Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
ESBWR Subcommittee on Fermi 3

Docket Number: N/A

Location: Rockville, Maryland

Date: Wednesday, August 20, 2014

Work Order No.: NRC-1013 Pages 1-400

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

ESBWR SUBCOMMITTEE ON FERMI 3

+ + + + +

WEDNESDAY

AUGUST 20, 2014

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Michael L. Corradini, Chairman, presiding.

COMMITTEE MEMBERS:

MICHAEL L. CORRADINI, Subcommittee Chairman

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR. Member

PETER C. RICCARDELLA, Member

JOHN W. STETKAR, Member

ACRS CONSULTANTS:

WILLIAM HINZE

WILLIAM SHACK

DESIGNATED FEDERAL OFFICIALS:

CHRISTOPHER L. BROWN

KATHY D. WEAVER

ALSO PRESENT:

JON AKE, RES

DAN BARSS, NSIR

LAUREL BAUER, NRO

R. TAYLOR BLAKE, GEH

MIKE BRANDON, DTE Electric

JOHN BURKE, RES

PATRICIA L. CAMPBELL, GEH

LUISSETTE CANDELARIO, NRO

MANAS CHAKRAVORTY, NRO

STEPHANIE DEVLIN, NRO

RAMON L. GASCOT, RES

BRANDON GOMER, Black & Veatch

TEKIA GOVAN, NRO

RANDY GUANTT, Sandia

NICHOLAS HANSING, NRO

KATHRYN HANSON, AMEC

RAUL HERNANDEZ, NRO

DAVID HINDS, GEH

BOB HOOKS, Sargent & Lundy

ATA ISTAR, NRO

DIANE JACKSON, NRO

RONALDO JENKINS, NRO

KEVIN KAMPS, Beyond Nuclear

REBECCA KARAS, NRO

MICHAEL KEEGAN, Don't Waste Michigan*

NICHOLAS LATZY, DTE Energy

YIU LAW, NRO

MARK LEWIS*

HUAN LI, NRO

RON MAY, DTE Electric

ED MEYER, Black & Veatch

MANUEL MIRANDA, Brookhaven National Laboratory

DAVID MISENHIMER, NRO

JAVAD MOSLEMIAN, Sargent & Lundy

ADRIAN MUNIZ, NRO

GREGORY OHLMACHER, Black & Veatch

SUNWOO PARK, NRO

SUSAN PICKERING, Sandia National Laboratory

JAMES A. ROBINSON, GEH

MARCOS ROLON, RES

DAVID SCHONBERGER*

ERIC SCHRADER, NSIR

SURENDRA SINGH, Sargent & Lundy

PETER SMITH, DTE Electric

G. STIREWALT, NRO

ANGELO STUBBS, NRO

SARAH TABATABAI, NRO

MIKE TAKACS, NRO

JOHN TAPPERT, NRO

RUTH THOMAS, Environmentalists, Inc.*

STEVE THOMAS, Black & Veatch

JOHN VAN HOUTEN, DTE Energy

MICHAEL WADLEY, Black & Veatch

GEORGE WANG, NRO

WEIJUN WANG, NRO

ERIC WEYHRICH, Sargent & Lundy

ZUHAN XI, NRO

JIM XU, NRO

BOB YOUNGS, AMEC

*Present via telephone

T-A-B-L-E O-F C-O-N-T-E-N-T-S

P-R-O-C-E-E-D-I-N-G-S

(8:27 a.m.)

CHAIRMAN CORRADINI: Okay. We'll have the meeting come to order. This is a meeting of the Advisory Committee on Reactor Safeguards. Our subcommittee is on FERMI Unit 3, the reference COLA.

My name is Mike Corradini. I'm Chairman of the subcommittee. Subcommittee members currently in attendance are Steve Schultz, John Stetkar, Ron Ballinger and soon to be Charlie Brown.

We have consultants, with our consultants Bill Hinze and Bill Shack. The purpose of this meeting is to discuss Fermi Section 2.5 and Fukushima recommendation 2.1, which is Chapter 20, closure of the ACRS action items related to the Chapters 1, 2, 3 and 20 and Fermi Sections 3.7 and 3.8.

The subcommittee will hear presentations by and hold discussions with representatives of the NRC staff and the applicant, Detroit Edison Company, regarding these matters.

The subcommittee will gather

information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full committee.

I am joined by Kathy Weaver and Chris Brown as the designated federal officials, plural for the meeting since they'll be rotating.

Rules for participation in today's meeting have been announced as part of the notice of this meeting previously publishing in Federal Register on July 23, 2014.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register Notice. It's requested that speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

Also, please silence all various appliances of various types, brands, colors, shapes and sizes, so there's no noise. We've not received any requests from the members of the public to make oral statements or written comments.

MALE PARTICIPANT: I just received this from --

CHAIRMAN CORRADINI: Okay. I

apologize. We have received some written comments from David Schonberger, a member of the public, which we will put into the record.

But we've not heard of requests for any public, oral statements at this time. There is a bridge line set up for Detroit Edison to call on if the applicant wants to bring on other subject matter experts as needed.

And just to check, do we have anybody on the bridge line now? Can the bridge line be opened? There's always a challenge of the day. You guys have people who have called in, I assume.

MR. SMITH: Not from DTE --

CHAIRMAN CORRADINI: Not from DTE.

MR. SMITH: -- or from any of our --

(Simultaneous speaking)

CHAIRMAN CORRADINI: So if anybody's on the bridge line, if you could please acknowledge, and then we'll put it back on mute. Okay.

MALE PARTICIPANT: Ratings are low.

CHAIRMAN CORRADINI: We are okay with that. Okay. Let me characterize where we sit within this. We've been having meetings on Fermi, the reference COLA since sometime in mid-2011.

We've covered most of the items prior to, in the first year or so relative to the ESBWR design and it's design, the certification, the certified design or soon to be hopefully certified design on the Fermi 3 site.

The last two subcommittee meetings have mainly focused on site-related issues, particularly things that were being wrapped up by the staff in terms of review by the applicant and Fukushima-related items.

So today we're going to finish up talking about seismic issues and the design related to the seismic issues as well as what I'll call remaining items and clarifications for Fukushima.

It's my intent at the end of the day, because I think we'll have time, to spend enough time with the applicant and the staff to at least plan out what's appropriate to be presented at the full committee since the intent is to have a letter from the committee to the commission about Fermi 3 R-COLA licensing decision in September.

So with that, I'll turn it over to the staff, Adrian Muniz, which is the project manager, is ready, willing.

MR. MUNIZ: Yes, I'm going to keep my remarks short.

CHAIRMAN CORRADINI: Okay.

MR. MUNIZ: We have a full agenda, so the staff is looking forward to a fruitful discussion today on the matters mentioned by you. So with that, I'll turn it over back to you.

CHAIRMAN CORRADINI: Okay. So Peter, are you the one that's going to lead off?

MR. SMITH: I'm going to start off --

CHAIRMAN CORRADINI: Okay.

MR. SMITH: -- with some background and some introductory remarks.

CHAIRMAN CORRADINI: Okay. Mr. Smith, you're up.

MR. SMITH: Okay. I'm Peter Smith. I'm Director of Nuclear Development, Licensing and Engineering for DTE Energy.

And I've had the privilege of working on the, leading the Fermi 3 license application for the last seven plus years. And I'm gratified that we're here today. Next slide, please.

So before I get going into the subject matter though I just want to introduce the team

that we have here today. So I'll take a minute to do that, and this will be my test of the day.

So first I'd like to introduce Ron May who's the executive vice president of DTE Energy, Major Enterprises Projects, my boss.

And also from DTE Energy I have Mike Brandon, who is the licensing manager for Fermi 3, Nick Latzy, principal licensing engineer for Fermi 3 and way in the back, John Van Houten, two time engineering intern has worked and done lots of work for us.

So he's here to learn. We're also joined here with Black & Veatch, who is our original combined license application contractor, people from GE Hitachi and from Sargent & Lundy.

So I'm going to go through on Black & Veatch. Mike Wadley is representing Black & Veatch. Steve Thomas, the engineering manager and project manager for Fermi 3, and Steve has been involved in this project right from the get go.

Ed Meyer as the lead geotechnical lead for this project has been involved right from the 2006 time frame. Greg Ohlmacher, who spent the summer of 2007 with me onsite doing the site

investigation.

Brandon Gomer, our geotechnical engineer, and then also with Black & Veatch I have Bob Youngs from AMEC, who did all of our seismic work and Kathryn Hanson who did all of the regional geology studies.

From General Electric Hitachi I have James Robinson, who's our project manager, Patricia Campbell from the regulatory affairs, David Hines, engineering manager and Taylor Blake, who's a civil structural engineer who's supported us on this work.

And then finally, from Sargent & Lundy, who did our SSI work, I have Bob Hooks, Javad Moslemian and Surendra Singh and the project manager, Eric Weyhrich. And I think I got everybody.

MALE PARTICIPANT: That's pretty impressive.

MR. SMITH: So I've passed the test. Yesterday was giving the history of everybody who's involved here, so anyways. To move on here, we're down to these last three sections to talk about before this committee.

And they've been a long time coming here, so I just want to kind of lay out what we plan to present today a little bit from a history standpoint.

So we had submitted in our original application all of the geotechnical work and it was originally based on every SOG updated through 2007 roughly.

And that's where we stayed for quite a while. In 2010 we embarked upon doing soil structure interaction analysis for Fermi 3 to really address two areas.

One was the Fermi site is a rock site where you encounter bedrock about 30 feet below the existing grade, roughly. And as a result of that, the seismic Category 1 reactor building, fuel building and control building are partially embedded in bedrock at the site.

So there's an interface between backfill and bedrock with the structure. So we did, SSI did really address two things, one that discontinuity between the backfill and the bedrock, and secondly, to deal with the effective, the backfill on the structures as permitted by the DCD

to do SSI for that or site specific analysis for that.

So we embarked on that in 2010, and originally we were using SASSI 2000, which we'll probably talk about a little bit later.

And as with the time, much of our modeling was done using the subtraction method. So about that same time in the 2010, 2011 time frame, there was a lot of churn about anomalies with use of the subtraction method within SASSI.

Subtraction method allows you to simplify the analysis to allow you to do larger structures within the limits of the interaction nodes in the software.

So that was churning, and we had a number of questions related to that. And then in parallel with that, Fukushima occurred, and then out of the Fukushima Near Term Task Force Recommendation 2.1.

The CEUS seismic source characterization, reevaluation occurred in 2012. So in 2012 we actually just stepped back and took a pause.

And we decided that rather than try to

rationalize the differences in the site seismic characteristics based on CEUS from the previous work, which would have been a margin kind of argument.

And we were dealing with the questions regarding use of the subtraction method in our original SSI analysis, we decided to basically restart.

So we created a whole new site seismic characteristic based on CEUS, and we re-performed all of our previous SSI analysis using the CEUS inputs and also we upgraded to use SASSI 2010, which allows you to have more interaction nodes.

And as a result we were able to use the direct method for everything that we could, and where we couldn't, we used the modified subtraction method for structures that had too many interaction nodes for that.

So, and MSM was benchmarked. And we'll talk about this in much more detail as time goes on. So I'm just going to page on here.

We're going to talk about Section 2.5, and we have, Greg is going to talk about the basic geology and seismic information.

Bob Youngs is going to talk about the vibratory ground motion. Kathryn Hanson is going to talk about surface faulting and the regional investigations.

And Ed Meyers is going to talk about the stability of materials in foundations and slopes. Next slide, please.

So I've already talked about why we did the SSI. I kind of wanted to get ahead of myself as I often do. And then finally we're going to talk about the results of the SSI.

And I kind of have a little bit of overview, so we basically went from developing a seismic hazard, translating those into inputs for SSI and then the SSI results for comparison with the capabilities of the ESBWR certified design.

So, next slide. So I'm going to give you some kind of high level --

CONSULTANT HINZE: Mike, can I ask a question?

MR. SMITH: Sure.

CONSULTANT HINZE: Here if I may, certainly the threat of seismic activity to the spent fuel pool is an important part of the 2.1

interventions.

I didn't find any indication that you had looked at spent fuel. Is that going to be discussed today, or what's --

(Simultaneous speaking)

MR. SMITH: No, because it was discussed within the scope of the certified design.

CONSULTANT HINZE: Okay.

MR. SMITH: Yes.

CONSULTANT HINZE: So totally within that?

MR. SMITH: Yes, so basically we're at the comparison with the certified design.

CHAIRMAN CORRADINI: So to the extent that the certified design bounds the source term, life is okay.

MR. SMITH: Correct.

CONSULTANT HINZE: It might be well to just indicate that in the FSAR for people that are interested in how you've dealt with that part of 2.1.

MR. SMITH: Okay. We'll let that steep for a little bit here.

CHAIRMAN CORRADINI: But I think where

Bill is coming from is that you have some questions raised amongst us just to make sure that we could, a few years ago when we discussed it.

MR. SMITH: So that question came up after Fukushima within the discussions around the certified design, was answered in that context.

And so the CSDRS is Certified Seismic Design Response Spectra for the reactor building, fuel building, includes the spent fuel pool and bounds that issue.

So our need is to demonstrate that our site is bounded by the Certified Seismic Design Response Spectra. And so this is what shows. So these guys who are much smarter than I am will talk in more detail about this.

But in the final results here, the red line represents the DCD Certified Seismic Design Response Spectra. The blue lines represent the site-specific ground motion response spectra for the Fermi site that's based on the CEUS and updated through 2012 seismic source characterization.

So, and as illustrated by the figures, there's quite a bit, the site's well enveloped by the certified design with significant amount of

margin. So that was the first part of comparison. Next slide, please.

So then the next thing I mentioned is the development went on to developing the inputs for the soil structure interaction analysis. So same figures as before.

But this time you see the black line there, which is an enhanced SSI foundation input response vector that was developed using the guidance of Reg Guide 1.160 and Interim Staff Guidance 17.

And as an enhanced, and it also was enveloped by the Certified Seismic Design Response Spectra, again, with a significant amount of margin.

And then the next step in this thing was to actually perform the SSI analysis. Go ahead, Nick. And so what I've illustrated here are the in-structure response spectra for the limiting in-structure response spectra in comparison with the DCD-based in-structure response spectra.

So again, you see the red line, which is the Fermi site in-structure response spectra from our SSI analysis in comparison to what the

capability of ESBWR is.

