.0289	0.1149	0.4609	1.3396
0.04	25	0.0584	0.2799	1.1173	3.4735	0.0724	0.3255	1.2475	3.8678
0.1	10	0.0461	0.1922	0.7205	2.0545	0.0573	0.2250	0.8330	2.3847
0.2	5	0.0361	0.1359	0.4473	1.2438	0.0456	0.1625	0.5445	1.4949
0.4	2.5	0.0254	0.0886	0.2451	0.6288	0.0316	0.1045	0.3004	0.8124
1	1	0.0139	0.0537	0.1422	0.3080	0.0177	0.0592	0.1529	0.3546
2	0.5	0.0083	0.0402	0.1236	0.2832	0.0111	0.0441	0.1244	0.2760

Central Illinois

AMEC E&I Calculation				
PGA	Mean	15th	50th	85th
0.1	3.36E-04	9.12E-05	2.09E-04	5.13E-04
0.15	1.48E-04	4.07E-05	9.77E-05	2.14E-04
0.2	8.35E-05	2.34E-05	5.89E-05	1.23E-04
0.3	3.82E-05	1.12E-05	2.82E-05	6.31E-05
0.5	1.47E-05	3.89E-06	1.07E-05	2.63E-05
0.7	7.69E-06	1.74E-06	5.25E-06	1.38E-05
1	3.63E-06	6.61E-07	2.19E-06	6.61E-06
1.5	1.38E-06	1.86E-07	7.24E-07	2.51E-06
2	6.35E-07	6.76E-08	2.95E-07	1.12E-06
3	1.82E-07	1.35E-08	6.92E-08	3.09E-07
5	2.78E-08	2.19E-09	8.71E-09	4.27E-08
7	6.58E-09	1.12E-09	2.69E-09	1.05E-08
10	1.18E-09	7.24E-10	1.20E-09	2.95E-09

10 Hz PSA	Mean	15th	50th	85th
0.1	1.29E-03	4.37E-04	9.55E-04	2.04E-03
0.15	6.10E-04	2.00E-04	4.27E-04	9.33E-04
0.2	3.45E-04	1.12E-04	2.40E-04	5.01E-04
0.3	1.50E-04	4.79E-05	1.07E-04	2.14E-04
0.5	5.20E-05	1.66E-05	3.89E-05	7.94E-05
0.7	2.61E-05	8.32E-06	2.04E-05	4.27E-05
1	1.26E-05	3.89E-06	9.77E-06	2.14E-05
1.5	5.27E-06	1.48E-06	3.98E-06	9.33E-06
2	2.71E-06	7.08E-07	2.00E-06	4.79E-06
3	9.60E-07	2.14E-07	6.61E-07	1.74E-06
5	2.12E-07	3.72E-08	1.32E-07	3.89E-07
7	6.85E-08	1.02E-08	3.89E-08	1.29E-07
10	1.82E-08	3.09E-09	9.77E-09	3.47E-08

1 Hz PSA	Mean	15th	50th	85th
0.01	4.30E-03	1.91E-03	3.98E-03	7.41E-03
0.015	2.82E-03	1.05E-03	2.51E-03	5.01E-03
0.02	2.05E-03	6.31E-04	1.70E-03	3.72E-03
0.03	1.22E-03	2.75E-04	8.51E-04	2.34E-03
0.05	5.31E-04	8.13E-05	2.82E-04	1.00E-03
0.07	2.73E-04	3.31E-05	1.20E-04	4.68E-04
0.1	1.21E-04	1.18E-05	4.47E-05	1.78E-04
0.15	4.27E-05	3.55E-06	1.38E-05	5.37E-05
0.2	1.89E-05	1.45E-06	5.75E-06	2.24E-05
0.3	5.44E-06	3.98E-07	1.66E-06	6.76E-06
0.5	1.05E-06	6.76E-08	3.80E-07	1.59E-06
0.7	3.54E-07	2.04E-08	1.32E-07	6.17E-07
1	1.14E-07	6.17E-09	4.27E-08	2.24E-07

CEUS SSC Table 8.2.1-1		
PGA	Mean	15th
0.1	3.27E-04	8.32E-05
0.15	1.42E-04	3.89E-05
0.2	7.90E-05	2.24E-05
0.3	3.56E-05	1.05E-05
0.5	1.34E-05	3.47E-06
0.7	6.93E-06	1.51E-06
1	3.23E-06	5.75E-07
1.5	1.22E-06	1.55E-07
2	5.55E-07	5.31E-08
3	1.58E-07	9.77E-09
5	2.40E-08	7.59E-10
7	5.68E-09	1.10E-10
10	1.03E-09	1.20E-11

10 Hz PSA	Mean	15th
0.1	1.27E-03	4.37E-04
0.15	5.98E-04	1.91E-04
0.2	3.37E-04	1.06E-04
0.3	1.45E-04	4.47E-05
0.5	4.91E-05	1.59E-05
0.7	2.44E-05	7.41E-06
1	1.16E-05	3.47E-06
1.5	4.79E-06	1.32E-06
2	2.45E-06	6.17E-07
3	8.61E-07	1.78E-07
5	1.90E-07	2.75E-08
7	6.14E-08	6.68E-09
10	1.64E-08	1.23E-09

1 Hz PSA	Mean	15th
0.01	4.48E-03	1.86E-03
0.015	2.90E-03	1.00E-03
0.02	2.08E-03	6.17E-04
0.03	1.21E-03	2.69E-04
0.05	5.16E-04	7.76E-05
0.07	2.62E-04	3.16E-05
0.1	1.15E-04	1.12E-05
0.15	4.00E-05	3.24E-06
0.2	1.75E-05	1.32E-06
0.3	5.02E-06	3.43E-07
0.5	9.67E-07	5.13E-08
0.7	3.29E-07	1.38E-08
1	1.07E-07	3.24E-09

50th	85th
2.04E-04	5.01E-04
9.55E-05	2.04E-04
5.50E-05	1.18E-04
2.57E-05	5.89E-05
9.77E-06	2.40E-05
4.57E-06	1.29E-05
2.00E-06	6.03E-06
6.17E-07	2.29E-06
2.51E-07	1.00E-06
5.89E-08	2.69E-07
6.46E-09	3.89E-08
1.23E-09	8.51E-09
1.72E-10	1.41E-09

50th	85th
9.33E-04	2.00E-03
4.07E-04	9.33E-04
2.34E-04	5.01E-04
1.02E-04	2.04E-04
3.63E-05	7.76E-05
1.82E-05	3.89E-05
9.12E-06	1.95E-05
3.47E-06	8.51E-06
1.74E-06	4.27E-06
5.75E-07	1.62E-06
1.10E-07	3.55E-07
3.16E-08	1.18E-07
7.41E-09	3.06E-08

50th	85th
3.72E-03	7.16E-03
2.46E-03	4.90E-03
1.62E-03	3.72E-03
8.13E-04	2.29E-03
2.69E-04	9.33E-04
1.10E-04	4.37E-04
4.17E-05	1.66E-04
1.29E-05	5.13E-05
5.25E-06	2.09E-05
1.51E-06	6.46E-06
3.31E-07	1.51E-06
1.14E-07	5.75E-07
3.39E-08	2.04E-07

Chattanooga

AMEC E&I Calculation

PGA	Mean	15th	50th	85th
0.1	6.55E-04	2.09E-04	4.47E-04	1.15E-03
0.15	3.57E-04	1.10E-04	2.34E-04	6.46E-04
0.2	2.31E-04	6.92E-05	1.48E-04	4.27E-04
0.3	1.22E-04	3.47E-05	7.94E-05	2.29E-04
0.5	5.14E-05	1.26E-05	3.24E-05	9.33E-05
0.7	2.73E-05	5.75E-06	1.66E-05	4.90E-05
1	1.29E-05	2.29E-06	7.24E-06	2.34E-05
1.5	4.90E-06	6.61E-07	2.40E-06	8.91E-06
2	2.24E-06	2.40E-07	9.77E-07	4.07E-06
3	6.35E-07	4.79E-08	2.29E-07	1.07E-06
5	9.61E-08	5.25E-09	2.69E-08	1.48E-07
7	2.25E-08	1.48E-09	6.17E-09	3.31E-08
10	4.01E-09	7.59E-10	1.59E-09	7.08E-09

10 Hz PSA	Mean	15th	50th	85th
0.1	1.80E-03	6.92E-04	1.48E-03	2.88E-03
0.15	9.82E-04	3.63E-04	7.41E-04	1.62E-03
0.2	6.32E-04	2.24E-04	4.47E-04	1.10E-03
0.3	3.36E-04	1.15E-04	2.24E-04	6.03E-04
0.5	1.47E-04	4.90E-05	9.55E-05	2.69E-04
0.7	8.21E-05	2.63E-05	5.37E-05	1.55E-04
1	4.24E-05	1.26E-05	2.75E-05	7.94E-05
1.5	1.85E-05	5.13E-06	1.18E-05	3.39E-05
2	9.58E-06	2.46E-06	5.89E-06	1.74E-05
3	3.41E-06	7.59E-07	2.04E-06	6.17E-06
5	7.53E-07	1.35E-07	4.17E-07	1.35E-06
7	2.42E-07	3.63E-08	1.26E-07	4.37E-07
10	6.35E-08	8.71E-09	3.02E-08	1.15E-07