So again, we have a significant amount of margin between, this is the lease margin figures that we've shown here.

So at the high level, the central theme of today and there's other topics to talk about here is the development of the site hazard with the updated to CEUS using a consistent set of analytical tools that address the previous subtraction method modeling questions.

And the net result for us is the comparison with the design capability with, which is well enveloped. Our site is well enveloped by the ESBWR design.

So, and I think that's it for this. One last, I'm going to say this 100 times today I think, the Fermi site is well-enveloped by the ESBWR standard plant design.

So let's go into the high level. The central theme was to get to the SSI results for comparison, and there are other discussion issues associated with the site investigation.

And so we're going to move on to Section 2.5. So I'm going to start off here, and

then I'm going to turn it over to Greg Ohlmacher in a bit. So next slide, please.

So we talked about Section 2.5 deals with the geologic, seismic and geotechnical characterization of the site.

And we're going to go through the subsections of 2.5 and summarize the main points, and again, demonstrate that the Fermi site is well enveloped by the ESBWR standard plant design.

So again, this is just a listing of the sections. Greg is going to talk about Section 2.5.1, Bob Youngs about vibratory ground motion.

Again, Kathryn Hanson will talk about surface faulting, and then Ed Meyers will deal with the last two sections on stability of materials and foundations and stability of slopes.

So we conducted our site investigation basically during the summer of 2007, and the investigation plan, we had set up a technical advisory board of these experts that provided input into the development of the site investigation as well as were consultants during the conduct of the site investigation and then reviewed the results.

And so we just wanted to mention that.

Next slide, please. So with that, I'm going to turn it over to Greg Ohlmacher from Black & Veatch.

DR. OHLMACHER: Good morning. I'm Greg, Dr. Gregory Ohlmacher. I'm a geologist with Black & Veatch Corporation. Section 2.5.1 covers the geologic, geophysical and seismic conditions for the Fermi 3 site.

The goal of this section is one, to determine the geologic and seismic suitability of the site. Two, to examine the geologic tectonic and seismic findings since the Fermi 2 FSAR and determine if these impact the seismic and plant design.

And three, to provide the basis for ESBWR standard plant siting. For the site vicinity, this section evaluates the potential geologic, seismic and related anthropogenic hazards for the Fermi 3 site. Next slide.

Beginning with the 2000 mile site, excuse me, beginning with the 200 mile site region, the site lies within the central stable region of the North American Plate.

As the name implies, this region is characterized by low seismic activity and low

stress. The topography is subdued with the only significant relief southeast of the Fermi 3 site in the Appalachian Plateau.

This slide shows the geology is simple. Bedrock consists of flat line to gently dipping Paleozoic sedimentary rocks.

The rocks are mildly deformed into broad, gentle folds referred to as basins and arches. The site is along the southeast flank of the Michigan Basin near the crest of the Findlay Arch.

These minimally deformed Paleozoic rocks sit uncomfortably on Precambrian igneous and metamorphic basement rocks. Next slide.

This regional northwest, southeast cross section, developed from geologic logs of oil wells available from the Michigan Department of Environmental Quality and the Ohio Geological Survey depict the regional structure of the Paleozoic sedimentary strata.

Note that the vertical scale for this cross section is 26 times larger than the horizontal scale, which greatly exaggerates the nearly horizontal dip of the strata.

The Fermi 3 site will be located near the crest of Findlay Arch in the outcrop areas of the Bass Islands and Salina Groups.

The first observation is that the geologic units in the site region are relatively uniform. Some thickening of the units exist in the central portions of the Michigan and Appalachian Basins.

For example, the Salina Group, which is the upper unit below Lake Erie, thickens to the west and to the Michigan Basin.

The second observation is that unit, are nearly horizontal to gently dipping, especially in the vicinity of the Fermi 3 site, highlighting a simple geologic pattern with minimal deformation during and following the Paleozoic.

Overlying the Paleozoic sedimentary units are quarternary units associated with the glacial and post-glacial history of this site region.

Linear features visible on the map provide evidence for the advance and retreat of several ice loads and paleoshoreline features related to proglacial lakes.

The light blue area surrounding Lake Erie are lacustrine deposits of Holocene and Late Wisconsin Age. Elevation data along the shoreline features in the light blue areas was used to evaluate evidence of quarternary deformation as will be discussed in Section 2.5.3.

CONSULTANT HINZE: The till beneath the lacustrine is Wisconsin?

FEMALE PARTICIPANT: Yes.

DR. OHLMACHER: The question was the till beneath the lacustrine deposits was lacustrine, and the answer is yes.

CONSULTANT HINZE: No, is Wisconsin in?

DR. OHLMACHER: Wisconsin.

CONSULTANT HINZE: Right.

CHAIRMAN CORRADINI: So for a non-geologist, what you're telling us is that things are relatively smoothly changing is what I am taking out of this from the previous slide. Things are very, very slowly changing as a function of distance away or to the site.

DR. OHLMACHER: The question was is, the geology of the site appears to be very smoothly changing. And that is correct.

CHAIRMAN CORRADINI: You don't have to repeat. We're all on speaker or microphone, so he's got us whether you like it or not.

DR. OHLMACHER: I'm sorry. Next slide. Within five miles of the Fermi 3 site, bedrock consists of Silurian and Devonian age rocks. The light purple rocks at the Fermi 3 site are dolomites of the Silurian Bass Islands Group.

The Bass Islands Group was the first bedrock unit encountered during the sub-surface investigation, at an average depth of 28 feet below the existing ground surface.

Because the soil is thin, seismic Category 1 structures will be partially embedded into the Bass Islands Group. The Bass Islands Group over rise dolomites and shales of the Silurian Salina Group, the dark purple in the lower left corner of the map.

The Devonian Garden Islands Formation, the darker blue northwest of the Fermi 3 site, sits atop the Bass Island Group and is composed of dolomitic sandstone, dolomite and cherty dolomite.

Above the Garden Island Formation and the Bass Islands Group is the Devonian Sylvania

Sandstone, the lighter blue green north of the Fermi 3 site, which is composed of quartz sandstone with dolomite cement.

The broad outcrop pattern indicates that the units are nearly horizontal. Next slide. This north/south cross section at the Fermi 3 site is based on data from the sub-surface investigation.

The vertical scale is ten times larger than the horizontal scale, again, exaggerating the nearly horizontal dip of the strata.

The youngest unit encountered is sandy to bouldery fill placed as part of the Fermi 2 site development. Around and below the fill, the next older unit is a quarternary lacustrine deposit composed of gray to reddish brown clay.

The lacustrine and fill deposits overlay two glacial till units. The upper till is brown and sandier, and the lower till is gray.

Both tills are composed of clay with sand, gravel and pebbles. A thin layer containing sporadic cobbles and small boulders exist between the two till units.

And a layer of cobbles and boulders

exist above bedrock. Below the quarternary units, the Bass Islands Group, dolomite was encountered.

Within the Bass Islands Group, two marker horizons were observed and oolitic dolomite, the bright pink layer, and a black shale layer.

Below the Bass Islands Group, the Salina Group is composed of dolomite, shale and anhydrite. The Salina Group is subdivided into seven units, given letter designations A through G from oldest to youngest.

Salina Group Units B, C, E and F were encountered at the Fermi 3 site during the sub-surface investigation.

The marker horizons within the Bass Islands Group and contacts between the geologic units highlight a broad syncline with nearly horizontal limbs. The geologic pattern --

CONSULTANT HINZE: Greg, could I ask a question?

DR. OHLMACHER: Yes.

CONSULTANT HINZE: Are those --

CHAIRMAN CORRADINI: We need to break up the --

CONSULTANT HINZE: Are these units the

same at Fermi 2? Fermi 2 has Salina Group Unit G. Why is that different?

DR. OHLMACHER: You are correct. We reevaluated the stratigraphy when we did the Fermi 3, and I used data that was available from the Michigan Department of Environmental Quality.

They were evaluated natural gamma logs, and I compared them with natural gamma logs that we took at Fermi 3 and determined that the stratigraphy was slightly different than what was presented in Fermi 2.

CONSULTANT HINZE: Is that because of dip? Is that because of erosion? What's the reason for this? Why are you missing G here?

DR. OHLMACHER: Unit G is very similar to the basal unit of the Bass Islands Group, and the upper unit in, the upper part of Salina Unit F.

And at the site, I could not determine whether, where the boundaries were for Unit G and so I just incorporated what I thought was Unit G into the Bass Islands Group.

CONSULTANT HINZE: So this is an interpretation based upon the electric logs. And the --

DR. OHLMACHER: And the cores that we collected.

CONSULTANT HINZE: Okay. Is there more erosion? Is the bedrock lower at Fermi 3 than it is at Fermi 2?

DR. OHLMACHER: I don't believe so.

CHAIRMAN CORRADINI: You mean deeper? Instead of 30 feet, 35 feet, it's something like --

CONSULTANT HINZE: Yes, right. We're going without the G here, and I was just trying to figure out why. Is this erosion? Is this deformation? Is this, what's the reason for it?

DR. OHLMACHER: Again, the only thing I can say is that it's a reinterpretation of the data.

CONSULTANT HINZE: Okay. That's, now we're cutting to the chase. Okay. So it's possible that G does not occur at Fermi 2 bedrock then. Is that what you're saying?

DR. OHLMACHER: It is possible that G does not.

CONSULTANT HINZE: Thank you. I appreciate it.

DR. OHLMACHER: Not a problem.

MR. SMITH: Especially since we have no holes on both sides. We did both north of Fermi 2 as well as in the drilling plan as well as south of Fermi 2 right on the edge of the protected area boundary. So we traversed the whole site with the investigation.

CONSULTANT HINZE: Are those drill holes protected in that profile, or are they in that profile?

DR. OHLMACHER: They're actually on that profile.

CHAIRMAN CORRADINI: So the slides depicts what actually was drilled at that kind of X two dimensional plane?

DR. OHLMACHER: Yes.

CHAIRMAN CORRADINI: Okay.

MR. SMITH: We have another drawing later in the presentation that show --

CONSULTANT HINZE: It would be the limits of the Fermi 3 reactor building and the fuel building.

MR. MEYER: So this is Ed Meyer. The reactor building would be right in here. The control building's here.

CONSULTANT HINZE: Okay. That helps to give us some scale then. Thank you very much. Thank you.

DR. OHLMACHER: The mark of horizons within the Bass Islands Group and contacts between geologic units highlight a broad syncline with nearly horizontal limbs.

The geologic pattern observed at the site is similar to the simple regional pattern with minimal deformation. The properties of the soil and rock units are uniform across the site. A comprehensive data gathering process --

MEMBER BROWN: Can I ask one question? I'm also a non-geologist and extremely ignorant to what you're talking about. So I'll ask the question anyway.

You talk about boulders as being a constituent of one of these layers when you were talking about, if you're going down this --

DR. OHLMACHER: Yes.

MEMBER BROWN: In my super mind pictures I go down and there's these clumps of boulders in various locations underneath.

And that implies to the lack of those

who don't really know about that, a bunch of discontinuities in like big macro grain boundaries in the structure of part of the underlying parts.

MR. SMITH: So what Greg's talking about, so if you look at the history of the Fermi site.

MEMBER BROWN: Yes.

MR. SMITH: Fermi 1 was originally just a spigot of kind of a peninsula, and it was surrounded by wetland. And then when Fermi 2 was constructed, the area of Fermi 2 and Fermi 3 was clear of detritus from the wetlands and then filled with quarry.

And those are the boulders that you're referring to in --

MEMBER BROWN: What's Quarry 1?

MR. SMITH: We have two large quarries, and they were quarried.

MEMBER BROWN: Oh quarried, I'm sorry.

MR. SMITH: Filled with quarry material. It looks like the size of bookbags.

MEMBER BROWN: That's what you were talking about in the first --

(Simultaneous speaking)

CONSULTANT HINZE: There are also the boulders in the hill. There also could be, from us ice rafting in the middle of the lacustrine.

DR. OHLMACHER: Yes, that is true, too.

MALE PARTICIPANT: I'm very familiar with that.

MEMBER BROWN: I just was curious about the predictability of that stuff when you've got all these. I think about materials that Bill Shack talks about and all these grain boundaries and discontinuities, including stressors.

And maybe they don't move the same way, so I was just asking a --

MEMBER BALLINGER: These are very big grain material.

MEMBER BROWN: I agree with you.

MEMBER BALLINGER: Not gray, grain boundaries. Okay. They're very good scatterers of seismic waves.

MEMBER BROWN: Is that good?

CHAIRMAN CORRADINI: Yes, that's good.

MEMBER BROWN: That's all I needed to know.

(Simultaneous speaking)

MEMBER BROWN: Thank you.

CHAIRMAN CORRADINI: Go ahead.

DR. OHLMACHER: A comprehensive data gathering process was used to develop Section 2.5.1, and the findings support the assessments that demonstrate the geologic and seismic acceptability of the Fermi 3 site.

Other findings include no capable tectonic sources exist within 200 miles of the site. No known surface faults exist within 25 miles of the site. The geologic and related anthropogenic hazards in the site vicinity are negligible. Thank you.

CHAIRMAN CORRADINI: Questions for Greg? Okay.

MR. SMITH: Bob Youngs.

MR. YOUNGS: Good morning. I'm Bob Youngs from AMEC, and I will be presenting a summary of Section 2.5.2 with the purpose of 2.5.2, which is the vibratory ground motion section is to characterize the potential earthquake hazard, the sources of potential earthquake hazards in the site region, to characterize the seismic hazard at the Fermi 3 site and to characterize the seismic

response of the material overlying hard bedrock or hard rock, to develop the ground motion response vector at the site, the GMRS.

Next slide, please. The basic summary of the methodology that was used to conduct the evaluations in Section 2.5.2.

As Peter mentioned earlier, we used the Central and Eastern United States seismic source characterization, the acronym CEUS SSC model, that was published in NUREG-2115.

As Peter indicated, we changed from original use of the updated EPRI-SOG model. When a CEUS SSC model became available and when evaluations showed that it had, use of that model had a significant impact on the seismic hazard at the site.

And this model has been, the CEUS SSC model has been endorsed for use assessing seismic hazard in the facilities, specifically as a part of the Fukushima Task Force recommendations.

We also used the, developing the seismic hazard assessment, the EPRI 2004, 2006 ground motion model characterization.

This was the ground motion model

characterization we had used previously, and we maintained use of that through our development of the new application input piles.

This model has also been endorsed for use in responding to the Fukushima Task Force recommendations.

As specified in Regulatory Guide 1.208, we performed evaluation of whether new information that had been developed post the development of these models, the source characterization model and the ground motion model, whether there was new information that would impact those models.

And in doing that evaluation we used guidance provided in NUREG-2117.

CONSULTANT HINZE: Could I ask a question about that, Bob? In updating your model or updating your catalog, did you delete triggered earthquakes?

I note that the USGS report of 2014 that they published last month, they excluded triggered earthquakes. Did you --

MR. YOUNGS: We did not identify any triggered earthquakes within the 200 mile radius region, so I don't think we've eliminated any of

those.

CONSULTANT HINZE: Did you include, for example, the Youngstown and the Lake County earthquakes?

MR. YOUNGS: I'm not sure. I don't remember the dates on those.

CONSULTANT HINZE: Well, the Ashtabula one, the Lake County one, is 1986.

MR. YOUNGS: So that would've been, so it, I would have to get back --

(Simultaneous speaking)

MR. YOUNGS: Yes, so I don't remember the details of that. That would have been in the --

CONSULTANT HINZE: I'm talking about 2012s around Youngstown, for example.

MR. YOUNGS: I would, I don't really remember whether we with, we basically identified two events within the 200 mile region that were --

CONSULTANT HINZE: It really would be helpful, I think in the FSAR to identify whether you did or did not include or exclude the triggered earthquakes, so those that are from areas in which there are injection welds and there is a strong

likelihood that they are triggered.

Let me go to another question. I note that the staff has come up with, that you have come up with, two earthquakes within the region, within the 200 miles.

And these are greater than three, and I think one is, if I'm correct, one is in Indiana. And one is over in the Youngstown area.

MR. YOUNGS: Yes.

CONSULTANT HINZE: The staff in looking at the, in coming up with their own updating of the catalog, comes up with, I think it's seven earthquakes that exceed three. What's the cause of that difference? This is a question focused to make you look good.

MR. YOUNGS: Well, I may not look good. Seven earthquakes within the --

CONSULTANT HINZE: Within the 200 mile radius.

MR. YOUNGS: Yes, but the question is what's the magnitude assessment. Is it --

(Simultaneous speaking)

CONSULTANT HINZE: In 2009 --

(Simultaneous speaking)

MR. YOUNGS: Right. There are a number of earthquakes that would have been characterized as body wave magnitudes perhaps about three, but they would be below, normal magnitude 2.9.

CONSULTANT HINZE: Can you, just for the uninitiated, can you expand a bit, please?

MR. YOUNGS: Okay. So the process, the catalog that was developed for the CEUS SSC model was developed in terms of a uniform moment magnitude scale.

So moment of magnitude is a seis measure that is a preferred seis measure that is used for ground motion modeling because it's a scale that does not saturate with size.

It can measure the size of earthquakes from Magnitude 3 up to Magnitude 9.5 in a continuous scale, and it's related to the basic low frequency energy and the size of the ruptures.

So it's the preferred magnitude scale for developing ground motion models, and as a part of the CEUS-SSC model we focused on developing a catalog that represented earthquake sizes in terms of this magnitude scale that would be consistent and compatible with the ground motion models that

would be used for hazard calculation.

So to do so, it required us to develop correlations between the magnitude scales reported in catalogs, which are typically not lower magnitude.

They're typically instrumental magnitudes determined from instrumentation, such as a typical scale in the east is the body wave magnitude scale.

And so most earthquake catalogs report magnitudes in terms of body wave, and the correlation is not 1:1 such that body wave magnitudes are typically a little bit larger than moment magnitudes.

So this difference is typically on the order of 0.2 to 0.3 units. So there are a number of units --

CHAIRMAN CORRADINI: The difference is what? I'm sorry.

MR. YOUNGS: On the order of 0.2 to 0.3 units. So a body weight magnitude of three would be a moment magnitude of 2.7.

CHAIRMAN CORRADINI: Okay.

MR. YOUNGS: So the earthquake

parameter characterization, the earthquake recurrence model that was developed for the CEUS SSC model started with Magnitude 2.9.

So anything that was smaller than Magnitude 2.9, moment magnitude was not used for assessing recurrence.

And there are a number of earthquakes within the 200 mile region that are smaller than moment magnitude 2.9 but probably had body wave magnitude near three or above three.

So that may be the source of the difference between what we develop in terms of moment magnitude and compared to what the staff evaluated. I'm not really, I don't remember --

CHAIRMAN CORRADINI: That's all right. We'll ask the staff, too.

MR. YOUNGS: Okay.

CHAIRMAN CORRADINI: We just wanted to get your opinion. Bill, did that at least get to part of your question?

CONSULTANT HINZE: Right, let me ask, regarding the ground motion models you decided not to use some of the updated models based upon the NGA, the next generation attenuation models for the

eastern United States.

Would this have made any difference from the 2006 update of the EPRI?

MR. YOUNGS: So as a part of our evaluation we looked at the models that had been published prior, I mean post the EPRI 2004, 2006 ground motion models.

And those models generally fell within the range. Their predictions fell within the range or were lower than the predictions from the EPRI 2004, 2006 models.

But there was no comprehensive study available at the time we did our work that basically wrapped those all together and updated the 2004 model.

So this work was completed prior to EPRI completing their 2013 update of the 2004, 2006 models. So that update was not available at the time we developed our inputs.

CONSULTANT HINZE: That's confirmed by the recent USGS work, comparing the 2008 and '14.

MR. YOUNGS: So if we had used the 2013 EPRI model, anticipation would be we would've come up with a little bit lower hazard than we have now.

CONSULTANT HINZE: Important point to make, yes.

CHAIRMAN CORRADINI: So I'm sorry again to make you slow down. One more time, can you one more --

MR. YOUNGS: Okay. So if we had --

CHAIRMAN CORRADINI: These guys are in coordination, but I'm, I guess I was thinking you were going to tell us that after they did the reevaluation in 2013 things would've been worse.

But you're telling us things would've been less, so I don't get it. So can you try it again?

MR. YOUNGS: So the EPRI 2013, EPRI conducted an evaluation of the 2004, 2006 EPRI ground motion models, and their evaluation was specifically to assess whether an update was needed for, as a part of the industry response to the Fukushima Task Force Recommendations.

So their evaluation looked at newer ground motion models that had been published after the development of the EPRI 2004 ground motion model.

And the conclusion was that an update

was warranted and that the update would result in slightly lower ground motion estimates that you get using the 2004, 2006 ground motion models.

CHAIRMAN CORRADINI: Okay.

MR. YOUNGS: So the EPRI 2013 report has comparisons at seven demonstration sites of the hazard you would calculate using an EPRI 2004, 2006 or the hazard with, compared to the hazard you would calculate using the EPRI 2013 update.

CHAIRMAN CORRADINI: So can I say it back to you so I got it in my head? Then I'll forget it, but at least for the moment I've captured it.

So if I had some sort of seismic event of some sort of magnitude, the ground motion induced from that has to have a model transmitted from the source of the seismic activity to the site.

MR. YOUNGS: Yes.

CHAIRMAN CORRADINI: And that model when re-looked at concluded that the EPRI '04, '06 models were bounding --

MR. YOUNGS: Yes.

CHAIRMAN CORRADINI: -- for the seven

examples.

MR. YOUNGS: For the seven example sites.

CHAIRMAN CORRADINI: Okay.

MR. YOUNGS: And for in general, plotting the model just in terms of comparison over a distance of magnitude range they were higher.

MEMBER STETKAR: What ground motion model does USGS use in their analysis?

MR. YOUNGS: They use a collection of published models, five or six models.

MEMBER STETKAR: As Bill's aware, the USGS 2014 estimates for the Fermi site are measurably higher than even the 2010.

(Simultaneous speaking)

CONSULTANT HINZE: Considerably higher, but that's because the absolute magnitude is so small.

MEMBER STETKAR: That's right, but we're interested in seismic hazard. We're not --

CONSULTANT HINZE: Right.

MEMBER STETKAR: I was curious about why, if your allegation is that the EPRI ground motion models would reduce the seismic hazard, I'm

curious why the 2014 USGS shows a seismic hazard that's measurably higher, on a percentage basis but --

CONSULTANT HINZE: Their 2014 is less than their 2008.

MEMBER STETKAR: No, it's higher.

CONSULTANT HINZE: Well, we'll talk.

MEMBER STETKAR: Do you have the data points?

CONSULTANT HINZE: Well, I've got the maps.

MEMBER STETKAR: The maps, but do you have the actual data points. I have the data points, and I compared them. I mean it went into the seismic hazard curve, so they're actually higher for the site.

MR. YOUNGS: Well, it would also depend on whether --

CONSULTANT HINZE: The values are higher, but the ground motion model for the ground motion models.

MEMBER STETKAR: I'm just looking at a seismic hazard. I'm looking at --

(Simultaneous speaking)

MEMBER STETKAR: -- frequency versus peak ground acceleration.

CONSULTANT HINZE: You're absolutely right. Those are higher.

MEMBER STETKAR: Those are higher.

CONSULTANT HINZE: Absolutely.

MEMBER STETKAR: Okay.

CONSULTANT HINZE: The ratios are certainly --

MEMBER STETKAR: The ratios are significant. That's right. They are.

CHAIRMAN CORRADINI: So I'm not sure what you guys are agreeing to.

MEMBER STETKAR: What I'm trying to find out is, I'll eventually get to a question that I'm going to ask, but one of the things that I noted was that if I compare USGS 2008, there was a 2010 update to the 2010, which none of these are at the site.

They're at the actual 81 degrees, 81.95 degrees north, 83.25 degrees west at the site, except that the 2010 updates were only in a tenth of a degree increment.

If I look at that, from 2008 to 2010

when they updated, I don't know what they did, whether they changed the ground motion models, I don't know what they did.

I didn't read enough. In their graph they went up considerably in 2014. So what I'm curious about, did it go up because the USGS found many more sources?

Or did they update their ground motion models but differently than the EPRI models? I'm curious why the hazard in 2014, if indeed the current state of knowledge about the ground motion models would reduce the hazard, why it's increased.

And it's increased measurably, I mean on a fractional basis measurably, not on an absolute G basis.

MR. YOUNGS: So the USGS has been involved, evolving their characterization of the sources and the ground motion over time.

MEMBER STETKAR: It's not clear which of those two.

MR. YOUNGS: We cannot be clear as to which of those contribute to the --

MEMBER STETKAR: And I'll accept that. Your analyses were based on the 2008 incarnation of

the sources.

MR. YOUNGS: Our analysis is based on the 2012 EPRI, sorry, the CEUS SSC model, the source model we're using, which is the 2012, published in 2012.

What I was talking about in terms of the ground motion model, just given that the source model is the same, if we change the ground motion models from --

MEMBER STETKAR: You'd see a decrease.

MR. YOUNGS: -- EPRI 2004 to EPRI 2013 anticipation would be the hazard would go down a little bit.

MEMBER STETKAR: If USGS was using those same ground motion models would indicate that the USGS has identified many, many, many more sources or at least closer sources.

MR. YOUNGS: Or changed the way they're characterized the rates of activity. They use, I don't think they've identified more sources in the region.

MEMBER STETKAR: Probably not.

MR. YOUNGS: They've identified, basically they use a method of smoothing the

seismicity with a spacial density model, which basically takes the available catalog and then calculates a spacial density of earthquake rates across the region.

MEMBER STETKAR: I mean the catalog hasn't changed except for --

MR. YOUNGS: Oklahoma is always changing.

MEMBER STETKAR: Well, I mean in terms of large sources.

MR. YOUNGS: In terms of large sources, but the valuation of the catalog and the magnitudes is always under change.

One of the things that has changed also is that the USGS is moving from using body wave magnitude, which they used in 2008 to moment magnitude, which they're using now.

And all of those factor into how the ground motion hazard is actually calculated.

CHAIRMAN CORRADINI: So can I say something back to you that, you said it, but it strikes me. You used the word smoothing. So are you counting, I use the term engineering judgment.

Are you telling me that if they have a

catalog of activity and then they determine a ground motion at some location, they smooth where the activity would be so that instead of it happening here it could happen in a broader range?

So just by the smoothing technique, that actually makes things look more intense at a certain location? That's what I thought you just said.

MR. YOUNGS: Well, they do smooth. It basically, the earthquake catalog are basically points in space.

CHAIRMAN CORRADINI: But --

MR. YOUNGS: But the assumption is that they represent an average rate and that, which varies smoothly across the region instead of just spikes.

CHAIRMAN CORRADINI: Sure.

MR. YOUNGS: So the --

CHAIRMAN CORRADINI: But the smoothing technique would affect the, if I understood again, the smoothing technique would affect where the spike is and how that spike would be represented a distance away from this spike.

MR. YOUNGS: Yes.

CHAIRMAN CORRADINI: Or, I shouldn't say spike but from the actual data.

MR. YOUNGS: From the actual location of the earthquakes, how that earthquake event is represented in space in terms of a rate.

So it's typically, they use a Gaussian smoother with a varying bandwidth on the order of I think from 25 to 75 kilometers.

CHAIRMAN CORRADINI: But the choosing of that bandwidth, we'll call it the standard deviation, is a matter of engineering judgment.

MR. YOUNGS: There are techniques to assess it from the data, but it's often typically a trace of engineering judgment.

CHAIRMAN CORRADINI: Okay. Thank you.

CONSULTANT HINZE: They actually use more than one method of smoothing and weight them because they don't know that they have the right smoothing method. And so what they do is use engineering judgment to put a weight.

CHAIRMAN CORRADINI: No, no, I'm with you, but what I'm trying to get is John's asking the question, and he say an end result that changed from eight to ten to 14 and what's the source of

it.

So it's not only the seismic source. It's not only the ground motion. It's also potentially the smoothing of what the data was.

MR. YOUNGS: And the change in the catalog, the magnitude scale.

CHAIRMAN CORRADINI: Okay. Thank you. Keep on going. I'm sure we'll be back to you again.

MR. YOUNGS: So I think, so the, in terms of what we looked at for updating the, both the source model and the ground motion models, which I already covered a significant part of, but anyway.

We looked at updating the earthquake catalog for the four years. The catalog that's associated with the CEUS SSC model goes to the end of 2008.