1 Hz PSA	Mean	15th	50th	85th
0.01	5.15E-03	2.40E-03	4.79E-03	8.71E-03
0.015	3.28E-03	1.29E-03	2.88E-03	5.75E-03
0.02	2.32E-03	7.59E-04	1.95E-03	4.27E-03
0.03	1.33E-03	3.39E-04	9.77E-04	2.51E-03
0.05	5.72E-04	1.07E-04	3.47E-04	1.02E-03
0.07	2.98E-04	4.79E-05	1.59E-04	5.01E-04
0.1	1.38E-04	1.95E-05	6.46E-05	2.14E-04
0.15	5.32E-05	6.76E-06	2.29E-05	8.32E-05
0.2	2.58E-05	3.02E-06	1.12E-05	4.17E-05
0.3	8.97E-06	8.91E-07	3.98E-06	1.48E-05
0.5	2.29E-06	1.66E-07	1.00E-06	4.17E-06
0.7	9.14E-07	5.01E-08	3.72E-07	1.74E-06
1	3.32E-07	1.26E-08	1.23E-07	6.46E-07

CEUS SSC Table 8.2.2-1

PGA	Mean	15th
0.1	6.36E-04	2.04E-04
0.15	3.44E-04	1.10E-04
0.2	2.21E-04	6.76E-05
0.3	1.17E-04	3.39E-05
0.5	4.88E-05	1.20E-05
0.7	2.58E-05	5.62E-06
1	1.22E-05	2.14E-06
1.5	4.60E-06	6.17E-07
2	2.10E-06	2.19E-07
3	5.93E-07	4.17E-08
5	8.95E-08	3.72E-09
7	2.10E-08	5.56E-10
10	3.75E-09	5.89E-11

10 Hz PSA	Mean	15th
0.1	1.77E-03	6.61E-04
0.15	9.63E-04	3.55E-04
0.2	6.17E-04	2.19E-04
0.3	3.25E-04	1.10E-04
0.5	1.41E-04	4.62E-05
0.7	7.85E-05	2.40E-05
1	4.04E-05	1.20E-05
1.5	1.75E-05	4.90E-06
2	9.08E-06	2.29E-06
3	3.23E-06	7.08E-07
5	7.12E-07	1.26E-07
7	2.29E-07	3.16E-08
10	6.04E-08	6.46E-09

1 Hz PSA	Mean	15th
0.01	5.39E-03	2.29E-03
0.015	3.40E-03	1.23E-03
0.02	2.38E-03	7.08E-04
0.03	1.34E-03	3.31E-04
0.05	5.64E-04	1.02E-04
0.07	2.90E-04	4.47E-05
0.1	1.33E-04	1.82E-05
0.15	5.06E-05	6.03E-06
0.2	2.45E-05	2.82E-06
0.3	8.50E-06	8.13E-07
0.5	2.18E-06	1.45E-07
0.7	8.76E-07	4.17E-08
1	3.19E-07	1.01E-08

50th	85th
4.37E-04	1.07E-03
2.19E-04	6.17E-04
1.45E-04	4.07E-04
7.24E-05	2.19E-04
3.06E-05	8.91E-05
1.59E-05	4.79E-05
6.92E-06	2.24E-05
2.29E-06	8.51E-06
9.02E-07	3.72E-06
2.19E-07	1.00E-06
2.40E-08	1.35E-07
4.57E-09	3.06E-08
6.17E-10	5.25E-09

50th	85th
1.41E-03	2.82E-03
7.08E-04	1.62E-03
4.37E-04	1.07E-03
2.19E-04	5.75E-04
8.91E-05	2.69E-04
5.13E-05	1.45E-04
2.57E-05	7.76E-05
1.12E-05	3.16E-05
5.62E-06	1.70E-05
1.86E-06	5.62E-06
3.80E-07	1.32E-06
1.18E-07	4.07E-07
2.75E-08	1.10E-07

50th	85th
4.57E-03	8.51E-03
2.82E-03	5.62E-03
1.86E-03	4.27E-03
9.33E-04	2.46E-03
3.31E-04	1.00E-03
1.45E-04	4.68E-04
6.10E-05	2.04E-04
2.16E-05	7.76E-05
1.05E-05	3.89E-05
3.72E-06	1.43E-05
9.33E-07	3.98E-06
3.55E-07	1.68E-06
1.10E-07	6.17E-07

Houston

AMEC E&I Calculation

PGA	Mean	15th	50th	85th
0.01	7.97E-04	1.62E-04	3.80E-04	1.51E-03
0.015	4.51E-04	8.71E-05	2.04E-04	7.24E-04
0.02	2.89E-04	5.50E-05	1.26E-04	4.07E-04
0.03	1.52E-04	2.95E-05	6.61E-05	1.86E-04
0.05	6.53E-05	1.32E-05	3.09E-05	7.08E-05
0.07	3.56E-05	7.94E-06	1.91E-05	4.07E-05
0.1	1.82E-05	4.57E-06	1.18E-05	2.40E-05
0.15	8.88E-06	2.51E-06	6.76E-06	1.35E-05
0.2	5.57E-06	1.59E-06	4.57E-06	8.91E-06
0.3	2.99E-06	7.94E-07	2.51E-06	5.01E-06
0.5	1.34E-06	3.02E-07	1.07E-06	2.34E-06
0.7	7.53E-07	1.41E-07	5.50E-07	1.38E-06
1	3.82E-07	5.75E-08	2.46E-07	7.08E-07

10 Hz PSA	Mean	15th	50th	85th
0.01	1.72E-03	4.79E-04	1.18E-03	3.09E-03
0.015	1.13E-03	2.75E-04	6.76E-04	2.09E-03
0.02	8.01E-04	1.91E-04	4.37E-04	1.48E-03
0.03	4.62E-04	1.05E-04	2.40E-04	7.59E-04
0.05	2.16E-04	4.79E-05	1.10E-04	2.75E-04
0.07	1.27E-04	2.88E-05	6.46E-05	1.41E-04
0.1	7.04E-05	1.62E-05	3.63E-05	7.59E-05
0.15	3.40E-05	8.32E-06	2.00E-05	3.89E-05
0.2	1.98E-05	5.25E-06	1.29E-05	2.46E-05
0.3	9.30E-06	2.69E-06	7.08E-06	1.35E-05
0.5	3.81E-06	1.15E-06	3.24E-06	6.17E-06
0.7	2.15E-06	6.17E-07	1.86E-06	3.63E-06
1	1.14E-06	2.95E-07	9.77E-07	1.95E-06

1 Hz PSA	Mean	15th	50th	85th
0.01	1.05E-03	1.29E-04	6.03E-04	2.24E-03
0.015	6.30E-04	5.50E-05	2.63E-04	1.29E-03
0.02	4.14E-04	3.02E-05	1.35E-04	7.59E-04
0.03	2.13E-04	1.26E-05	5.01E-05	3.02E-04
0.05	8.20E-05	4.17E-06	1.51E-05	7.41E-05
0.07	4.06E-05	2.00E-06	6.76E-06	2.82E-05
0.1	1.76E-05	9.12E-07	3.02E-06	1.07E-05
0.15	5.98E-06	3.47E-07	1.26E-06	4.17E-06
0.2	2.59E-06	1.78E-07	6.76E-07	2.24E-06
0.3	7.60E-07	6.76E-08	2.82E-07	8.91E-07
0.5	1.71E-07	1.70E-08	8.51E-08	2.95E-07
0.7	6.81E-08	7.24E-09	3.72E-08	1.38E-07
1	2.61E-08	2.88E-09	1.48E-08	5.89E-08

CEUS SSC Table 8.2.3-1

PGA	Mean	15th
0.01	7.82E-04	1.55E-04
0.015	4.35E-04	8.32E-05
0.02	2.77E-04	5.13E-05
0.03	1.45E-04	2.66E-05
0.05	6.17E-05	1.12E-05
0.07	3.33E-05	6.92E-06
0.1	1.70E-05	3.85E-06
0.15	8.35E-06	2.00E-06
0.2	5.26E-06	1.27E-06
0.3	2.82E-06	6.61E-07
0.5	1.26E-06	2.34E-07
0.7	7.03E-07	1.06E-07
1	3.56E-07	4.17E-08

10 Hz PSA	Mean	15th
0.01	1.77E-03	5.01E-04
0.015	1.13E-03	2.88E-04
0.02	7.90E-04	1.91E-04
0.03	4.49E-04	1.02E-04
0.05	2.08E-04	4.47E-05
0.07	1.22E-04	2.57E-05
0.1	6.68E-05	1.43E-05
0.15	3.19E-05	7.41E-06
0.2	1.85E-05	4.57E-06
0.3	8.74E-06	2.29E-06
0.5	3.60E-06	9.02E-07
0.7	2.03E-06	4.68E-07
1	1.08E-06	2.34E-07

1 Hz PSA	Mean	15th
0.01	1.07E-03	1.26E-04
0.015	6.30E-04	5.31E-05
0.02	4.09E-04	2.95E-05
0.03	2.07E-04	1.20E-05
0.05	7.82E-05	3.72E-06
0.07	3.82E-05	1.74E-06
0.1	1.63E-05	7.59E-07
0.15	5.45E-06	2.88E-07
0.2	2.35E-06	1.45E-07
0.3	6.92E-07	5.13E-08
0.5	1.59E-07	1.20E-08
0.7	6.42E-08	3.98E-09
1	2.47E-08	1.15E-09

50th	85th
3.80E-04	1.41E-03
1.91E-04	6.61E-04
1.26E-04	3.80E-04
6.31E-05	1.78E-04
2.95E-05	6.76E-05
1.82E-05	3.89E-05
1.12E-05	2.32E-05
6.46E-06	1.29E-05
4.27E-06	8.51E-06
2.29E-06	4.90E-06
1.00E-06	2.29E-06
5.01E-07	1.32E-06
2.27E-07	6.61E-07