We looked at the additional four years of data post that. In one case, and specifically we looked within the 200 mile radius of the site and looked at the number of earthquakes that have occurred in that radius and compared it with what the CEUS SSC model predicted would come.

And we found that the number that occurred was consistent with the predictions from that model. So we felt that there was no need to update the seismicity rates based on the data.

The data that occurred post that model we did look at the moderate magnitude earthquakes that have occurred in the central and eastern United States post that model, in particular the Mineral, Virginia earthquake, which had an effect, a very minor effect on the maximum magnitude distribution for one source that was relatively distant from our site, so therefore had very little impact on the hazard assessment at the site.

And in the investigation we found no indication of any additional seismic sources that we would need to add to the EPRI, to the CEUS SSC model so that we could go forward with that model to do the seismic hazard assessment.

CONSULTANT HINZE: And you did not modify the sizable tectonic zones?

MR. YOUNGS: We did not modify the zones. As it was indicated, we did look at ground motion models that have been published post-EPRI 2004, 2006 and concluded that they were within or

lower than the EPRI 2004 ground motion models.

So we continued using the EPRI 2004 ground motion models because that was an endorsed study. And it made it easier to just proceed with that endorsed model and the fact that it was a bounding model compared to newer data.

And then giving that model the use of the 2004 ground motion model and the CEUS SSC model, we computed the seismic hazard at the site considering the contributions of all sources within 1000 kilometers.

And important, we had found in that analysis there's an important contribution to the hazard of the site from a New Madrid source to the southwest at a distance of about 750 kilometers.

So it was a major contributor to the hazard at low frequencies at the Fermi 3 site. And once having the hard rock hazard, then we developed site amplification functions based on the --

MEMBER STETKAR: Bob, let me stop you there because now I'm finally going to get to my question because you're going to get into the site ground response.

If I look at the seismic hazard curves,

and you haven't presented them here, if I look at the FASR figures and the tabulations, something that strikes me, and I always look for this, is at low frequency ground motion, half a hertz up to a hertz or so, a little over, the uncertainty in the seismic hazard behaves as if I would expect.

So, for example, you plot acceleration, spectra acceleration of ten to the minus four G, which is really small up to about 1G and above.

But the tables as far as the distributions I stopped at 1G. Though the uncertainties in those distributions change, and by uncertainty I'm measuring a measure of the 90 percent confidence interval.

So these are roughly log normal distributions. I checked them. They're for all practical purposes log normal as everybody uses.

The uncertainties at very G's are about an error factor which is the square root of the 95th to the fifth of about two.

And if I get up to 1G at a half a hertz the error factor is 28, which gives me roughly a factor of a little less than 900 between my fifth and 95th.

At one hertz, it's about 14. And now if I go above one hertz, I suddenly see the uncertainties collapse dramatically such that, and let me throw out the ten to the minus four because you didn't plot those or tabulate them.

But at five hertz for example, at ten to the minus three G, which is for those of you who are familiar with Richter, there's not a direct correlation.

But it's sort of a two-ish range Richter scale, up to 1G, which is sort of a seven or eight-ish Richter earthquake. The uncertainty changes from about two to about three and a half.

Now, to give you a comparison, if I look at data collected from nuclear power plants on performance of equipment, pumps, valves, diesel generators, stuff that we have a lot of data, there is still an aleatory variability in the performance of that equipment, that gives me comparable uncertainties.

And to me I have absolutely no understanding why the uncertainty or a 1G earthquake at the Fermi site is comparable to the uncertainty for a 0.001G earthquake.

And I really want, I need to understand that at high frequencies because at low frequencies it behaves, not only as I would expect it, but perhaps even more wildly than I would expect it because those uncertainties get really big at high G levels.

But it's a pretty benign site, so could you explain to me why the uncertainties behave that way because I will not accept your seismic hazards until I understand why the uncertainties behave that way.

Small change in the uncertainty will result in a large change in a mean hazard --

(Simultaneous speaking)

MEMBER STETKAR: -- perhaps a factor of two. You're still probably are going to be under your seismic envelope, but I want to understand how the science is done.

And this is the third site that I've looked at that's behaved the same way, so I'm really suspicious of the crank that you're turning.

MR. YOUNGS: So the uncertainty that you're looking at is the range, what we call epistemic uncertainty in the models.

MEMBER STETKAR: I'm looking, I will not use names because to me uncertainty is uncertainty. I'm looking at, you have seismic hazard curves that give me a 95th percentile and a fifth percentile.

And I'm looking at that range --

MR. YOUNGS: Okay.

MEMBER STETKAR: If you want to explain to me how the uncertainties were combined to get that, I will listen.

CHAIRMAN CORRADINI: So can I just interject since you guys, once again, are talking a language that many of us might be lost in.

The way I interpret what his question was is if I go back to Peter's original plot, which was Slide 4 --

MEMBER STETKAR: That doesn't --

CHAIRMAN CORRADINI: Well, but I think it does. Let me just say it, and then you'll tell me I'm wrong. You always do, which is if I look at the blue line on Slide 4, what John is asking is there's a --

MEMBER STETKAR: It's your Slide 16, if you want to --

CHAIRMAN CORRADINI: Oh, it's your Slide 16.

MEMBER STETKAR: It's the same slide. There it is. It's the same slide.

CHAIRMAN CORRADINI: Oh, same slide, is that the blue line has a fuzz to it, and the fuzz at higher frequencies is different than the fuzz at lower frequencies and in a direction that surprises John.

And I don't understand enough, but I do understand that this is generic. He's asked this two others, and we haven't gotten an explanation that has satisfied at least him and a lot of the rest of us are confused. So do you want to take a crack?

MR. YOUNGS: I do my best.

CHAIRMAN CORRADINI: Okay.

MR. YOUNGS: Well, the range, so in the seismic hazard calculation, the basic model integrates the variability, what we call the natural variability or ground motions, and what we call aleatory or natural variability.

So if you have a recording from an earthquake like say for instance the Chi-Chi

earthquake you have, well 400, 500 ground motion recordings and they scatter about an average attenuation line.

And that scatter that we see, we typically call aleatory variability unless we can come up with a model for why the variability is.

So the aleatory variability is what we don't, can't model at the moment. So it gets lumped into just what we call randomness that we can't model at the present.

And that aleatory variability, which has a standard deviation in natural log units typically on the order of 0.6 or so is integrated into the hazard curve.

So the hazard curve integrates that out, and the hazard curve includes that aleatory variability, so there's no, that aleatory variability results in a single, mean hazard curve, a single hazard curve.

And what we, so then we say that's given a particular model. Say I chose the ground motion prediction model. I chose, and there are other, so let me step back again.

So there are aleatory variabilities

that I include, which is where are the earthquakes actually going to occur so that there is a spatial distribution model of where they are going to occur.

And that's also integrated into the hazard curve, so if you had only one spatial distribution model, one recurrence curve for how frequent earthquakes are, one ground motion model with this aleatory variability, you'd get one hazard curve. And there's no --

MEMBER STETKAR: There's one family of curves.

MR. YOUNGS: No, you get one hazard curve.

MEMBER STETKAR: Well, what do you define as a hazard curve?

MR. YOUNGS: A hazard curve is the integral, is the probability of exceeding a certain ground motion level --

MEMBER STETKAR: With no uncertainty.

MR. YOUNGS: -- with no uncertainty.

MEMBER STETKAR: No, you should get a family of curves.

MR. YOUNGS: Why?

MEMBER STETKAR: Because you have uncertainty in that.

MR. YOUNGS: No, you --

MEMBER STETKAR: You don't sample from the uncertainty in each of those parameters?

MR. YOUNGS: No, that's, no I'm saying if you had a single model you get a single hazard curve.

MEMBER STETKAR: I have the single model for failure of a diesel generator. That's a model, and I have uncertainty due to the variability in my data set. So therefore I have uncertainty in the failure rates --

MR. YOUNGS: Right.

MEMBER STETKAR: -- in that model. Now I have uncertainty in the models that I can use. I can use different models. There are different ways you can model failure.

MR. YOUNGS: Okay. So I guess we're not communicating exact. So I meant a single model you assume is correct you get a single hazard curve.

MEMBER STETKAR: You still should have some uncertainty, but keep going.

(Simultaneous speaking)

MR. YOUNGS: So then we do, we, so then we get to what you're talking about, which is the uncertainty in the models.

MEMBER STETKAR: Yes.

MR. YOUNGS: So we have uncertainty in the model itself, so we have alternative models that we could use. And then we have uncertainty in the model parameters because they're coming from limited data, not infinite data.

So that uncertainty in the models and the uncertainty in the model parameters are what go into our family of hazard curves.

MEMBER STETKAR: Okay.

MR. YOUNGS: So that's what we, in our jargon, we call epistemic uncertainty.

MEMBER STETKAR: Sure. That's one way of --

(Simultaneous speaking)

MR. YOUNGS: So we can argue forever about which --

MEMBER STETKAR: That's why I don't like to use --

(Simultaneous speaking)

MR. YOUNGS: So we use a range of models and characterizing both alternative models that could be used and the uncertainty in those models given the fact that they're developed from finite data.

And that produces the family of hazard curves that go into the fractile, the fifth, the 95th you were talking about.

MEMBER STETKAR: Okay.

CHAIRMAN CORRADINI: And that results in, just if I might break in, that results in I'll use the word fuzz.

That is, if I had that blue line, and I colored the blue line, I'd see actually more dispersion at the lower frequencies and lower dispersion at the higher frequencies, just based on everything you just said.

MR. YOUNGS: Yes.

CHAIRMAN CORRADINI: Do you guys have the FSAR on, there are a couple of figures in the FSAR that are illustrative of this process.

But Bob, why does the uncertainty decrease so dramatically at higher acceleration? I'm sorry, at higher ground motion frequencies?

MR. YOUNGS: So the --

CHAIRMAN CORRADINI: At one hertz and above, for example.

MR. YOUNGS: So it has to do largely with the magnitudes that are driving the hazard assessment, high frequency versus low frequency.

So at high frequencies of ten hertz, in that neighborhood, the hazard is not coming from the largest events. It's coming largely from the Magnitude 5 to 6 events in the general site vicinity. So it has, therefore hazard is controlled by the --

MEMBER STETKAR: Are we that certain? I mean given the fact that there are not many of those in the general site vicinity, we're that certain when I extrapolate up to peak ground acceleration, spectra accelerations up in the range of one.

And in fact you go up to about 5G in a couple of the tabulations. We're that certain?

I mean we're as certain, for example, as if I go collect thousands of operating hours, probably now millions of operating hours and put some valves and pipes, and not pipes but diesel

generators and equipment and power plants, we're as certain up at these very, very high accelerations about the seismic hazard at that site as I am about the operation of a piece of equipment for which I have a lot of actual actuarial data?

To me, that, I don't understand that. I don't understand why that is.

MR. YOUNGS: Well, we, I don't have an experience with --

MEMBER STETKAR: I'm just saying. You have to take that --

MR. YOUNGS: Right.

MEMBER STETKAR: A typical band, 90 percent confidence interval is on the order of about five to ten, which is an error factor of about two and a half to three or so, which is what I'm seeing here for seismic uncertainty at very high G levels.

MR. YOUNGS: But that frequency is controlled primarily by the rate of earthquake prediction, rate of earthquake occurrence and the alternative ground motion models.

MEMBER STETKAR: But why as we have less and less data, less and less experience,

doesn't my uncertainty increase as I would expect?

MR. YOUNGS: Because --

MEMBER STETKAR: This is of equipment if I've had only one failure, my uncertainty tends to be fairly large because if I have another one tomorrow, it could double the failure rate. So my uncertainty tends to be quite large.

MR. YOUNGS: So --

MEMBER STETKAR: As you have less and less of experience, your uncertainty typically increases.

MR. YOUNGS: So at higher frequencies, it's still controlled primarily by the rate of prediction of the frequency of earthquakes and the magnitude five and six range.

And so that uncertainty and that frequency and the frequency of those earthquakes are what's controlling the hazard both at high G levels and at low G levels because the ground motions are not being, the hazard is not being produced by the largest events.

We have the largest uncertainty in our model in how big the events could be. That's the largest source of our uncertainty.

CHAIRMAN CORRADINI: So can I --

MR. YOUNGS: And there was an upper, the upper limit of the size of earthquakes that could occur in any location.

It's one of the biggest uncertainties in seismic hazard estimation. And that uncertainty shows us at low frequency --

MEMBER STETKAR: It does.

MR. YOUNGS: -- because the magnitudes that contribute to the hazard at low frequency are the largest magnitudes. They dominate the hazard.

But as you move to higher frequency, those earthquakes are not the ones that dominate the hazard anymore. It's the moderate size events that dominate the hazard.

CHAIRMAN CORRADINI: So --

MR. YOUNGS: So the uncertainty on how big they could get doesn't show up in the hazard assessment.

CHAIRMAN CORRADINI: So you're saying a couple of things, if I could just repeat them so we're clear because I don't think you satisfied John, but at least I understand what you're telling us.

What you're saying is the uncertainty of the blue curve at low frequencies is large because the data of those intense earthquakes is less known, therefore, higher uncertainty.

And at the high frequencies, there's more seismic data, so therefore the uncertainty is smaller.

MR. YOUNGS: There is more data driving the parameters that control the hazard.

CHAIRMAN CORRADINI: But if I might, where he's bothered is when he's jumping to another regime of data the uncertainty band is strikingly small compared to where he has a wealth of data from equipment.

MEMBER STETKAR: Because the events that they have close to the site are very small.

CHAIRMAN CORRADINI: But more frequency.

MEMBER STETKAR: But very small compared to their extrapolation to these very large acceleration earthquakes. They don't have a wealth of 1G, 2G earthquakes anywhere near the site.

CHAIRMAN CORRADINI: No, you don't.

MEMBER STETKAR: Why are you so certain

about the frequency of the 1G earthquake at the site if you have a lack of data?

MR. YOUNGS: We have an estimate of the frequency of occurrence of earthquakes, not 1G earthquakes. We have an estimate of the frequency of occurrence of earthquakes of Magnitudes 5 to 6 based on --

MEMBER STETKAR: Moment magnitude.

MR. YOUNGS: Based on Moment Magnitude 5 to 6, based on the historical record, which is several hundred years and a model that implies that they vary relatively smoothly in space.

And we have alternative versions of that model. We have 24 alternative versions of the recurrence models, but, so we have an uncertainty band on the frequency of earthquakes of the size of interest. The --

MEMBER STETKAR: When you say the size, what is the size of interest?

MR. YOUNGS: Well, we did the hazard assessment for Magnitudes 5 and larger, so it's a frequency of Magnitude 5 and larger earthquakes.

But what is driving the hazard at high frequency is the frequency from five to six,

primarily --

MEMBER STETKAR: Versus?

MR. YOUNGS: Versus the frequency of six to seven. That's what's driving the hazard, and what's driving the hazard, what's allowing the ground motions to get high in the assessment is that we are just modeling those events coming closer and closer to the site.

It's still not, we're still not, the hazard is still not being driven by Magnitude 7's, even at 1G.

MEMBER STETKAR: Even at 1G?

MR. YOUNGS: At high frequency.

MEMBER STETKAR: At high frequency.

MR. YOUNGS: As you get to low frequency motions, then the effective magnitude becomes much stronger on the ground motions.

So with high frequency, the effective magnitude on ground motions is weaker at high frequency than at low frequency.

So if you plotted response spectra from earthquakes at a close distance, you will find that the ground motions, the predicted ground motions at ten hertz will vary less from Magnitude 5 to 7 at

ten hertz than they will at one hertz.

As you get to lower frequencies, the ultimate size of the earthquakes becomes more important to the hazard assessment.

CHAIRMAN CORRADINI: Enough for now?

MEMBER STETKAR: Enough for now. I'll have to think about that. As I said, I'm not a ground motion guy, okay. I do deal with uncertainty a lot, and --

CHAIRMAN CORRADINI: That's what's, I mean I want to make sure we get it on the record that you guys just happen to be the ones up in front of us today. But this question has been asked and will be asked of a number of --

MEMBER STETKAR: And I've seen it at sites that are closer to New Madrid than you guys are with a much different geology. I've seen the same behavior, and that makes me really curious about the point that you're trying to make.

MR. YOUNGS: Well, it has to do, I think partly it has to do with what the sensitivity of the ground motions to the magnitudes and what magnitudes are controlling the hazard.

CHAIRMAN CORRADINI: Okay. Let's move

one. I think at least we've got a --

MEMBER STETKAR: I'll have to think about it.

CHAIRMAN CORRADINI: I don't know if you want to go back --

(Simultaneous speaking)

MR. YOUNGS: I think, so the last two steps in Section 2.5.2 were we developed then site-specific amplification functions, which are taking the ground motion assessment as the generic hard rocks, which is down about 400 feet below the base of the building.

And we bring it up to the level of the, for the GMRS we bring it up to the top most confident horizon. And at the Fermi 3 site, the plan is to remove all existing material above the Bass Islands Group bedrock within the footprint of the Category 1 structures.

So we defined our horizon for where the GMRS was defined would be at the top of the Bass Islands Group bedrock.

And that bedrock has a relatively high velocity. It's about 6500 feet per second, so the site amplification up to that horizon is pretty

minimal at this site.

CONSULTANT HINZE: How sensitive are the results to the level of the hard rock, because Fermi 2 and Fermi 3 have different levels?

MR. YOUNGS: Do you mean the depth to it?

CONSULTANT HINZE: Yes, within the unit.

MR. YOUNGS: I would say we're not particularly sensitive to that horizon location. Once you get down below the, into Salina C or B. C or B they get up, the velocity climbs back up close to the nominal 9200 feet per second.

CONSULTANT HINZE: And you use a randomized modeling for your amplification functions, yet we're heard from Greg that these are very uniform. Why the randomized even when there are two points.

MR. YOUNGS: The randomizing is to account for the fact that the velocity is not identical everywhere.

It does have variability and the fact the waves will be traveling at the different angles up through this material and to basically smooth

out the peaks we would see from a single constant model, which don't really show up in actual ground motion recording.

CONSULTANT HINZE: Thank you.

MR. YOUNGS: So with those, then we then developed the GMRS at the horizon on top of the Bass Islands Group bedrock. The next slide just shows a map of the seismicity.

This is the CEUS SSC catalog for a region that basically encompasses everywhere that would be important to the hazard assessment at Fermi 3. The site is located in the center and the dashed line is the 200 mile radius site region.

The site itself is located in a quieter seismic area compared to the more active areas to the southwest, which is in the New Madrid region and the Wabash Valley and to the northeast along the St. Lawrence and Ottawa Graben areas.

As I indicated, we did an update of the catalog post the CEUS SSC catalog, and they're hard to see. But there are red circles in the site region, and these again, are plotted in terms of moment magnitude.

And the two events that we have

identified that are above the Magnitude 2.9 are one that occurred in central Indiana and one that occurred in eastern Ohio about Magnitude 3.8 and 3.7, I think if I remember right.

MEMBER STETKAR: What's the largest moment magnitude within 300 miles?

MR. YOUNGS: In the catalog itself?

MEMBER STETKAR: Yes.

MR. YOUNGS: I would say five, in the mid-fives.

MEMBER STETKAR: Mid-fives, okay.

MR. YOUNGS: And I think there are several fives. I know there's the Anna, Ohio earthquake cluster is within the 200 mile radius.

CONSULTANT HINZE: 5.7 at a max.

MR. YOUNGS: Yes, something like that. I don't recall the actual moment magnitude estimate for that, but it's in the mid-fives.

So in also looking at the data, the new information, the very limited four years of data that we gathered post the CEUS SSC model basically showed a scattered pattern that was similar to the pattern we saw before.

So there was no identified or new

cluster group that showed up in that short period of catalog. The next slide just shows a close up of the seismicity in the vicinity of the site, which is basically characterized by sparse seismicity within 50 miles.

This is the 50 mile circle, and there is spectra earthquake activity is near Cleveland to the southeast.

CHAIRMAN CORRADINI: Is that where the five was that you were talking about?

MR. YOUNGS: I don't remember whether there's a five in Cleveland. The five is in Anna, Ohio, which is I think down near the, to the southwest of the site.

CHAIRMAN CORRADINI: And the other thing you said that I want to make sure I wrote down, that even though you've identified all this, the biggest contributor still is, what's it called? I can't remember.

MR. YOUNGS: A large contributor to the hazard at low frequency is New Madrid.

CHAIRMAN CORRADINI: Okay. That's what I thought you had said.

MR. YOUNGS: And that's mainly because

it's a big event, and it occurs frequently in the model.

MEMBER STETKAR: Remember when he says frequency, that's acceleration, hertz. It's not annual frequency.

CHAIRMAN CORRADINI: Right, but I thought what he, he can say it again.

MEMBER STETKAR: At low ground motion frequency, half a hertz, New Madrid is driving the results. But it happened because it occurs frequently in time.

CHAIRMAN CORRADINI: That's what I said. That's what I thought he said.

MR. YOUNGS: Frequently in time.

CHAIRMAN CORRADINI: That's what I thought you said.

(Simultaneous speaking)

MR. YOUNGS: Low frequency response is driven by the New Madrid source --

CHAIRMAN CORRADINI: Okay.

MR. YOUNGS: -- even though it's 700 kilometers away. It's basically driven by that because it's a large magnitude, and it's predicted frequency on the order of every 500 years.

CHAIRMAN CORRADINI: Thank you.

MR. YOUNGS: So this is basically that, and then the next slide just shows after we've done the site amplification, the site will be discussed, the characterization will be discussed after I'm done.

But basically in terms of the GMRS we're dealing with a rock site with a relatively high velocity, so there was little amplification in the response, the hard rock spectra, to produce the GMRS, which is show here by the blue line resulting from the mean hazard curve.

So this is the performance-based ground motion model as specified in Reg Guide 1.208, and it is well enveloped by the ESBWR certified design response spectra, summary of --

CHAIRMAN CORRADINI: I'm sorry. I didn't mean to, we're all set.

MR. YOUNGS: Well, that's the end of 2.5.2.

CHAIRMAN CORRADINI: So questions for Bob? Anymore questions for Bob? Okay. So Ms. Hanson is next up?

MR. YOUNGS: Correct.

MS. HANSON: Yes. My name is Kathryn Hanson. I'm with AMEC E&I, and I'm going to speak to the work that was done to characterize surface faulting at the Fermi site.

The Section 2.5.3 addresses the potential, the surface deformation at the site from both tectonic as well as non-tectonic processes.

(Off record comments)

MS. HANSON: In accordance with guidelines outlined in Reg Guide 1.208 we conducted a number of studies and investigations to assess the potential for future surface or near surface rupture at the Fermi site and also within the site area, the five mile radius.

These included a review of the available site specific information, both from the Fermi 2 FSAR as well as the Fermi 3 COLA investigations.

We reviewed, compiled and reviewed, published and unpublished literature and data focusing particularly on the structure and tectonics of the site region and for surface faulting the site vicinity and side area in particular.

We focused our attention on southeast Michigan, northern Ohio and adjacent parts of Canada. We interpreted various types of aerial photographs and remote sensing imagery.

We conducted a lineament analysis and also this imagery and data sets were used to evaluate Paleo shorelines from glacial and post-glacial lakes.

As Greg pointed out, these were very useful datums for evaluating evidence for recent quarternary vertical deformation in the site vicinity.

The field investigations are involved consultations with, and field reconnaissance with local experts. These include geologists and seismologists from Michigan and Ohio surveys as well as some of the universities.

And we also discussed information with the Geological Survey of Canada. Quarries proved to be our best opportunities for exposure of both bedrock at quarternary deposits in the site vicinity.

And so we spent time doing reconnaissance on the ground as well as an aerial

reconnaissance with a helicopter to look at these exposures.

In one quarry, approximately ten miles from the Fermi site, some small scale tectonic and non-tectonic deformation features were observed.

We conducted detailed mapping of the quarry walls using a ground based lidar survey and also some trenching to evaluate the origin of those features and the timing recency of movement related to those bedrock structures that were observed in Bass Islands Group, bedrock similar to what was exposed at the, or is present at the Fermi 3 site.

This slide shows map structures and seismicity in the site vicinity. The dashed blue line is the 25 mile radius circle. The, none of the larger structures that lie just to the, on the margins of that and just beyond that.

This include the Bowling Green Fault and the Maumee Faults to the southwest and the Howell Anticline and related fault to the northwest.

Within the site vicinity, there are, minor structures have been identified. These include small faults shown in the gold and small

faults shown by the purple lines.

These structures are largely inferred from interpretation or sub-surface information from early oil and gas exploration. And they identified known faults, but they also postulated some inferred faults or possible faults.

These are shown by the dashed yellow lines, and, which the northern most one being the New Boston Pool and the southern most one being the Sumpter Pool structures.

The blue lines on this figure represent the previously mapped Paleo shorelines from these glacial and post-glacial lakes. And we use those to evaluate evidence for vertical tectonics in the site vicinity.

None of the known or inferred faults within the site vicinity have any surface expression, and none of them are clearly associated with any alignments of microseismicity or moderate sized earthquakes.

Next slide. The studies completed for the Fermi 3 COLA demonstrated that there are no capable tectonic sources within the site area or within the site vicinity.

The potential for both tectonic and non-tectonic deformation at the site is negligible. In accordance with License Condition 2.5.3-1, a detailed geologic mapping of the excavation will be conducted of the floor and walls of excavations for safety-related features.

And any geologic features identified within the excavations will be evaluated. And the NRC will be notified once the excavations are available, are open for examination.

CONSULTANT HINZE: Kathryn, my understanding is that license condition was driven by the concern with respect to voids in the Bass Islands Group or the Upper Salina Group.

What is your take on the study of the voids in the footprint of the nuclear island at Fermi 3?

MS. HANSON: Greg Ohlmacher can probably speak more specifically to that. I can point out that we did see some similar types of paleokarsts in the quarries, exposures that we logged in detail.

And so we have some, not only just boring data but also some exposures that provide

some information on that. But Greg is most knowledgeable about the paleokarsts.

CONSULTANT HINZE: Let me ask one question before Greg gets into this. Is it my understanding that there is only one drill hole in the footprint of the RB/FB? There is only one drill hole in that 40,000 square feet area.

MR. MEYER: This is Ed Meyer. We have, there's one right at the center of the reactor and then in accordance with Reg Guide 1.132 we went all the way around the perimeter, yes.

CONSULTANT HINZE: Do you think the one hole is sufficient to test the presence of voids in that footprint?

MR. MEYER: Based on the overall investigation, I would say that the site is thoroughly investigated. So I think the answer is yes because the spacing of most of the borings are very close.

CONSULTANT HINZE: The spacing of the borings are close, but there's a lot of room in that 40,000 square feet. It's approximately 200 by 200 feet. And so one drill hole in the center and goes around the parts, around March, there's a lot

of room for voids in that zone.

(Off record comments)

CONSULTANT HINZE: And I think that's why the license condition was implemented. I have a mapping of the surface of the --

MR. MEYER: Actually, if you look in the SRP, it's stated in there that that it required. So it actually comes out of the SRPs that it's very clear that that's going to be the requirement.

So it's really not associated with this site. It would be any site.

CONSULTANT HINZE: How would you recognize the presence of voids simply by surface geological mapping? There's all kinds of room for hidden voids, which could be of concern for the stability of the site.

MR. MEYER: Well, based on the investigation, and Greg could speak to this a little better than I can, we just didn't really encounter any. So based on the density of the borings we have, our conclusion is that there are no voids.

MR. MEYER: We do know as Kathryn has

pointed out that the quarry does have voids or paleovoids --

MS. HANSON: That have filled.

CONSULTANT HINZE: So it does occur?

MS. HANSON: As I said, Greg can speak to it best as far as the regional data as well as the site specific data on karsts.

DR. OHLMACHER: We do believe that there are paleovoids at the site and that they are filled, that that's what we did. We did encounter breccias during the sub-surface investigation. We did not encounter open voids during the investigation.

CONSULTANT HINZE: These are the center hole and those on the perimeter?

DR. OHLMACHER: Yes, that is correct.

MR. SMITH: How many holes did we drill in total on the site and in the vicinity of the power block?

MR. MEYER: I believe it was 60 or 70. Oh, in the power block?

MR. SMITH: No, in the vicinity. I mean we did some remotely but you said there --

MR. MEYER: 70 borings.

MR. SMITH: That's uniform, plus we had all of the borings from Fermi 2 --

MR. MEYER: Correct.