50th	85th
1.23E-03	3.24E-03
7.08E-04	2.07E-03
4.37E-04	1.41E-03
2.34E-04	7.08E-04
1.10E-04	2.51E-04
6.31E-05	1.35E-04
3.63E-05	7.24E-05
1.95E-05	3.76E-05
1.20E-05	2.40E-05
6.92E-06	1.29E-05
3.02E-06	6.03E-06
1.74E-06	3.47E-06
9.33E-07	1.86E-06

50th	85th
5.75E-04	2.14E-03
2.51E-04	1.23E-03
1.26E-04	7.08E-04
4.79E-05	2.79E-04
1.38E-05	6.76E-05
6.46E-06	2.57E-05
2.82E-06	1.01E-05
1.15E-06	3.98E-06
6.17E-07	2.14E-06
2.51E-07	8.71E-07
7.24E-08	2.69E-07
3.16E-08	1.26E-07
1.12E-08	5.13E-08

Jackson

AMEC E&I Calculation				
PGA	Mean	15th	50th	85th
0.01	3.44E-03	1.26E-03	2.88E-03	5.50E-03
0.015	2.43E-03	7.41E-04	1.95E-03	4.17E-03
0.02	1.82E-03	4.68E-04	1.35E-03	3.31E-03
0.03	1.11E-03	2.14E-04	6.92E-04	2.19E-03
0.05	4.93E-04	7.41E-05	2.34E-04	8.91E-04
0.07	2.57E-04	3.80E-05	1.07E-04	4.17E-04
0.1	1.20E-04	1.95E-05	4.90E-05	1.66E-04
0.15	4.80E-05	9.12E-06	2.29E-05	5.62E-05
0.2	2.49E-05	5.37E-06	1.41E-05	3.02E-05
0.3	1.03E-05	2.46E-06	7.41E-06	1.45E-05
0.5	3.91E-06	8.91E-07	3.02E-06	6.61E-06
0.7	2.12E-06	4.27E-07	1.55E-06	3.89E-06
1	1.07E-06	1.82E-07	7.08E-07	2.00E-06

10 Hz PSA	Mean	15th	50th	85th
0.1	5.13E-04	9.12E-05	2.75E-04	9.33E-04
0.15	2.40E-04	4.07E-05	1.12E-04	3.80E-04
0.2	1.32E-04	2.34E-05	6.03E-05	1.82E-04
0.3	5.34E-05	1.07E-05	2.63E-05	6.17E-05
0.5	1.62E-05	3.80E-06	1.00E-05	2.00E-05
0.7	7.59E-06	1.95E-06	5.50E-06	1.07E-05
1	3.53E-06	9.12E-07	2.82E-06	5.62E-06
1.5	1.50E-06	3.63E-07	1.23E-06	2.57E-06
2	7.97E-07	1.74E-07	6.46E-07	1.38E-06
3	3.00E-07	5.50E-08	2.29E-07	5.37E-07
5	7.26E-08	1.02E-08	5.01E-08	1.35E-07
7	2.49E-08	3.47E-09	1.62E-08	4.90E-08
10	7.04E-09	1.35E-09	5.01E-09	1.48E-08

1 Hz PSA	Mean	15th	50th	85th
0.01	2.54E-03	8.32E-04	2.24E-03	4.37E-03
0.015	1.84E-03	4.57E-04	1.48E-03	3.39E-03
0.02	1.40E-03	2.75E-04	1.02E-03	2.69E-03
0.03	8.67E-04	1.15E-04	5.13E-04	1.74E-03
0.05	3.87E-04	3.39E-05	1.59E-04	7.41E-04
0.07	2.00E-04	1.41E-05	6.46E-05	3.39E-04
0.1	8.94E-05	5.50E-06	2.29E-05	1.26E-04
0.15	3.13E-05	1.82E-06	7.24E-06	3.39E-05
0.2	1.37E-05	8.13E-07	3.24E-06	1.29E-05
0.3	3.84E-06	2.57E-07	1.02E-06	3.72E-06
0.5	7.13E-07	5.25E-08	2.63E-07	9.33E-07
0.7	2.41E-07	1.74E-08	1.05E-07	3.89E-07
1	8.09E-08	5.89E-09	3.80E-08	1.59E-07

From Table 8.2.4.1		
PGA	Mean	15th
0.01	3.35E-03	1.23E-03
0.015	2.34E-03	7.08E-04
0.02	1.74E-03	4.37E-04
0.03	1.05E-03	2.04E-04
0.05	4.64E-04	6.76E-05
0.07	2.43E-04	3.63E-05
0.1	1.14E-04	1.76E-05
0.15	4.54E-05	7.94E-06
0.2	2.35E-05	4.73E-06
0.3	9.78E-06	2.14E-06
0.5	3.69E-06	7.33E-07
0.7	2.00E-06	3.55E-07
1	1.00E-06	1.45E-07

10 Hz PSA	Mean	15th
0.1	4.85E-04	8.32E-05
0.15	2.27E-04	3.89E-05
0.2	1.25E-04	2.16E-05
0.3	5.06E-05	9.77E-06
0.5	1.54E-05	3.47E-06
0.7	7.21E-06	1.68E-06
1	3.35E-06	7.59E-07
1.5	1.42E-06	2.88E-07
2	7.51E-07	1.35E-07
3	2.82E-07	4.32E-08
5	6.80E-08	7.41E-09
7	2.34E-08	2.00E-09
10	6.62E-09	3.94E-10

1 Hz PSA	Mean	15th
0.01	2.51E-03	8.13E-04
0.015	1.80E-03	4.37E-04
0.02	1.35E-03	2.51E-04
0.03	8.18E-04	1.10E-04
0.05	3.56E-04	3.06E-05
0.07	1.82E-04	1.25E-05
0.1	8.04E-05	4.57E-06
0.15	2.79E-05	1.51E-06
0.2	1.21E-05	7.08E-07
0.3	3.40E-06	2.19E-07
0.5	6.42E-07	4.17E-08
0.7	2.22E-07	1.25E-08
1	7.58E-08	3.35E-09

50th	85th
2.82E-03	5.25E-03
1.86E-03	3.98E-03
1.23E-03	3.24E-03
6.38E-04	2.00E-03
2.19E-04	8.71E-04
1.02E-04	4.07E-04
4.79E-05	1.66E-04
2.24E-05	5.89E-05
1.38E-05	2.95E-05
6.92E-06	1.38E-05
2.82E-06	6.46E-06
1.41E-06	3.72E-06
6.61E-07	1.86E-06

50th	85th
2.69E-04	8.71E-04
1.10E-04	3.55E-04
5.89E-05	1.78E-04
2.57E-05	6.31E-05
9.77E-06	2.02E-05
5.25E-06	1.05E-05
2.63E-06	5.25E-06
1.15E-06	2.46E-06
6.17E-07	1.32E-06
2.04E-07	5.01E-07
4.47E-08	1.26E-07
1.38E-08	4.32E-08
3.47E-09	1.29E-08

50th	85th
2.14E-03	4.27E-03
1.41E-03	3.24E-03
9.33E-04	2.63E-03
4.68E-04	1.62E-03
1.45E-04	6.61E-04
5.89E-05	2.99E-04
2.16E-05	1.10E-04
6.92E-06	3.06E-05
3.02E-06	1.20E-05
9.33E-07	3.47E-06
2.34E-07	8.71E-07
9.55E-08	3.67E-07
3.16E-08	1.45E-07

Manchester

AMEC E&I Calculation

PGA	Mean	15th	50th	85th
0.1	3.86E-04	1.62E-04	3.24E-04	5.89E-04
0.15	2.13E-04	8.51E-05	1.78E-04	3.39E-04
0.2	1.39E-04	5.37E-05	1.15E-04	2.24E-04
0.3	7.39E-05	2.57E-05	6.03E-05	1.26E-04
0.5	3.15E-05	8.91E-06	2.40E-05	5.62E-05
0.7	1.69E-05	4.17E-06	1.18E-05	3.09E-05
1	8.13E-06	1.70E-06	5.13E-06	1.48E-05
1.5	3.15E-06	5.13E-07	1.78E-06	5.62E-06
2	1.47E-06	1.95E-07	7.59E-07	2.63E-06
3	4.28E-07	4.07E-08	1.86E-07	7.24E-07
5	6.74E-08	5.37E-09	2.40E-08	1.07E-07
7	1.63E-08	1.74E-09	6.31E-09	2.63E-08
10	3.03E-09	9.55E-10	1.86E-09	6.46E-09

10 Hz PSA	Mean	15th	50th	85th
0.1	1.01E-03	5.37E-04	9.12E-04	1.45E-03
0.15	5.63E-04	2.88E-04	5.01E-04	8.32E-04
0.2	3.68E-04	1.78E-04	3.31E-04	5.50E-04
0.3	1.99E-04	9.12E-05	1.78E-04	3.09E-04
0.5	8.86E-05	3.63E-05	7.59E-05	1.41E-04
0.7	5.02E-05	1.95E-05	4.27E-05	8.13E-05
1	2.63E-05	9.33E-06	2.14E-05	4.37E-05
1.5	1.17E-05	3.63E-06	9.12E-06	2.00E-05
2	6.17E-06	1.78E-06	4.68E-06	1.07E-05
3	2.26E-06	5.62E-07	1.59E-06	3.98E-06
5	5.25E-07	1.05E-07	3.39E-07	9.33E-07
7	1.75E-07	3.02E-08	1.07E-07	3.24E-07
10	4.82E-08	8.13E-09	2.75E-08	9.12E-08

1 Hz PSA	Mean	15th	50th	85th
0.01	2.54E-03	1.15E-03	2.24E-03	4.90E-03
0.015	1.41E-03	5.62E-04	1.20E-03	2.69E-03
0.02	8.96E-04	3.31E-04	7.41E-04	1.70E-03
0.03	4.55E-04	1.51E-04	3.63E-04	8.51E-04
0.05	1.82E-04	5.25E-05	1.41E-04	3.31E-04
0.07	9.64E-05	2.57E-05	7.24E-05	1.74E-04
0.1	4.81E-05	1.18E-05	3.55E-05	8.71E-05
0.15	2.14E-05	4.68E-06	1.51E-05	3.98E-05
0.2	1.19E-05	2.34E-06	8.32E-06	2.24E-05
0.3	5.07E-06	8.51E-07	3.31E-06	1.00E-05
0.5	1.62E-06	1.95E-07	9.55E-07	3.31E-06
0.7	7.18E-07	6.76E-08	3.89E-07	1.48E-06
1	2.83E-07	1.91E-08	1.38E-07	5.89E-07

CEUS SSC Table 8.2.5-1

PGA	Mean	15th
0.1	3.73E-04	1.55E-04
0.15	2.05E-04	8.32E-05
0.2	1.33E-04	5.13E-05
0.3	7.06E-05	2.40E-05
0.5	2.99E-05	8.51E-06
0.7	1.60E-05	3.98E-06
1	7.66E-06	1.62E-06
1.5	2.96E-06	4.68E-07
2	1.37E-06	1.78E-07
3	4.00E-07	3.63E-08
5	6.31E-08	3.47E-09
7	1.53E-08	5.75E-10
10	2.84E-09	6.76E-11

10 Hz PSA	Mean	15th
0.1	9.79E-04	5.19E-04
0.15	5.46E-04	2.69E-04
0.2	3.56E-04	1.78E-04
0.3	1.92E-04	8.91E-05
0.5	8.50E-05	3.39E-05
0.7	4.80E-05	1.82E-05
1	2.51E-05	8.51E-06
1.5	1.11E-05	3.47E-06
2	5.84E-06	1.62E-06
3	2.14E-06	5.19E-07
5	4.96E-07	9.55E-08
7	1.66E-07	2.57E-08
10	4.57E-08	5.62E-09

1 Hz PSA	Mean	15th
0.01	2.62E-03	9.33E-04
0.015	1.43E-03	4.68E-04
0.02	9.02E-04	2.88E-04
0.03	4.54E-04	1.35E-04
0.05	1.79E-04	4.79E-05
0.07	9.45E-05	2.40E-05
0.1	4.69E-05	1.05E-05
0.15	2.08E-05	4.27E-06
0.2	1.15E-05	2.14E-06
0.3	4.89E-06	7.59E-07
0.5	1.56E-06	1.78E-07
0.7	6.91E-07	5.89E-08
1	2.72E-07	1.59E-08

50th	85th
3.09E-04	5.75E-04
1.66E-04	3.31E-04
1.10E-04	2.19E-04
5.69E-05	1.18E-04
2.24E-05	5.50E-05
1.12E-05	2.95E-05
4.90E-06	1.38E-05
1.62E-06	5.25E-06
7.08E-07	2.46E-06
1.72E-07	6.61E-07
2.09E-08	1.02E-07
4.27E-09	2.32E-08
6.17E-10	4.27E-09

50th	85th
8.71E-04	1.41E-03
5.01E-04	8.13E-04
3.09E-04	5.37E-04
1.66E-04	2.88E-04
7.24E-05	1.35E-04
4.17E-05	7.76E-05
2.09E-05	4.17E-05
8.51E-06	1.95E-05
4.57E-06	1.01E-05
1.51E-06	3.72E-06
3.20E-07	8.71E-07
9.89E-08	2.99E-07
2.40E-08	8.32E-08

50th	85th
1.86E-03	4.42E-03
1.00E-03	2.37E-03
6.38E-04	1.51E-03
3.09E-04	7.59E-04
1.26E-04	2.88E-04
6.76E-05	1.55E-04
3.27E-05	8.04E-05
1.38E-05	3.63E-05
7.94E-06	2.09E-05
3.13E-06	9.77E-06
8.71E-07	3.13E-06
3.55E-07	1.41E-06
1.26E-07	5.37E-07

Savannah

AMEC E&I Calculation

PGA	Mean	15th	50th	85th
0.1	7.75E-04	2.46E-04	6.31E-04	1.32E-03
0.15	4.10E-04	1.10E-04	3.02E-04	7.08E-04
0.2	2.41E-04	5.89E-05	1.66E-04	4.27E-04
0.3	1.03E-04	2.19E-05	6.46E-05	1.78E-04
0.5	3.18E-05	5.37E-06	1.91E-05	5.62E-05
0.7	1.42E-05	2.04E-06	7.76E-06	2.51E-05
1	5.81E-06	7.08E-07	2.95E-06	1.05E-05
1.5	1.97E-06	1.86E-07	8.91E-07	3.47E-06
2	8.47E-07	6.61E-08	3.55E-07	1.45E-06
3	2.26E-07	1.41E-08	8.13E-08	3.72E-07
5	3.27E-08	2.51E-09	1.02E-08	5.13E-08
7	7.61E-09	1.32E-09	3.24E-09	1.26E-08
10	1.36E-09	9.33E-10	1.48E-09	3.47E-09

10 Hz PSA	Mean	15th	50th	85th
0.1	1.69E-03	7.76E-04	1.55E-03	2.69E-03
0.15	1.10E-03	4.27E-04	9.77E-04	1.82E-03
0.2	7.62E-04	2.69E-04	6.46E-04	1.26E-03
0.3	4.12E-04	1.26E-04	3.24E-04	7.08E-04
0.5	1.58E-04	4.07E-05	1.12E-04	2.75E-04
0.7	7.58E-05	1.78E-05	5.13E-05	1.35E-04
1	3.25E-05	6.92E-06	2.04E-05	5.62E-05
1.5	1.16E-05	2.09E-06	6.92E-06	2.00E-05
2	5.42E-06	8.51E-07	3.09E-06	9.33E-06
3	1.72E-06	2.24E-07	9.12E-07	3.02E-06
5	3.46E-07	3.63E-08	1.70E-07	6.03E-07
7	1.06E-07	1.05E-08	5.13E-08	1.91E-07
10	2.70E-08	3.39E-09	1.29E-08	5.13E-08

1 Hz PSA	Mean	15th	50th	85th
0.01	2.81E-03	1.48E-03	2.75E-03	4.57E-03
0.015	2.07E-03	9.55E-04	2.00E-03	3.39E-03
0.02	1.66E-03	6.92E-04	1.55E-03	2.82E-03
0.03	1.16E-03	3.89E-04	1.02E-03	2.00E-03
0.05	6.53E-04	1.55E-04	5.13E-04	1.20E-03
0.07	4.08E-04	7.59E-05	2.82E-04	7.59E-04
0.1	2.25E-04	3.16E-05	1.35E-04	4.37E-04
0.15	1.01E-04	1.07E-05	5.01E-05	1.95E-04
0.2	5.28E-05	4.68E-06	2.24E-05	1.00E-04
0.3	1.90E-05	1.32E-06	6.61E-06	3.39E-05
0.5	4.43E-06	2.29E-07	1.32E-06	6.92E-06
0.7	1.55E-06	6.76E-08	4.27E-07	2.19E-06
1	4.76E-07	1.62E-08	1.20E-07	6.46E-07

From Table 8.2.6-1

PGA	Mean-tab	15th
0.1	8.13E-04	2.34E-04
0.15	4.46E-04	1.02E-04
0.2	2.70E-04	5.50E-05
0.3	1.22E-04	1.95E-05
0.5	3.99E-05	4.90E-06
0.7	1.81E-05	1.86E-06
1	7.37E-06	6.61E-07
1.5	2.40E-06	1.72E-07
2	9.94E-07	6.10E-08
3	2.50E-07	1.20E-08
5	3.40E-08	1.04E-09
7	7.66E-09	1.66E-10
10	1.34E-09	1.82E-11

10 Hz PSA	Mean-tab	15th
0.1	1.71E-03	7.08E-04
0.15	1.13E-03	4.07E-04
0.2	7.99E-04	2.51E-04
0.3	4.46E-04	1.18E-04
0.5	1.81E-04	3.89E-05
0.7	9.06E-05	1.70E-05
1	4.08E-05	6.46E-06
1.5	1.53E-05	1.86E-06
2	7.23E-06	7.59E-07
3	2.30E-06	2.04E-07
5	4.44E-07	3.16E-08
7	1.31E-07	8.51E-09
10	3.17E-08	1.74E-09

1 Hz PSA	Mean-tab	15th
0.01	2.88E-03	1.32E-03
0.015	2.10E-03	8.41E-04
0.02	1.68E-03	5.75E-04
0.03	1.18E-03	3.31E-04
0.05	6.82E-04	1.26E-04
0.07	4.37E-04	5.89E-05
0.1	2.50E-04	2.40E-05
0.15	1.19E-04	7.94E-06
0.2	6.51E-05	3.24E-06
0.3	2.53E-05	9.02E-07
0.5	6.52E-06	1.55E-07
0.7	2.41E-06	4.17E-08
1	7.64E-07	9.77E-09