MR. SMITH: -- that we examined. So --

CONSULTANT HINZE: And these went through the Bass Island into the Salina, and none of them experienced any voids. If they were voids, they were paleovoids. They were filled. Okay. Thank you.

CHAIRMAN CORRADINI: So I knew this was going to come up, so just to make sure I've got it right in my notes. So the point is the licensing condition requires additional mapping as you get closer to the --

MR. SMITH: After you do the excavation and you've opened the excavation, you examine and make it available to examine the exposed rock.

CHAIRMAN CORRADINI: And then your point, Bill, is you're looking for, I'm sorry. Go ahead.

CONSULTANT HINZE: The license condition is surface mapping, and I'm concerned about hidden voids. This is very important that we are certain that there are not hidden voids in

there.

And there are ways to do some remote sensing of those hidden voids, but apparently, that's not been implemented.

CHAIRMAN CORRADINI: It's not part of the license condition.

CONSULTANT HINZE: That's right.

MR. MEYER: And one of the things we did in almost all the borings was optical televiewer. So we didn't just kind of forward cover it, and then the water was very clear.

And the resolution was very good. So we could actually see what we were going through in each one of these borings, and we just --

CONSULTANT HINZE: Well, it's a caliper log, right?

CHAIRMAN CORRADINI: That's correct.

CONSULTANT HINZE: Okay.

CHAIRMAN CORRADINI: Go ahead. I'm sorry.

MS. HANSON: I'm done.

CHAIRMAN CORRADINI: Then we're going to move to Ed, 2.5.4, Ed Meyer.

MR. MEYER: This is Ed Meyer. These

next slides address Section 2.5.4, Stability of Sub-surface Materials and Foundation.

Section 2.5.4 discusses the field and laboratory portions of the sub-surface investigation performed for the Fermi 3 site to characterize the soil, bedrock and ground water conditions.

Engineering properties of the sub-surface materials are then presented based on the information gathered during the investigation.

This section also portrays as the ESBWR interfaces with the Fermi 3 site and bedrock conditions, and there will a slide that comes up here later that shows that.

Based on the interface with the physical site and material properties, analyses were performed to confirm that the Fermi 3 site is well enveloped by the ESBWR standard plant design.

Next slide. The front surface investigation at the Fermi 3 site was performed from April to September of 2007.

The investigation was developed based on the guidance provided in NRC Regulatory Guide 1.132 Site Investigations for Foundations of

Nuclear Power Plans and Regulatory Guide 1.208 A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion.

The investigation including drilling sampling of the soil and bedrock and installation of physiometers. The locations shown on here are specifically at the location of Fermi 3.

In situ testing was performed for use in establishing engineering parameters for the soil and bedrock. Geophysical testing was performed for classification of soil and bedrock and establishing engineering properties.

Laboratory testing of the soil and bedrock was also performed to classify the samples, and again, establish engineering properties.

The results of the sub-surface investigation we used to understand the site area sub-surface conditions as Greg already discussed for Section 2.5.1, to establish the engineering properties of the soil and bedrock for use in engineering evaluation, to calculate the liable static and dynamic bearing capacities for the reactor building, fuel building, the control building and the fire water service complex, to

calculate rebounds due to excavation for foundations and settlements caused by foundation loading, and to calculate the static and dynamic lateral earth pressure.

The information gathered during the investigation was also used to assess construction considerations for excavation and the engineered granular backfill materials source.

And finally, investigation results were used to develop the description of the instrumentation and monitoring program for seismic Category 1 structures discussed in Section 2.5.4, 5.6. Next slide. Thank you.

This slide illustrates the foundation interfaces, the excavation and provides a cross section for the reactor building, control building and fire water service complex for Fermi 3.

The supporting material for the reactor building, fuel building and control building, as I've said, is the Bass Islands Group bedrock.

The fire water service complex is founded on fill concrete that extends to the top of the Bass Islands Group bedrock. The shear wave velocity of the Bass Islands Group bedrock is

approximately 6600 feet per second.

In our hard rock at the Fermi 3 site is at a depth of about 425 feet. This is where the shear wave velocity is greater than 9200 feet per second.

The sub-surface is characterized by near horizontal layers of soil and rock with uniform properties across the site. And this figure, as it says, has a 2.5 vertical, the horizontal exaggeration.

So any vertical variations here are exaggerated. There's no potential for liquefaction because the reactor building and fuel building and control building are on the bedrock.

The fire water service complex is on fill concrete that extends to the Bass Islands Group bedrock, and the engineered granular backfill surrounding will be well compacted. Next slide.

In conclusion, the Fermi 3 site sub-surface conditions consist of near horizontal layers of soil and bedrock with uniform soil and bedrock properties.

The reactor building, fuel building and control building are supported on the Bass Islands

Group bedrock. The fire water service complex is supported on fill concrete that extends to the Bass Islands Group bedrock.

The bearing capacities at Fermi 3 meet the ESBWR standard plant design demands, the upcoming discussion for Sections 3.7 and 3.8 will address the bearing demands from the site-specific soil structure interaction analyses, which are also less in the Fermi 3 allowable bearing capacities.

Foundation settlements are within the ESBWR standard plant design criteria. There are no liquefaction potential. Excuse me. There is no liquefaction potential because the reactor building, fuel building and control building foundations are on bedrock.

The fire water service complex is on fill concrete that extends to the top of bedrock, and the engineered granular backfill surrounding the building will be compacted to a dense consistency. Next slide.

And finally, the results in Section 2.5.4 demonstrate that the Fermi 3 site is well enveloped by the ESBWR standard plant design. And that's the last slide for 2.5.4.

CHAIRMAN CORRADINI: Questions for Ed?

MR. MEYER: With that, I've got, I do cover 2.5.5.

CHAIRMAN CORRADINI: Okay.

MR. MEYER: I can keep going.

CHAIRMAN CORRADINI: Okay.

MR. MEYER: This slide addresses Section 2.5.5, which is Stability of Slopes. There are no permanent slopes for Fermi 3 associated with cooling ponds, heat sinks, retaining walls, bulk heads, dams or jetties.

The only permanent slopes are used to transition 7.5 feet up from the existing grade to final plant grade, and these slopes would be 12.5 horizontal to one vertical, which is approximately four to five degree angle.

The slopes will be constructed using compacted, engineered granular backfill, which will be dense with a minimum angle of internal friction of 35 degrees.

Therefore, these shallow permanent slopes at the Fermi 3 site are stable, and that is all I have.

CHAIRMAN CORRADINI: Okay. General

questions, Ron?

MEMBER BALLINGER: I have a metallurgist question, which probably means it's pretty stupid. Is it possible for you to have an earthquake in one end of Lake Erie and have a wave come down that lake and impact the site?

MR. MEYER: You mean a tsunami?

MEMBER BALLINGER: I don't know. It's a lake. It would probably be an erector site tsunami if it's Lake Erie.

CHAIRMAN CORRADINI: We asked questions about flooding before. I remember.

MEMBER BALLINGER: I mean that's a long way. It's within that 700 kilometer.

MR. THOMAS: This is Steve Thomas from Black & Veatch, and as you mentioned, we talked about flooding in Section 2.4.

One of the subsections deals with the potential for a tsunami wave to hit the site.

MEMBER BALLINGER: Okay.

MR. THOMAS: And it does, it's basically, what you look at is historical information for the region to look at the potential for a tsunami wave. We concluded that wasn't a

concern for the site.

MEMBER BALLINGER: Okay.

CHAIRMAN CORRADINI: To give you a little background, I think this is back a couple years ago or three years ago, but I remember when we were discussing this there was a lot of discussion about flooding from a different source, which was a precipitation and also there's a --

MR. THOMAS: It's a wind driven surge.

CHAIRMAN CORRADINI: Thank you.

(Simultaneous speaking)

CHAIRMAN CORRADINI: All right, other questions for the team in front of us? I'm sorry.

CONSULTANT HINZE: The USGS has the eastern end of Lake Erie as a, not a zero slope stability region, but it has some potential through its slope stability slippage. Is that a result of the lacustrine rocks that are present in the area?

MS. HANSON: The eastern or the western end?

CONSULTANT HINZE: The western, I'm sorry.

MS. HANSON: Western, yes. I think along the Maumee River there's a lot of lacustrine,

and that seems to be the unit that's more prone to failure.

CONSULTANT HINZE: And you're eliminating that possibility by keeping the slopes below their critical limit?

MS. HANSON: Well, Ed can speak to that, but at the site itself we're, found that there's very shallow, and they're removing lacustrine and the fill from the vicinity of the safety area structures.

CHAIRMAN CORRADINI: Other questions? Okay. Why don't we take a break now because staff is going to come up. They'll get their shot at this. So let's take a break for ten minutes. We'll be back at 10:25 so staff can reassemble.

(Whereupon, the above-entitled matter went off the record at 10:15 a.m.)

CHAIRMAN CORRADINI: Okay. We're back. Tekia, are you going to read us your risk portion?

MS. GOVAN: I will start the presentation. Good morning. My name is Tekia Govan. I am the project manager for the review of Section 2.5 entitled Geology, Seismology and Geotechnical Engineering as the section is

contained in the FERMI Unit 3 COL application.

Today, the staff is here to present the findings of their review for Phase IV which has resulted in an Advanced Safety Evaluation Report with no open items.

Sections 2.1 through 2.4 of the staff's Advance Safety -- final staff B Advance Final Safety Evaluation was presented to the ACRS Subcommittee in August 2012.

So, this presentation that we'll be presenting today for Section 2.5 will conclude our presentation for Chapter 2 entitled Site Characteristics.

The staff review team consisted of myself, project manager, Tekia Govan; Diane Jackson our branch chief; technical reviewers Laurel Bauer, Sarah Tabatabai, Zuhan Xi and Luissette Candelario.

For this presentation, Laurel will lead the discussion for Sections 2.5.1 and 2.5.3. Sarah Tabatabai will lead the discussion for 2.5.2. And Zuhan will lead the discussion for 2.5.4 and 2.5.5.

We have a lot to discuss with these presentations. So, I'll turn it over to the technical staff.

MS. BAUER: Good morning. My name is Laurel Bauer. I'm going to be providing an overview of the NRC staff's evaluation of the FSAR Section 2.5.1 related to basic geologic and seismic information, and Section 2.5.3 related to surface faulting.

In the previous presentation, you saw the applicant provided an overview of the basic information that was included in these sections.

The staff evaluated the applicant's characterization of the regional and the site-specific geology, including the geologic history, the tectonic history, the stratigraphy and the potential for geologic hazards at the site. And this information address COL B and 2.5.1 address COL Action Item 20-26-A.

The staff focused on the applicant's characterization of the Quaternary geologic features. In the case of the FERMI 3 site, this was predominantly the glacial and post-glacial history of the site.

The staff evaluated the applicant's analysis of faults and potential faults, the potential deformation due to glacial isostatic

adjustment or the response of the earth's crust due to glacial rebound and glacial retreat, as well as non-seismic deformation features and the potential for deformation due to human activity.

The staff reviewed what the applicant did in their field investigations. We reviewed the lineament analysis and the data that was used for the analysis.

We also did our own literature review and then looked at the review, the evaluations that were done for FERMI Units 2.

The staff made two visits to the site. Once in July of 2007 to see some of the boring that was being done prior to the application being submitted, and then again in November 2009 to observe the applicant's field reconnaissance investigations.

We visited several locations at the site and surrounding the site, including the Denniston Quarry located approximately 10 miles from the site. And then also visited locations of paleoshoreline features as well.

In addition, the staff asked a number of RAIs to further clarity the information

contained in the application, and then also to supplement that information as needed.

This information supported the staff's review and will be B and is used in the staff's evaluations for vibratory ground motion, for surface faulting and then for the subsurface investigations that were completed.

And the staff determined that the applicant had provided adequate B an adequate characterization of the geological features of the site in accordance with the NRC regulations.

Moving on to Section 2.5.3, the information that was provided by the applicant in Section 2.5.1 as well as in 2.5.3 that went into the geologic, the seismic and the geophysical investigations that were conducted, were used to determine the potential for surface faulting at the site, both tectonic and non-tectonic deformation associated with faulting.

And this is within an eight kilometer or five-mile radius of the FERMI 3 site. And based on the staff's review, the staff concluded that the information that was provided, that the applicant had provided a thorough characterization of the

potential for deformation at the site.

Are there any questions on the geologic information and the surface faulting information?

CONSULTANT HINZE: Well, Laurel, you're satisfied that there has been a sufficient amount of investigation and looking forward to the license condition with the surface mapping, that there are no voids at the footprint of the nuclear island?

MS. BAUER: We believe that with the evaluation that we did looking at the bore hole information, looking at the nearby quarries even with the paleokarst features, looking at excavations that were done for the previous units, that the staff could make a finding that we have reasonable assurance that there were no voids that would affect the stability of the site.

And we believe that with the license condition, what the license condition will do is provide further verification and other means for mapping to be done to look to -- just to verify that nothing is seen in the walls or in the floors of the excavations.

And just B I apologize. I meant to go into the license condition to clarify. This

license condition is not specific to FERMI, but will be implemented at all of the COL sites.

CONSULTANT HINZE: And it will be a surface mapping, but if anything is unbored in that mapping that there may be further investigations related to subsurface characteristics.

MS. BAUER: Certainly. I believe if something significant is found in those excavations, that would be the case.

CHAIRMAN CORRADINI: So, can I ask you a question just to understand, just a generic question? So, you excavate the site and you look at it.

What do you look for that gives you pause to look further?

MS. BAUER: Um B

CHAIRMAN CORRADINI: I don't, I mean B

MS. BAUER: You would look for any significant fractures or voids. You would look for anything significant in the walls where B similar to what we saw in the Denniston Quarry.

If there is any evidence of large voids or cavities in the walls of the excavations, that could be something significant, and then any sort

of fractures or features in the floors that they excavate.

CHAIRMAN CORRADINI: So, all this is a matter of judgement. So, when you say "large," something like a few feet?

MS. BAUER: Um B

CHAIRMAN CORRADINI: I'm just trying to get a feeling for what you guys B if you're out there doing it, what would you say, nah, not a problem, and, yeah, I B

MS. BAUER: We certainly see some paleokarst features that are on the order of, you know, a foot, a foot and a half or a couple of feet, maybe even a meter.