50th-tab	85th
6.17E-04	1.41E-03
3.09E-04	8.13E-04
1.66E-04	5.01E-04
6.76E-05	2.19E-04
1.95E-05	7.00E-05
7.94E-06	2.95E-05
2.92E-06	1.25E-05
8.71E-07	3.98E-06
3.55E-07	1.62E-06
7.76E-08	3.80E-07
8.51E-09	5.13E-08
1.68E-09	1.08E-08
2.34E-10	1.86E-09

50th-tab	85th
1.51E-03	2.82E-03
9.66E-04	1.86E-03
6.61E-04	1.32E-03
3.31E-04	8.13E-04
1.18E-04	3.31E-04
5.13E-05	1.66E-04
2.09E-05	7.00E-05
6.92E-06	2.57E-05
3.02E-06	1.12E-05
9.33E-07	3.47E-06
1.66E-07	6.84E-07
4.79E-08	2.04E-07
1.12E-08	5.13E-08

50th-tab	85th
2.63E-03	4.57E-03
1.86E-03	3.47E-03
1.51E-03	2.82E-03
1.00E-03	2.00E-03
5.01E-04	1.27E-03
2.88E-04	8.41E-04
1.35E-04	5.01E-04
5.13E-05	2.34E-04
2.24E-05	1.26E-04
6.46E-06	4.47E-05
1.23E-06	9.44E-06
3.80E-07	3.02E-06
1.10E-07	8.13E-07

Topeka

AMEC E&I Calculation

PGA	Mean	15th	50th	85th
0.01	4.04E-03	1.66E-03	3.31E-03	7.59E-03
0.015	2.49E-03	9.12E-04	1.82E-03	4.90E-03
0.02	1.70E-03	5.89E-04	1.18E-03	3.24E-03
0.03	9.41E-04	3.09E-04	6.17E-04	1.62E-03
0.05	4.27E-04	1.35E-04	2.82E-04	6.61E-04
0.07	2.51E-04	7.76E-05	1.70E-04	3.72E-04
0.1	1.42E-04	4.47E-05	1.00E-04	2.14E-04
0.15	7.37E-05	2.34E-05	5.62E-05	1.15E-04
0.2	4.66E-05	1.48E-05	3.63E-05	7.59E-05
0.3	2.45E-05	7.08E-06	1.91E-05	4.17E-05
0.5	1.04E-05	2.51E-06	7.59E-06	1.86E-05
0.7	5.61E-06	1.10E-06	3.72E-06	1.02E-05
1	2.70E-06	4.07E-07	1.59E-06	5.01E-06

10 Hz PSA	Mean	15th	50th	85th
0.1	4.26E-04	1.55E-04	3.09E-04	6.31E-04
0.15	2.22E-04	7.94E-05	1.62E-04	3.24E-04
0.2	1.38E-04	4.79E-05	1.05E-04	2.04E-04
0.3	7.03E-05	2.40E-05	5.50E-05	1.07E-04
0.5	2.97E-05	9.77E-06	2.40E-05	4.79E-05
0.7	1.66E-05	5.13E-06	1.32E-05	2.75E-05
1	8.59E-06	2.40E-06	6.76E-06	1.48E-05
1.5	3.78E-06	9.12E-07	2.82E-06	6.61E-06
2	1.98E-06	4.17E-07	1.41E-06	3.55E-06
3	7.12E-07	1.20E-07	4.68E-07	1.29E-06
5	1.59E-07	1.91E-08	8.91E-08	2.95E-07
7	5.15E-08	5.37E-09	2.63E-08	9.77E-08
10	1.37E-08	1.51E-09	6.92E-09	2.63E-08

1 Hz PSA	Mean	15th	50th	85th
0.01	2.17E-03	6.03E-04	1.74E-03	3.89E-03
0.015	1.36E-03	2.82E-04	9.33E-04	2.63E-03
0.02	9.32E-04	1.51E-04	5.37E-04	1.82E-03
0.03	5.00E-04	6.17E-05	2.24E-04	9.33E-04
0.05	1.97E-04	1.74E-05	6.92E-05	2.82E-04
0.07	9.81E-05	7.24E-06	3.02E-05	1.18E-04
0.1	4.35E-05	2.88E-06	1.20E-05	4.68E-05
0.15	1.56E-05	9.33E-07	4.27E-06	1.70E-05
0.2	7.12E-06	3.89E-07	2.04E-06	8.51E-06
0.3	2.23E-06	1.00E-07	7.24E-07	3.16E-06
0.5	5.14E-07	1.62E-08	1.70E-07	9.12E-07
0.7	1.99E-07	4.79E-09	6.03E-08	3.89E-07
1	7.17E-08	1.55E-09	1.82E-08	1.45E-07

CEUS SSC Table 8.2.7-1

PGA	Mean	15th
0.01	4.03E-03	1.51E-03
0.015	2.46E-03	8.71E-04
0.02	1.67E-03	5.37E-04
0.03	9.14E-04	2.88E-04
0.05	4.10E-04	1.18E-04
0.07	2.40E-04	6.76E-05
0.1	1.35E-04	3.89E-05
0.15	6.97E-05	2.09E-05
0.2	4.40E-05	1.29E-05
0.3	2.31E-05	6.24E-06
0.5	9.77E-06	2.14E-06
0.7	5.24E-06	9.33E-07
1	2.51E-06	3.43E-07

10 Hz PSA	Mean	15th
0.1	4.11E-04	1.45E-04
0.15	2.13E-04	7.24E-05
0.2	1.32E-04	4.47E-05
0.3	6.67E-05	2.24E-05
0.5	2.81E-05	9.12E-06
0.7	1.56E-05	4.57E-06
1	8.08E-06	2.14E-06
1.5	3.55E-06	8.13E-07
2	1.85E-06	3.55E-07
3	6.66E-07	1.02E-07
5	1.49E-07	1.48E-08
7	4.84E-08	3.24E-09
10	1.29E-08	5.19E-10

1 Hz PSA	Mean	15th
0.01	2.32E-03	6.17E-04
0.015	1.42E-03	2.69E-04
0.02	9.55E-04	1.50E-04
0.03	5.00E-04	5.89E-05
0.05	1.92E-04	1.59E-05
0.07	9.44E-05	6.68E-06
0.1	4.13E-05	2.63E-06
0.15	1.46E-05	8.13E-07
0.2	6.63E-06	3.09E-07
0.3	2.08E-06	6.76E-08
0.5	4.85E-07	6.68E-09
0.7	1.89E-07	1.37E-09
1	6.87E-08	2.19E-10

50th	85th
3.02E-03	6.46E-03
1.74E-03	4.27E-03
1.11E-03	2.82E-03
5.75E-04	1.51E-03
2.69E-04	6.17E-04
1.66E-04	3.55E-04
9.55E-05	2.04E-04
5.13E-05	1.10E-04
3.39E-05	7.24E-05
1.82E-05	3.89E-05
6.92E-06	1.76E-05
3.47E-06	9.77E-06
1.41E-06	4.57E-06

50th	85th
2.88E-04	5.75E-04
1.55E-04	3.09E-04
1.02E-04	1.91E-04
5.13E-05	1.02E-04
2.24E-05	4.47E-05
1.29E-05	2.57E-05
6.24E-06	1.38E-05
2.63E-06	6.46E-06
1.32E-06	3.24E-06
4.37E-07	1.23E-06
8.32E-08	2.69E-07
2.48E-08	8.91E-08
5.62E-09	2.40E-08

50th	85th
1.74E-03	4.12E-03
9.33E-04	2.63E-03
5.37E-04	1.86E-03
2.19E-04	9.02E-04
6.31E-05	2.69E-04
2.75E-05	1.10E-04
1.12E-05	4.47E-05
3.98E-06	1.59E-05
1.86E-06	7.94E-06
6.61E-07	3.02E-06
1.55E-07	8.71E-07
5.31E-08	3.67E-07
1.59E-08	1.35E-07

Fermi 3
GMRS

Spectral Period (sec)	Spectral Frequency (Hz)	Spectral Accleration (g) for: Horizontal GMRS, Updated EPRI-SOG, Full CAV	Vertical GMRS, Updated EPRI-SOG, Full CAV	Horizontal GMRS, CEUS SSC, Modified CAV	Vertical GMRS, CEUS SSC, Modified CAV
0.01	100	0.4032	0.4032	0.4913	0.4913
0.0166	60.24096386	0.6274	0.7136	0.7694	0.8751
0.02	50	0.7115	0.7999	0.8718	0.9802
0.025	40	0.8644	0.9012	1.0611	1.1064
0.03	33.33333333	0.9866	0.9546	1.2220	1.1823
0.033	30.3030303	1.0789	1.0142	1.3425	1.2620
0.04	25	1.3202	1.1618	1.6493	1.4514
0.042	23.80952381	1.3494	1.1715	1.6917	1.4686
0.044	22.72727273	1.3683	1.1725	1.7214	1.4751
0.046	21.73913043	1.3678	1.1574	1.7230	1.4579
0.048	20.83333333	1.3334	1.1141	1.6835	1.4066
0.05	20	1.3136	1.0843	1.6588	1.3693
0.055	18.18181818	1.2580	1.0151	1.5757	1.2714
0.06	16.66666667	1.1829	0.9444	1.4849	1.1855
0.065	15.38461538	1.0878	0.8600	1.3705	1.0835
0.07	14.28571429	1.0090	0.7905	1.2755	0.9993
0.075	13.33333333	0.9575	0.7439	1.2143	0.9433
0.08	12.5	0.9118	0.7028	1.1597	0.8938
0.085	11.76470588	0.8708	0.6662	1.1106	0.8497
0.09	11.11111111	0.8338	0.6335	1.0672	0.8108
0.095	10.52631579	0.8003	0.6040	1.0291	0.7767
0.1	10	0.7698	0.5773	0.9943	0.7457
0.11	9.090909091	0.7100	0.5325	0.9266	0.6950
0.12	8.333333333	0.6594	0.4946	0.8689	0.6517
0.13	7.692307692	0.6161	0.4621	0.8190	0.6142
0.14	7.142857143	0.5785	0.4339	0.7753	0.5815
0.15	6.666666667	0.5456	0.4092	0.7368	0.5526
0.16	6.25	0.5165	0.3874	0.7024	0.5268
0.17	5.882352941	0.4906	0.3680	0.6717	0.5037
0.18	5.555555556	0.4674	0.3505	0.6439	0.4829
0.19	5.263157895	0.4466	0.3350	0.6186	0.4640
0.2	5	0.4296	0.3222	0.5956	0.4467
0.22	4.545454545	0.4011	0.3008	0.5527	0.4145
0.24	4.166666667	0.3766	0.2825	0.5161	0.3871
0.26	3.846153846	0.3555	0.2666	0.4847	0.3635
0.28	3.571428571	0.3408	0.2556	0.4625	0.3468
0.3	3.333333333	0.3258	0.2444	0.4402	0.3302
0.32	3.125	0.3029	0.2272	0.4076	0.3057
0.34	2.941176471	0.2801	0.2101	0.3755	0.2816
0.36	2.777777778	0.2574	0.1931	0.3439	0.2579
0.38	2.631578947	0.2388	0.1791	0.3179	0.2384
0.4	2.5	0.2205	0.1654	0.2926	0.2195
0.42	2.380952381	0.2031	0.1523	0.2683	0.2012
0.44	2.272727273	0.1884	0.1413	0.2479	0.1859
0.46	2.173913043	0.1748	0.1311	0.2291	0.1718
0.48	2.083333333	0.1655	0.1241	0.2160	0.1620
0.5	2	0.1553	0.1165	0.2020	0.1515
0.55	1.818181818	0.1342	0.1007	0.1731	0.1298
0.6	1.666666667	0.1184	0.0888	0.1515	0.1136
0.65	1.538461538	0.1059	0.0794	0.1345	0.1009
0.7	1.428571429	0.0957	0.0718	0.1207	0.0906
0.75	1.333333333	0.0882	0.0661	0.1106	0.0829
0.8	1.25	0.0835	0.0626	0.1041	0.0780
0.85	1.176470588	0.0790	0.0592	0.0979	0.0735

0.9	1.111111111	0.0758	0.0568	0.0935	0.0701
0.95	1.052631579	0.0723	0.0542	0.0888	0.0666
1	1	0.0695	0.0521	0.0849	0.0637
1.1	0.909090909	0.0667	0.0500	0.0810	0.0608
1.2	0.833333333	0.0643	0.0482	0.0777	0.0583
1.3	0.769230769	0.0621	0.0466	0.0747	0.0560
1.4	0.714285714	0.0606	0.0454	0.0725	0.0544
1.5	0.666666667	0.0597	0.0448	0.0707	0.0531
1.6	0.625	0.0587	0.0440	0.0689	0.0517
1.7	0.588235294	0.0578	0.0434	0.0672	0.0504
1.8	0.555555556	0.0572	0.0429	0.0660	0.0495
1.9	0.526315789	0.0563	0.0422	0.0645	0.0483
2	0.5	0.0557	0.0418	0.0633	0.0475
2.2	0.454545455	0.0518	0.0389	0.0588	0.0441
2.4	0.416666667	0.0487	0.0365	0.0552	0.0414
2.6	0.384615385	0.0460	0.0345	0.0520	0.0390
2.8	0.357142857	0.0440	0.0330	0.0496	0.0372
3	0.333333333	0.0421	0.0316	0.0475	0.0356
3.2	0.3125	0.0404	0.0303	0.0455	0.0341
3.4	0.294117647	0.0387	0.0290	0.0436	0.0327
3.6	0.277777778	0.0373	0.0280	0.0419	0.0315
3.8	0.263157895	0.0360	0.0270	0.0405	0.0304
4	0.25	0.0349	0.0262	0.0392	0.0294
4.2	0.238095238	0.0338	0.0254	0.0379	0.0285
4.4	0.227272727	0.0329	0.0247	0.0369	0.0276
4.6	0.217391304	0.0319	0.0240	0.0358	0.0268
4.8	0.208333333	0.0311	0.0233	0.0348	0.0261
5	0.2	0.0304	0.0228	0.0339	0.0254
5.5	0.181818182	0.0287	0.0216	0.0312	0.0234
6	0.166666667	0.0272	0.0204	0.0288	0.0216
6.5	0.153846154	0.0258	0.0194	0.0268	0.0201
7	0.142857143	0.0246	0.0184	0.0250	0.0187
7.5	0.133333333	0.0236	0.0177	0.0235	0.0176
8	0.125	0.0227	0.0170	0.0220	0.0165
8.5	0.117647059	0.0219	0.0164	0.0206	0.0155
9	0.111111111	0.0212	0.0159	0.0195	0.0146
10	0.1	0.0199	0.0149	0.0175	0.0131

Fermi 3
RB/FB TSCR FIRS

Spectral Period (sec)	Spectral Frequency (Hz)	Spectral Accleration (g) for: Horizontal RB/FB TSCR FIRS, Updated EPRI-SOG, Full CAV	Vertical RB/FB TSCR FIRS, Updated EPRI-SOG, Full CAV	Horizontal RB/FB TSCR FIRS, CEUS SSC, Modified CAV	Vertical RB/FB TSCR FIRS, CEUS SSC, Modified CAV
0.01	100	0.2185	0.2185	0.2662	0.2662
0.0166	60.24096386	0.3656	0.4158	0.4473	0.5088
0.02	50	0.4318	0.4855	0.5291	0.5949
0.025	40	0.4607	0.4803	0.5655	0.5896
0.03	33.33333333	0.4554	0.4406	0.5599	0.5417
0.033	30.3030303	0.4646	0.4367	0.5717	0.5374
0.04	25	0.4837	0.4257	0.5961	0.5246
0.042	23.80952381	0.4867	0.4225	0.6011	0.5218
0.044	22.72727273	0.4895	0.4195	0.6059	0.5192
0.046	21.73913043	0.4922	0.4165	0.6105	0.5165
0.048	20.83333333	0.4948	0.4135	0.6149	0.5138
0.05	20	0.4974	0.4106	0.6192	0.5111
0.055	18.18181818	0.5033	0.4061	0.6293	0.5078
0.06	16.66666667	0.5088	0.4062	0.6387	0.5099
0.065	15.38461538	0.4968	0.3928	0.6260	0.4949
0.07	14.28571429	0.4922	0.3856	0.6228	0.4879
0.075	13.33333333	0.4879	0.3790	0.6206	0.4821
0.08	12.5	0.4839	0.3729	0.6186	0.4768
0.085	11.76470588	0.4801	0.3673	0.6166	0.4718
0.09	11.11111111	0.4766	0.3621	0.6149	0.4671
0.095	10.52631579	0.4734	0.3573	0.6132	0.4628
0.1	10	0.4703	0.3527	0.6116	0.4587
0.11	9.090909091	0.4606	0.3455	0.6047	0.4535
0.12	8.333333333	0.4520	0.3390	0.5984	0.4488
0.13	7.692307692	0.4442	0.3331	0.5928	0.4446
0.14	7.142857143	0.4371	0.3278	0.5876	0.4407
0.15	6.666666667	0.4306	0.3229	0.5828	0.4371
0.16	6.25	0.4246	0.3184	0.5783	0.4337
0.17	5.882352941	0.4190	0.3142	0.5741	0.4306
0.18	5.555555556	0.4138	0.3104	0.5703	0.4277
0.19	5.263157895	0.4090	0.3068	0.5666	0.4250
0.2	5	0.4062	0.3047	0.5632	0.4224
0.22	4.545454545	0.3946	0.2960	0.5438	0.4078
0.24	4.166666667	0.3777	0.2833	0.5176	0.3882
0.26	3.846153846	0.3524	0.2643	0.4805	0.3604
0.28	3.571428571	0.3226	0.2419	0.4378	0.3283
0.3	3.333333333	0.2964	0.2223	0.4004	0.3003
0.32	3.125	0.2683	0.2013	0.3611	0.2708
0.34	2.941176471	0.2450	0.1838	0.3285	0.2464
0.36	2.777777778	0.2246	0.1684	0.3000	0.2250
0.38	2.631578947	0.2089	0.1566	0.2780	0.2085
0.4	2.5	0.1932	0.1449	0.2564	0.1923
0.42	2.380952381	0.1793	0.1345	0.2368	0.1776
0.44	2.272727273	0.1676	0.1257	0.2205	0.1654
0.46	2.173913043	0.1574	0.1180	0.2062	0.1547
0.48	2.083333333	0.1494	0.1120	0.1950	0.1462
0.5	2	0.1413	0.1060	0.1837	0.1378
0.55	1.818181818	0.1242	0.0931	0.1601	0.1201
0.6	1.666666667	0.1110	0.0832	0.1420	0.1065
0.65	1.538461538	0.0998	0.0749	0.1268	0.0951
0.7	1.428571429	0.0907	0.0681	0.1145	0.0859
0.75	1.333333333	0.0843	0.0632	0.1057	0.0792
0.8	1.25	0.0801	0.0601	0.0999	0.0749
0.85	1.176470588	0.0763	0.0572	0.0946	0.0709