I'm going to refer over to my geotechnical engineer, also, in terms of the size of the feature that we would consider significant.

MR. XI: Well, from this site is, you know, from the bore hole results we notice that there is a, you know, the general voids is 0.1 meter. So, which is B I'm sorry. It's three cm. It's 0.1 foot. So, which is a very small void.

And also at B

CHAIRMAN CORRADINI: That's 1.2 inches.

MR. XI: Yeah, right, right, right, yeah.

CHAIRMAN CORRADINI: You just said three centimeters.

MR. XI: It's three centimeters, yeah. We can call 0.1 B

MEMBER BROWN: Yeah, but 2.54 centimeters per inch, isn't it?

CHAIRMAN CORRADINI: No, but I'm just trying to B

MS. BAUER: You're asking what B

CHAIRMAN CORRADINI: I'm just trying to understand B

MS. BAUER: -- type of size we would be concerned with.

CHAIRMAN CORRADINI: You start digging around a hole, and you look at the hole and you see funny things on the walls of the hole.

At what size of the funny things do you start going, hm, let's do more than surface mapping?

CONSULTANT HINZE: Well, you know, surface mapping can really help you. What it can do is if there are a large number of voids, what

you will have B in the subsurface that are hidden, chances are that you will find an irregularity in the surface that is manifestation of voids. And these may be from six inches to several feet.

But typically if you have a lot of solutioning, that bedrock surface is going to be very irregular.

CHAIRMAN CORRADINI: Okay.

CONSULTANT HINZE: And if you find that it's smooth, that it's been smoothed by the glaciers, I don't think you really have anything to worry about.

And that's how I would handle it in a surface mapping B

MS. BAUER: And I think looking in the walls, too, one difference would be whether or not they're filled or open voids.

MEMBER BROWN: Are these voids in bedrock? Are we talking about bedrock voids? Not talking about sticking a backhoe down through dirt and we see B

MS. BAUER: We're talking about bedrock.

MEMBER BROWN: Bedrock, okay.

MS. BAUER: We're talking about the

Bass Islands Group.

(Speaking over each other.)

MEMBER BROWN: I was trying to get a calibration, that's all.

MR. XI: And also from the investigation and these what we call small voids, is that you fill voids.

MEMBER BROWN: How do they get filled? How do you fill a filled void from a B

MR. XI: Oh, this is from the OTB, Optical B

MEMBER BROWN: What's it filled with? More rock or B

MR. XI: Surface material.

MS. BAUER: Surface material.

MEMBER BROWN: Oh, surface material.

CONSULTANT HINZE: Into them, and that could reach through to the surface and cause B

MEMBER BROWN: Okay.

CONSULTANT HINZE: -- depressions. Significant depressions.

MEMBER BROWN: Okay.

MEMBER BALLINGER: A void, to me, is something that's encapsulated.

CONSULTANT HINZE: Well, they aren't tight, because they are B they've been produced by the movement of water through them.

MEMBER BALLINGER: Fissures.

CONSULTANT HINZE: So, there is movement through them and there are voids. And if you've ever been in a cave, that's what we're talking about.

MEMBER BALLINGER: I live in a cave.

(Laughter.)

(Comments off record.)

MEMBER BROWN: Okay, you've answered my question.

MS. BAUER: Okay.

MEMBER BROWN: Thank you.

CONSULTANT HINZE: Excuse me, but I would like to point out that there is an omission which I think is kind of serious in Figure 2.5.1-213. That's a map showing the seismic reflection profiles.

And you have the applicant and you have missed the fact that there are some profiles in Lake Erie which are in close proximity to the site that are not shown.

And those are in a couple of publications. One in Geology, and one in the Canadian Journal of Earth Science.

MS. BAUER: Okay.

CONSULTANT HINZE: I happen to be a co-author of them. So, I B

(Laughter.)

(Comments off record.)

MS. GOVAN: And you referenced Figure 2.5.1-13?

CONSULTANT HINZE: 213.

MS. GOVAN: Okay. Is that an action for the staff to come back?

CHAIRMAN CORRADINI: You don't have to come back. So, his comments were transmitted to staff, I think, about these references that he had that the staff should at least be aware of.

MS. GOVAN: Okay. Thank you.

MS. BAUER: All right. We're moving on to 2.5.2 with Sarah Tabatabai.

MS. TABATABAI: Good morning. My name is Sarah Tabatabai. I was the reviewer for FSAR Section 2.5.2 which describes the development of the site-specific GMRS.

Our review focused on COL Information Item 2.0-27(a) which includes all of the seismic information used to develop the site-specific GMRS.

Our review also focused on the applicant's response to RAI 01.05-1 which addressed the Fukushima recommendation 2.1 seismic hazard reevaluation.

Next slide, please. So, this is an outline of the presentation. First, I'll provide a brief background related to the 2.1 seismic hazard reevaluation. Then, I'll just briefly summarize the CEUS SSC model.

I won't summarize the applicant's discussion of FSAR Section 2.5.2, because they already did that.

Then, I will discuss the ACRS Subcommittee action item which is a discussion of Hazard curve uncertainty.

Then, I'll summarize our staff evaluation, what the applicant provided and then I'll also present an additional staff confirmation which was not in the SER and it includes an analysis related to the updated EPRI ground motion model, doing a calculation with that showing that

it was indeed produced a lower GMRS than the EPRI 2004-2006 model. And then, I'll just summarize our conclusions.

Next slide, please. So, this is just some background related to the 2.1 seismic hazard reevaluation.

So, originally the FERMI 3 COL FSAR Section 2.5.2 GMRS was based on an updated ERPI-SOG 1986 seismic source model and the EPRI 2004-2006 ground motion model.

However, since that was developed and the NRC issued RAI 01.05-1 in May of 2012 which addressed Recommendation 2.1 of the Fukushima Near-Term Task Force, this RAI requested the applicant to evaluate the potential impacts of the CEUS SSC model which is documented in NUREG-2115 on the seismic hazard at the FERMI 3 site and then, if it was necessary, to make any changes to the GMRS and for our foundation input response spectra, if necessary.

So, in response to RAI 01.05-1, the applicant made major revisions to FSAR Section 2.5.2 which included an updated PSHA, site response analysis and a GMRS which reflected the use of the

CEUS SSC model. And our review of this response is detailed in SER Section 2.5.2.

Next slide, please. So, I'm just going to give you a brief summary of the CEUS SSC model. There are three types of seismic source zones that make up the model.

The first is the Mmax, maximum magnitude source zones. And they're a bit -- basically, the CEUS is subdivided based on only maximum magnitude.

There's the seismotectonic source zones which are based on additional detailed seismotectonic information in addition to the maximum magnitudes.

And then you have the repeated large magnitude earthquake sources like the New Madrid source, and they're based on areas having two or more earthquakes with a moment magnitude greater than or equal to 6.5. And these source zones are based mainly on paleoseismic data.

And the figure here shows the logic tree, how these sources are incorporated into the model. And as you see, there's two branches. Mmax, maximum magnitudes branch, and the

seismotectonics zones branch.

And the RLME sources occur in both of these branches, because they are independent from these source zones.

On the next slide, here this figure shows the location of the FERMI 3 site shown by the red star. And this shows the locations of the RLME sources. And you can see the New Madrid source zone is here.

As Dr. Youngs said, it's about 700 kilometers away from the site. And it was the most significant source zone for the hazard out of the RLME sources.

Next slide. And this slide shows one of the Mmax source zone configurations. You can see the FERMI 3 site. It's located in the source zone known as the non-Mesozoic and younger extended crust.

And the next slide shows one of the configurations for the site's seismotectonic zones. And the FERMI 3 site is located in the mid-continent craton source zone.

CHAIRMAN CORRADINI: I'm sorry to slow you down, but B

MS. TABATABAI: Yes.

CHAIRMAN CORRADINI: -- what's the difference again?

MS. TABATABAI: So, the seismotectonic zones are based on detailed seismotectonic information as well as maximum magnitude, but this can include seismogenic depth, other, you know, regional fine-scale tectonic information whereas the maximum magnitude zones are just based on maximum magnitude like the largest magnitude that that zone could be capable of producing.

CHAIRMAN CORRADINI: Okay. Okay. Thank you.

MS. TABATABAI: Okay. So, I was going to briefly summarize what the applicant had done in FSAR Section 2.5.2 and how they addressed the Recommendation 2.1 reevaluation, but they did that in quite some detail. So, I'll just move on to our evaluation and the next slide.

The ACRS action item B I see Dr. Stetkar smiling.

CONSULTANT HINZE: Before you do that, can I ask a question?

You apparently agreed with the

applicant that you should include earthquakes that are triggered as a result of injection of fracking fluids?

MS. TABATABAI: We just reviewed the B

CONSULTANT HINZE: Because it's in contrast to what the USGS is doing.

MS. TABATABAI: Well, I looked at the US B as an independent review, I kind of B I just looked at the USGS catalog, earthquake catalog for that additional time period from 2009 to 2012. And I just kind of compared it to what the applicant did.

So, I included everything in that catalog. I didn't distinguish between triggered earthquakes or anything like that and it was similar. It was very similar.

I think as your concern was, there were more earthquakes. And, in fact, I did use a B I didn't convert it to moment magnitude. So, that would be the B

CONSULTANT HINZE: You know, that's another point that B

MS. TABATABAI: Yes.

CONSULTANT HINZE: -- Bob Youngs

pointed out that it would be well if you really emphasized the point that you are using magnitude and not moment magnitude B

MS. TABATABAI: Yes.

CONSULTANT HINZE: -- in that Figure 8 of the Section 2.5.2.

MS. TABATABAI: Okay.

CONSULTANT HINZE: But your feeling is that then the staff's feeling is that all earthquakes should be included whether they may be triggered or not.

MS. TABATABAI: Yeah, I think it B we didn't distinguish between those. Like, we didn't have a definitive answer whether that specific earthquake was B like, when I looked at the catalog, whether that was B it was included anyway as an earthquake.

MEMBER BROWN: It was included in your all's evaluation, but was it in theirs? That's what I'm trying to understand on the trigger thing.

CHAIRMAN CORRADINI: Can I ask a B before we get back to -- because he's asking a very specific opinion of you, but I want to ask a question.

How do you know it's triggered or not?

CONSULTANT HINZE: That's a slippery slope.

PARTICIPANT: I think there's still some debate there.

PARTICIPANT: That's a good question.

CONSULTANT HINZE: What you do is you compare the injection rate in the area with the seismic activity. And then the question is, how far can it extend?

What we're finding out now is that it can be up to, well, 30 kilometers, several tens of kilometers from the injection point.

So, it's a very B that's why I mentioned the word "slippery slope," because once you make that decision that you're going to exclude them, then you have to have very firm criteria for defining the trigger earthquakes.

And because of this USGS report that is just brand new which excluded them, I wanted to B

CHAIRMAN CORRADINI: Oh, okay. Then I misunderstood your question. So, your point is B your expectation is since it's hard to define them, it's best to include everything you observe.

CONSULTANT HINZE: That's certainly B

CHAIRMAN CORRADINI: That's what I heard you imply.

CONSULTANT HINZE: Right.

MEMBER STETKAR: And I think converting to moment magnitude and screening at a 2.9 gets rid of most of those anyway. That's the, you know, when you start --

CONSULTANT HINZE: But we are finding, you know, there are 5.6 triggered earthquakes, supposedly.

MEMBER STETKAR: Yes. Well, Oklahoma B

MS. BAUER: Well, I know with the Ashtabula earthquakes there's even, I mean, there's still some discussion on whether or not they're triggered or not triggered.

CONSULTANT HINZE: Yeah, the Lake County, you know, will forever be discussed, right.

CHAIRMAN CORRADINI: So, I got you to avoid giving your answer, but do you want to give an answer?

MS. TABATABAI: I'm good.

(Laughter.)

CHAIRMAN CORRADINI: Okay. Thank you.

MS. TABATABAI: So, now we're up to hazard curve uncertainty. So, we have an ACRS Subcommittee action item to discuss uncertainties relating to the hazard curves.

MEMBER BROWN: Mike, can I ask one question?

CHAIRMAN CORRADINI: Anything you want, Charlie.

MEMBER BROWN: Well, this is B I'm not sure I ask it correctly relative to Bill's triggered versus non-triggered, whatever, and the way it was explained by the applicant which I thought B I wouldn't say I understood it, but it seemed to make sense.

It sounds like you got to a satisfactory result without making the same approach that they did. In other words, you didn't convert to the moment, whatever you call them. You all stuck with whatever the basic data was and you drew your conclusions on a slightly different basis.

Am I correct on that?

MS. TABATABAI: Yes, but my conclusion was the same.

MEMBER BROWN: I understand that. I understand that. I'm just trying to B you have slightly different methodology and you came to the same conclusion they did that they were okay.

MS. TABATABAI: Yes.

MEMBER BROWN: Okay.

MS. TABATABAI: So, in response to the Recommendation 2.1 RAI, the applicant provided hazard curves including the mean and percentile curves for the CEUS SSC models, as well as the updated EPRI-SOG model so we could compare those.

On the next few slides, I compare the applicant's EPRI and CEUS SSC rock hazard curves. And I also show there's some corresponding uncertainty.

And in summary, the uncertainty increases in both models as spectral acceleration increases as measured by the fifth and 95th percentile hazard curves.

And then I also note that the EPRI-SOG hazard curve uncertainty is larger.

MEMBER STETKAR: Just for the record, that statement in that first sub-bullet is literally true. In a mathematical sense, it's

somewhat misleading.

For example, at 10 hertz in the applicant seismic hazard, the uncertainty is an ion measure. I'll get it right for my error factor. I'll talk about my 90 percent confidence interval.

At 0.001g, one-thousandth of a g is 3.8. And that you B

CHAIRMAN CORRADINI: What B

MEMBER STETKAR: 3.8. That's the ratio of the 95th to the fifth.

CHAIRMAN CORRADINI: Oh, the ratio.

MEMBER STETKAR: The ratio. It's the measure of the spread. At one g it's all the way up to 11.2. That is still a modest uncertainty. It does increase.

By comparison at 0.5 hertz, at 0.5 hertz B that was at 10 hertz, the numbers I quoted, 3.8 and 11.2. Remember those.

At 0.5 hertz at 0.001g, it's 7.4. And at one g it's 776. That is also an increase. It's a more dramatic increase.

MS. TABATABAI: I looked at B

MEMBER STETKAR: That's the source of my question.