0.9	1.111111111	0.0733	0.0549	0.0904	0.0678
0.95	1.052631579	0.0702	0.0527	0.0862	0.0647
1	1	0.0677	0.0507	0.0827	0.0620
1.1	0.909090909	0.0652	0.0489	0.0792	0.0594
1.2	0.833333333	0.0629	0.0472	0.0760	0.0570
1.3	0.769230769	0.0610	0.0458	0.0733	0.0550
1.4	0.714285714	0.0596	0.0447	0.0713	0.0534
1.5	0.666666667	0.0587	0.0440	0.0695	0.0522
1.6	0.625	0.0578	0.0433	0.0678	0.0509
1.7	0.588235294	0.0570	0.0427	0.0663	0.0497
1.8	0.555555556	0.0563	0.0422	0.0650	0.0488
1.9	0.526315789	0.0554	0.0416	0.0636	0.0477
2	0.5	0.0549	0.0412	0.0625	0.0469
2.2	0.454545455	0.0512	0.0384	0.0581	0.0436
2.4	0.416666667	0.0481	0.0361	0.0546	0.0409
2.6	0.384615385	0.0454	0.0341	0.0514	0.0386
2.8	0.357142857	0.0433	0.0324	0.0489	0.0367
3	0.333333333	0.0413	0.0310	0.0467	0.0350
3.2	0.3125	0.0396	0.0297	0.0446	0.0335
3.4	0.294117647	0.0379	0.0285	0.0427	0.0320
3.6	0.277777778	0.0364	0.0273	0.0410	0.0308
3.8	0.263157895	0.0351	0.0263	0.0395	0.0296
4	0.25	0.0340	0.0255	0.0382	0.0286
4.2	0.238095238	0.0329	0.0247	0.0370	0.0277
4.4	0.227272727	0.0319	0.0240	0.0358	0.0269
4.6	0.217391304	0.0310	0.0233	0.0348	0.0261
4.8	0.208333333	0.0302	0.0226	0.0338	0.0253
5	0.2	0.0294	0.0221	0.0329	0.0247
5.5	0.181818182	0.0278	0.0208	0.0302	0.0227
6	0.166666667	0.0262	0.0196	0.0278	0.0209
6.5	0.153846154	0.0248	0.0186	0.0258	0.0193
7	0.142857143	0.0235	0.0176	0.0240	0.0180
7.5	0.133333333	0.0225	0.0169	0.0225	0.0169
8	0.125	0.0216	0.0162	0.0210	0.0158
8.5	0.117647059	0.0209	0.0156	0.0197	0.0148
9	0.111111111	0.0202	0.0152	0.0186	0.0140
10	0.1	0.0188	0.0141	0.0166	0.0125

Fermi 3
CB TSCR FIRS

Spectral Period (sec)	Spectral Frequency (Hz)	Spectral Accleration (g) for: Horizontal CB TSCR FIRS, Updated EPRI-SOG, Full CAV	Vertical CB TSCR FIRS, Updated EPRI-SOG, Full CAV	Horizontal CB TSCR FIRS, CEUS SSC, Modified CAV	Vertical CB TSCR FIRS, CEUS SSC, Modified CAV
0.01	100	0.2125	0.2125	0.2589	0.2589
0.0166	60.24096386	0.3601	0.4096	0.4406	0.5012
0.02	50	0.4410	0.4959	0.5404	0.6077
0.025	40	0.5093	0.5310	0.6252	0.6519
0.03	33.33333333	0.5034	0.4871	0.6189	0.5988
0.033	30.3030303	0.4981	0.4682	0.6128	0.5761
0.04	25	0.4874	0.4289	0.6006	0.5286
0.042	23.80952381	0.4851	0.4211	0.5991	0.5201
0.044	22.72727273	0.4829	0.4138	0.5976	0.5121
0.046	21.73913043	0.4808	0.4068	0.5962	0.5045
0.048	20.83333333	0.4787	0.4000	0.5949	0.4971
0.05	20	0.4768	0.3936	0.5937	0.4901
0.055	18.18181818	0.4724	0.3812	0.5922	0.4778
0.06	16.66666667	0.4684	0.3739	0.5908	0.4716
0.065	15.38461538	0.4647	0.3674	0.5895	0.4660
0.07	14.28571429	0.4563	0.3575	0.5831	0.4569
0.075	13.33333333	0.4529	0.3519	0.5817	0.4519
0.08	12.5	0.4497	0.3466	0.5803	0.4473
0.085	11.76470588	0.4468	0.3418	0.5791	0.4430
0.09	11.11111111	0.4440	0.3373	0.5779	0.4390
0.095	10.52631579	0.4414	0.3331	0.5768	0.4353
0.1	10	0.4389	0.3292	0.5757	0.4318
0.11	9.090909091	0.4307	0.3230	0.5700	0.4275
0.12	8.333333333	0.4233	0.3175	0.5649	0.4237
0.13	7.692307692	0.4166	0.3124	0.5602	0.4202
0.14	7.142857143	0.4105	0.3078	0.5559	0.4169
0.15	6.666666667	0.4049	0.3036	0.5519	0.4139
0.16	6.25	0.3997	0.2998	0.5482	0.4112
0.17	5.882352941	0.3949	0.2962	0.5448	0.4086
0.18	5.555555556	0.3913	0.2935	0.5416	0.4062
0.19	5.263157895	0.3888	0.2916	0.5385	0.4039
0.2	5	0.3864	0.2898	0.5357	0.4017
0.22	4.545454545	0.3832	0.2874	0.5280	0.3960
0.24	4.166666667	0.3781	0.2836	0.5182	0.3886
0.26	3.846153846	0.3589	0.2692	0.4894	0.3671
0.28	3.571428571	0.3357	0.2518	0.4556	0.3417
0.3	3.333333333	0.3134	0.2351	0.4235	0.3176
0.32	3.125	0.2886	0.2165	0.3884	0.2913
0.34	2.941176471	0.2644	0.1983	0.3544	0.2658
0.36	2.777777778	0.2409	0.1806	0.3217	0.2413
0.38	2.631578947	0.2220	0.1665	0.2955	0.2216
0.4	2.5	0.2048	0.1536	0.2717	0.2038
0.42	2.380952381	0.1893	0.1420	0.2501	0.1876
0.44	2.272727273	0.1761	0.1320	0.2316	0.1737
0.46	2.173913043	0.1642	0.1232	0.2152	0.1614
0.48	2.083333333	0.1557	0.1168	0.2032	0.1524
0.5	2	0.1468	0.1101	0.1909	0.1432
0.55	1.818181818	0.1283	0.0962	0.1654	0.1241
0.6	1.666666667	0.1138	0.0853	0.1456	0.1092
0.65	1.538461538	0.1019	0.0764	0.1294	0.0970
0.7	1.428571429	0.0927	0.0695	0.1169	0.0877
0.75	1.333333333	0.0860	0.0645	0.1078	0.0809
0.8	1.25	0.0814	0.0611	0.1015	0.0761
0.85	1.176470588	0.0773	0.0580	0.0959	0.0719

0.9	1.111111111	0.0743	0.0557	0.0916	0.0687
0.95	1.052631579	0.0710	0.0533	0.0872	0.0654
1	1	0.0684	0.0513	0.0835	0.0627
1.1	0.909090909	0.0656	0.0492	0.0797	0.0598
1.2	0.833333333	0.0634	0.0475	0.0765	0.0574
1.3	0.769230769	0.0614	0.0461	0.0739	0.0554
1.4	0.714285714	0.0599	0.0449	0.0717	0.0538
1.5	0.666666667	0.0590	0.0443	0.0700	0.0525
1.6	0.625	0.0581	0.0436	0.0682	0.0512
1.7	0.588235294	0.0573	0.0429	0.0666	0.0500
1.8	0.555555556	0.0566	0.0425	0.0654	0.0490
1.9	0.526315789	0.0557	0.0418	0.0638	0.0479
2	0.5	0.0552	0.0414	0.0628	0.0471
2.2	0.454545455	0.0514	0.0385	0.0584	0.0438
2.4	0.416666667	0.0482	0.0362	0.0547	0.0410
2.6	0.384615385	0.0456	0.0342	0.0516	0.0387
2.8	0.357142857	0.0434	0.0325	0.0490	0.0368
3	0.333333333	0.0415	0.0311	0.0468	0.0351
3.2	0.3125	0.0397	0.0298	0.0448	0.0336
3.4	0.294117647	0.0381	0.0286	0.0429	0.0322
3.6	0.277777778	0.0366	0.0274	0.0412	0.0309
3.8	0.263157895	0.0353	0.0265	0.0397	0.0298
4	0.25	0.0341	0.0256	0.0384	0.0288
4.2	0.238095238	0.0331	0.0248	0.0371	0.0278
4.4	0.227272727	0.0321	0.0241	0.0360	0.0270
4.6	0.217391304	0.0311	0.0234	0.0349	0.0262
4.8	0.208333333	0.0303	0.0227	0.0339	0.0254
5	0.2	0.0295	0.0221	0.0330	0.0248
5.5	0.181818182	0.0278	0.0209	0.0303	0.0227
6	0.166666667	0.0262	0.0196	0.0279	0.0209
6.5	0.153846154	0.0249	0.0186	0.0259	0.0194
7	0.142857143	0.0236	0.0177	0.0241	0.0181
7.5	0.133333333	0.0226	0.0170	0.0226	0.0169
8	0.125	0.0218	0.0163	0.0211	0.0158
8.5	0.117647059	0.0210	0.0157	0.0198	0.0149
9	0.111111111	0.0203	0.0152	0.0187	0.0140
10	0.1	0.0189	0.0142	0.0167	0.0125

Fermi 3
FWSC TSCR FIRS
Based on 4500 psi Fill Concrete incorporating 2-D effects

Spectral Period (sec)	Spectral Frequency (Hz)	Spectral Accleration (g) for: Horizontal FWSC TSCR FIRS, Updated EPRI-SOG, Full CAV	Vertical FWSC TSCR FIRS, Updated EPRI-SOG, Full CAV	Horizontal FWSC TSCR FIRS, CEUS SSC, Modified CAV	Vertical FWSC TSCR FIRS, CEUS SSC, Modified CAV
0.01	100	0.2196	0.2196	0.2676	0.2676
0.0166	60.24096386	0.3769	0.4286	0.4611	0.5245
0.02	50	0.4565	0.5132	0.5593	0.6289
0.025	40	0.5684	0.5926	0.6978	0.7275
0.03	33.33333333	0.6899	0.6675	0.8482	0.8207
0.033	30.3030303	0.7400	0.6956	0.9105	0.8559
0.04	25	0.7638	0.6721	0.9413	0.8283
0.042	23.80952381	0.7414	0.6436	0.9156	0.7949
0.044	22.72727273	0.7206	0.6175	0.8918	0.7642
0.046	21.73913043	0.7013	0.5934	0.8697	0.7359
0.048	20.83333333	0.6832	0.5709	0.8490	0.7094
0.05	20	0.6664	0.5501	0.8296	0.6848
0.055	18.18181818	0.6287	0.5073	0.7861	0.6343
0.06	16.66666667	0.5961	0.4759	0.7483	0.5974
0.065	15.38461538	0.5798	0.4584	0.7305	0.5775
0.07	14.28571429	0.5656	0.4431	0.7151	0.5602
0.075	13.33333333	0.5517	0.4286	0.6996	0.5435
0.08	12.5	0.5389	0.4154	0.6854	0.5283
0.085	11.76470588	0.5272	0.4033	0.6729	0.5148
0.09	11.11111111	0.5164	0.3923	0.6623	0.5032
0.095	10.52631579	0.5064	0.3822	0.6525	0.4924
0.1	10	0.4970	0.3728	0.6433	0.4825
0.11	9.090909091	0.4761	0.3570	0.6224	0.4668
0.12	8.333333333	0.4577	0.3432	0.6040	0.4530
0.13	7.692307692	0.4414	0.3310	0.5876	0.4407
0.14	7.142857143	0.4268	0.3201	0.5727	0.4295
0.15	6.666666667	0.4137	0.3103	0.5592	0.4194
0.16	6.25	0.4018	0.3013	0.5469	0.4102
0.17	5.882352941	0.3909	0.2932	0.5356	0.4017
0.18	5.555555556	0.3809	0.2857	0.5251	0.3938
0.19	5.263157895	0.3721	0.2791	0.5154	0.3865
0.2	5	0.3653	0.2739	0.5063	0.3798
0.22	4.545454545	0.3540	0.2655	0.4878	0.3659
0.24	4.166666667	0.3440	0.2580	0.4715	0.3536
0.26	3.846153846	0.3351	0.2513	0.4569	0.3427
0.28	3.571428571	0.3271	0.2453	0.4439	0.3329
0.3	3.333333333	0.3197	0.2398	0.4320	0.3240
0.32	3.125	0.3054	0.2290	0.4109	0.3082
0.34	2.941176471	0.2898	0.2174	0.3886	0.2914
0.36	2.777777778	0.2706	0.2029	0.3614	0.2710
0.38	2.631578947	0.2538	0.1904	0.3379	0.2534
0.4	2.5	0.2347	0.1760	0.3114	0.2335
0.42	2.380952381	0.2167	0.1625	0.2863	0.2147
0.44	2.272727273	0.2008	0.1506	0.2641	0.1981
0.46	2.173913043	0.1857	0.1392	0.2433	0.1824
0.48	2.083333333	0.1751	0.1313	0.2286	0.1714
0.5	2	0.1637	0.1228	0.2129	0.1597
0.55	1.818181818	0.1392	0.1044	0.1795	0.1346
0.6	1.666666667	0.1224	0.0918	0.1566	0.1175
0.65	1.538461538	0.1084	0.0813	0.1378	0.1033
0.7	1.428571429	0.0978	0.0733	0.1234	0.0925
0.75	1.333333333	0.0901	0.0676	0.1130	0.0848
0.8	1.25	0.0847	0.0635	0.1055	0.0792
0.85	1.176470588	0.0802	0.0601	0.0994	0.0746

0.9	1.111111111	0.0764	0.0573	0.0942	0.0707
0.95	1.052631579	0.0729	0.0547	0.0895	0.0671
1	1	0.0700	0.0525	0.0856	0.0642
1.1	0.909090909	0.0673	0.0504	0.0817	0.0613
1.2	0.833333333	0.0645	0.0484	0.0780	0.0585
1.3	0.769230769	0.0626	0.0469	0.0752	0.0564
1.4	0.714285714	0.0609	0.0457	0.0729	0.0546
1.5	0.666666667	0.0599	0.0449	0.0709	0.0532
1.6	0.625	0.0589	0.0442	0.0691	0.0519
1.7	0.588235294	0.0578	0.0433	0.0673	0.0505
1.8	0.555555556	0.0572	0.0429	0.0660	0.0495
1.9	0.526315789	0.0563	0.0422	0.0645	0.0484
2	0.5	0.0556	0.0417	0.0633	0.0474
2.2	0.454545455	0.0517	0.0388	0.0587	0.0440
2.4	0.416666667	0.0486	0.0364	0.0551	0.0413
2.6	0.384615385	0.0459	0.0344	0.0519	0.0389
2.8	0.357142857	0.0438	0.0328	0.0494	0.0370
3	0.333333333	0.0419	0.0314	0.0472	0.0354
3.2	0.3125	0.0401	0.0301	0.0451	0.0339
3.4	0.294117647	0.0383	0.0287	0.0431	0.0324
3.6	0.277777778	0.0368	0.0276	0.0414	0.0311
3.8	0.263157895	0.0355	0.0266	0.0399	0.0299
4	0.25	0.0344	0.0258	0.0386	0.0290
4.2	0.238095238	0.0332	0.0249	0.0373	0.0280
4.4	0.227272727	0.0323	0.0243	0.0363	0.0272
4.6	0.217391304	0.0314	0.0235	0.0351	0.0264
4.8	0.208333333	0.0305	0.0229	0.0341	0.0256
5	0.2	0.0297	0.0223	0.0332	0.0249
5.5	0.181818182	0.0280	0.0210	0.0305	0.0228
6	0.166666667	0.0264	0.0198	0.0280	0.0210
6.5	0.153846154	0.0250	0.0188	0.0260	0.0195
7	0.142857143	0.0238	0.0178	0.0242	0.0182
7.5	0.133333333	0.0227	0.0171	0.0227	0.0170
8	0.125	0.0218	0.0164	0.0212	0.0159
8.5	0.117647059	0.0211	0.0158	0.0199	0.0149
9	0.111111111	0.0205	0.0153	0.0188	0.0141
10	0.1	0.0191	0.0143	0.0168	0.0126

Spectral Period (sec)	Spectral Frequency (Hz)	ESBWR Horizontal CSDRS, Spectral Acceleration (g)
0.01	100	0.5
0.015	66.6666667	0.793
0.02	50	1.100
0.02	40	1.203
0.03333333	30	1.35
0.04	25	1.350
0.05	20	1.350
0.06	16.6666667	1.220
0.075	13.3333333	1.079
0.09	11.1111111	0.975
0.1	10	0.920
0.111	9	0.783
0.15	6.66666667	0.817
0.2	5	0.851
0.25	4	0.878
0.3	3.33333333	0.901
0.4	2.5	0.939
0.5	2	0.781
0.6	1.66666667	0.672
0.75	1.33333333	0.560
0.85	1.17647059	0.505
1	1	0.442
1.5	0.66666667	0.316
2	0.5	0.250
3	0.33333333	0.179
4	0.25	0.141
5	2.00E-01	0.091
6	0.16666667	0.063
7	0.14285714	0.047
8	0.125	0.036
9	0.11111111	0.028
10	0.1	0.023

Spectral Period (sec)	Spectral Frequency (Hz)	ESBWR Vertical CSDRS, Spectral Acceleration (g)
0.01	100	0.5
0.015	66.6666667	0.838
0.02	50	1.210
0.02	40	1.223
0.03333333	30	1.24
0.04	25	1.180
0.05	20	1.110
0.06	16.6666667	0.992
0.075	13.3333333	0.864
0.09	11.1111111	0.773
0.1	10	0.724
0.111	9	0.783
0.15	6.66666667	0.817
0.2	5	0.850
0.25	4	0.877
0.28571429	3.5	0.894
0.4	2.5	0.671
0.5	2	0.555
0.6	1.66666667	0.475
0.75	1.33333333	0.392
0.85	1.17647059	0.353
1	1	0.307
1.5	0.66666667	0.217
2	0.5	0.170
3	0.33333333	0.120
4	0.25	0.094
5	2.00E-01	0.060
6	0.16666667	0.042
7	0.14285714	0.031
8	0.125	0.023
9	0.11111111	0.019
10	0.1	0.015