CHAIRMAN CORRADINI: He's just repeating what he's doing to the applicant to you.

MS. TABATABAI: Okay.

MEMBER STETKAR: But I was going to say just making the statement that it increases B

MS. TABATABAI: Well, based on what I B

MEMBER STETKAR: -- could be the difference between one and 1.01, you know. That's also an increase.

MEMBER RICCARDELLA: What were your numbers at 0.5 hertz again?

MEMBER STETKAR: At 0.5 hertz at 0.001g, thousandth of a g, ratio of 95th to the fifth B

MEMBER RICCARDELLA: Yes.

MEMBER STETKAR: -- is 7.4.

MEMBER RICCARDELLA: Okay.

MEMBER STETKAR: And at one hertz, it's 776. So, a factor of 100 increase. And at two hertz it's B

MEMBER RICCARDELLA: Wait. Wait. Wait.

MEMBER STETKAR: Okay.

MEMBER RICCARDELLA: You said one hertz. You meant one g?

MEMBER STETKAR: One g. I'm sorry. Did

I say hertz? One g.

MEMBER RICCARDELLA: Got it.

MEMBER STETKAR: 0.001g at 0.5 hertz, 7.4. One g at 0.5 hertz, 776.

MEMBER RICCARDELLA: So, it's a factor of a hundred.

MEMBER STETKAR: Right. At 10 hertz, 0.001g is 3.8. And one g is 11.2. So, a factor of three and a half.

MEMBER RICCARDELLA: Yeah.

MEMBER STETKAR: An increase, but a modest increase.

CHAIRMAN CORRADINI: Compared to a factor of a hundred.

MEMBER STETKAR: Compared to a factor of a hundred.

MS. TABATABAI: Okay. Well, I do have some figures on the next slides, if you want.

So, the hazard curve figure I plotted, here I plotted the mean hazard curve per the EPRI-SOG, which is the lighter green curve. And the darker green curve is the mean for the CEUS SSC model.

And then I've also plotted the fifth

and 95th percentiles for both models. The lighter blue curves are for the EPRI-SOG model.

CHAIRMAN CORRADINI: And that just so I B that is what I'll call is the older B

MS. TABATABAI: EPRI-SOG is the older B

CHAIRMAN CORRADINI: So, in theory, the CEUS is B

MS. TABATABAI: It's the new model that they used for B

CHAIRMAN CORRADINI: -- better.

MS. TABATABAI: Yes, it's more B it's recent, yes.

CHAIRMAN CORRADINI: More recent, okay. That's a fair characterization.

MEMBER STETKAR: And it shows B it is a good plot. It shows much smaller uncertainty and uniform B relatively uniform uncertainty. Can't say uniform, but it's relatively uniform over a very, very broad range of accelerations.

MS. TABATABAI: Well, yes.

MEMBER STETKAR: And that's as you show at the 100 hertz. You also show it at the next slide at the B

MS. TABATABAI: Yeah, basically the plot

next to it using the percentiles B

MEMBER STETKAR: Oh, okay.

MS. TABATABAI: -- I calculated the standard deviation as a function of B

MEMBER STETKAR: Okay. Yeah, that's B

MS. TABATABAI: This axis is for the spectral acceleration increases for a hundred hertz spectral acceleration, and then I calculated the standard deviation.

And you can see both models it does increase. And I believe your concern at the STP meeting was, you know, that you were concerned that it wasn't increasing as a function of B

MEMBER STETKAR: My concern is not that it's not increasing, because it does increase. My concern is that it's increasing in a relatively minuscule amount.

Okay. Let me try something else because I want to try it on you. If indeed at high spectral frequencies, let's be showing a plot here of a hundred hertz which is certainly a high frequency, if indeed the site-specific hazard is dominated by relatively close earthquakes with moment magnitudes I think they said on the order of

let's say five to six, those are fairly modest earthquakes in terms of acceleration. Kind of 0.1g, if I remember things correctly.

I'm basically extrapolating what I may have is a reasonable amount of data at relatively modest accelerations, and the problem is we're looking at log-log space which can be very deceiving, out to events that have not occurred.

We have no evidence of B

MS. TABATABAI: You're also looking at B the source zones don't just rely on historical data. They have B

MEMBER STETKAR: Right.

MS. TABATABAI: -- built into them, you know, distributions for maximum magnitude and it's not just based on historical data. It's based on what that source zone could be capable of producing as well.

MEMBER STETKAR: Okay. I hear all those words and I still come back to the fact that I still don't understand why the uncertainty does not increase dramatically at very high accelerations on the order of one g.

I can understand why it may be

relatively modest on the order of 0.01 to 0.1g, because that's sort of where our experience base is, you know. We hope that our experience base is driving the results.

But when we go far beyond that experience base, I don't understand why uncertainties remain for all practical purposes essentially the same.

CHAIRMAN CORRADINI: We have a comment behind you. We recognize that.

MR. AKE: This is Jon Ake from the Office of Research. And if I could make a comment on that, Dr. Stetkar, I think it's B I would say that if you look at the uncertainty that's portrayed in the plot on the left that Sarah is showing us there, the difference between the fifth and 95th percentile, you know, the metric of merit we're looking at really is the B are the values on the Y axis which would be the annual frequency of exceedance.

MEMBER STETKAR: Uh-huh.

MR. AKE: And say, for example, at one g, the difference between the fifth and 95th is approaching two orders of magnitude factor of a

hundred uncertainty in the annual frequency of exceedance on that axis.

And at that B in PGA space at one g, these are not necessarily values we have not seen and we think that our ground motion models are perhaps not really well constrained by that, but they're certainly well-informed by data that are at or B at that value or above. So, the shape of our ground motion distributions we think are reasonable at that kind of value.

The difference between the curves that Sarah is showing between the CEUS SSC, the more recently developed model, and the older EPRI-SOG model which was developed in the '80s, is really the difference in the fifth percentiles as you'll notice from looking at that figure.

The 95th percentile values and the means aren't terribly different.

MEMBER STETKAR: They aren't terribly different. And that B okay.

MR. AKE: And I think the way to characterize that is the class of models that we're contributing to the fifth percentiles in those curves there in the older models are basically no

longer viewed as credible models more specifically in terms of maximum magnitudes and things like that.

And I think Sarah has a very good way to sort of point that out to us.

MEMBER STETKAR: So, essentially you're taking experts who were considered experts back in 1986 and said they didn't know what they were talking about and threw them out.

MR. AKE: I wouldn't necessarily characterize it that way.

CHAIRMAN CORRADINI: They haven't been considered in the new model?

MR. AKE: Actually, many of the same experts participated in developing B

CHAIRMAN CORRADINI: But they've rethought their approach.

MR. AKE: Right. Exactly. Well, there's new information. And I think Bill could speak to that a little bit, too.

CHAIRMAN CORRADINI: But if I might just get back, so, the B don't go away. Yeah, I'm still troubled because I made notes to myself and this is B it's kind of like Greek and I'm trying to

interpret, but it is true that the uncertainty range at high frequencies B

PARTICIPANT: Spectral frequency?

CHAIRMAN CORRADINI: Yeah, at high hertz the uncertainty is smaller than the uncertainty at low hertz.

And that's what John started with, with the applicant. And you guys or you folks see it and would agree with that, and I'm still unclear as to the why.

And what I heard is the explanation by the applicant was the why stems from the fact that the data is from lower acceleration seismic activity data which is available at high frequency, high hertz.

MEMBER RICCARDELLA: I thought the explanation was that large earthquakes drive the low-frequency response in general. And that the smaller earthquakes are what drive the higher frequency response.

And we've had a lot more of those smaller earthquakes. So, therefore, there's less uncertainty.

MEMBER STETKAR: But how big are those

small earthquakes? They're not one g earthquakes. They're smaller earthquakes.

MEMBER RICCARDELLA: Yes.

MEMBER STETKAR: So, when I go from small earthquakes to really big earthquakes at high hertz, why do I have essentially the same uncertainty in the recurrence frequency of those really big earthquakes of which we have none compared to the more modest where we do have evidence?

I don't understand that.

MR. AKE: If you look at the B and I believe they're in plots. I have to admit that I have B this is not an application that I have really spent much time with, but I am sure that there are plots of this type in the COL and in the staff's assessment that illustrate the so-called deaggregation fine magnitude and distance for these different areas of interest in this case with 10 to the minus four, to 10 to the minus five, to 10 to the minus six per year sorts of ranges.

And most of the time these, as you say, the higher frequency part of the spectrum is dominated by the moderate magnitude earthquakes.

Earthquakes in the order of high fives to maybe six.

MEMBER STETKAR: Sarah, go back to two slides earlier where you showed the B that's good.

MR. AKE: And as you said a moment ago, the lower frequency part of the spectrum, half a hertz, is dominated by the much larger magnitude earthquakes.

MEMBER STETKAR: Okay. And I can understand that. And I can also understand why very large earthquakes at a very large distance from the site would impart large uncertainty B

MR. AKE: Yes.

MEMBER STETKAR: -- to my overall results. What I don't understand is why relatively modest earthquakes relatively close to the site impart modest uncertainty about very large earthquakes at the site.

CHAIRMAN CORRADINI: So, you understood his question. Let me ask it a different way.

Are you telling me that built inside of the other curve which is the one which is acceleration versus hertz, built inside of that is a large uncertainty on the high hertz values for

large earthquakes, but they're so small in terms of acceleration that they're essentially swamped by the medium-sized earthquakes at the high hertz range?

In other words, I have a lot of uncertainty, but it's just at very low acceleration.

MEMBER STETKAR: Mike, all they're doing for the acceleration versus hertz is slicing this on vertical planes B

CHAIRMAN CORRADINI: I understand.

MEMBER STETKAR: -- and picking off the mean value here.

CHAIRMAN CORRADINI: Right.

MEMBER STETKAR: That's all they're doing.

CHAIRMAN CORRADINI: Right.

MEMBER STETKAR: That's all they're doing. So, if indeed the uncertainty is underestimated, that single curve that you're looking at would be suppressed.

CHAIRMAN CORRADINI: Okay.

MEMBER STETKAR: Because if the dark green curve should be higher because the

uncertainty is larger B now, in this plot, the problem is you B and I don't know how the people B how folks normally calculate these things. A lot of times they'll calculate a median and apply an uncertainty distribution in which case as the uncertainty increases, the spread between the median and the mean increases and mean goes up, but I don't know how they do that. That's what I'm trying to struggle with.

MR. AKE: Actually, the way this is calculated, what you see there is not B the reason that things change across the x axis in terms of the breadth of that distribution is that B and that's what's shown on the right plot that Sarah is showing there. It's not exactly the way you were talking about, Dr. Stetkar.

There are tens of thousands of individual hazard curves that are calculated. And then at each x value on the x axis, you're basically looking just at the distribution of values in that vertical transect above, say, 0.1g or one g or a hundredth of a g looking at the distribution of all of those.

MEMBER STETKAR: Okay.

MR. AKE: And that's how it's actually calculated.

MEMBER STETKAR: Okay. On the other hand, surprisingly enough if you plot out the distributions, they look an awful lot B they look like a log-normal distribution. I mean, if you look at the parameters in the distributions, they really look like a log-normal distribution.

MR. AKE: That's because it's dominated by the ground motion prediction equations which are assumed as B

MEMBER STETKAR: And that's exactly what I'm worried about.

CHAIRMAN CORRADINI: Is that enough?

MEMBER STETKAR: You know, I still don't understand why they behave B in simple terms, what I am coming to understand is B and I'll use the word "extrapolation." Is that at high hertz you're taking a model that looks at a fairly large number of relatively modest earthquakes and extrapolating from that out to big earthquakes that have not occurred.

MR. AKE: I don't think that's exactly true.

MEMBER STETKAR; Okay.

MR. AKE: For each of the individual magnitudes and certain distances you have a log-normal distribution of predicted ground motions. And those in most cases are constrained by simulations as well as they B the more data-rich areas like the western United States, the data for many of these magnitude and distance bins is well-populated and we think we have a very stable estimate of the B of behavior in the form of that log-normal distribution.

For the eastern United States, they were more dependent upon some of the simulations and the observations form moderate magnitude events, smaller magnitude events.

MEMBER STETKAR: So, my uncertainty should be larger.

MR. AKE: The uncertainties in the ground motion models for the eastern United States are larger than the uncertainties in the ground motion models for the western United States. And it's really driven by both the data available, as well as the simple, logical conclusion that you reached that in data-poor areas, how can I assume

that the uncertainty of my ground motion models are similar to or less than the western US.

MEMBER STETKAR: Right.

CHAIRMAN CORRADINI: So, I think at least you guys have communicated, but what I see is this is a generic thing. We're only, in substance, picking on the current applicant because we've seen this before.

So, I guess that's why I want to make sure that I'm understanding that you're trying to give us confidence in something that we're still unsure about, okay.

John, do you have more questions?

MEMBER STETKAR: No, because I B

CHAIRMAN CORRADINI: No is the answer, okay.

MEMBER STETKAR: I have a lot of questions. The problem is I don't know how the math is actually done. And without knowing how the math is really done -- you can say a lot of words that sound good, but without knowing how the math is really done, how those uncertainties are actually developed and quantified, you know, I can't say anything.

CHAIRMAN CORRADINI: Okay.

MS. TABATABAI: So, next I'm just going to summarize our staff evaluation. We did a PSHA confirmatory analysis using our own in-house software. And these figures just compare the one hertz spectral acceleration and a hundred hertz spectral acceleration.

And these are just for the background sources, because at the time we did these calculations we didn't have the full B we didn't have RLME sources, but this just shows the background sources and you can see there's a very good comparison between the applicant's and our results.

The next slide, we also did a site response confirmatory analysis. And there's a very good comparison between applicant's results and our results as well.

And then I just want to say that so we did an additional confirmation after this because like I said in the previous slide, we didn't have the full PSHA model, we didn't have the RLME sources incorporated into it yet.

And then also we used the EPRI 2004-

2006 ground motion model and that B the new updated one came out last year after the B our SER was completed.

So, I did another evaluation which is shown in the next slide using the full PSHA model and the updated EPRI 2013 model.

So, the green curves are our results or the GMRS results. The lighter curve is using the EPRI 2004-2006 model. And the dark green curve is the same results using the 2013 EPRI model and it's quite a bit lower.

In both cases, they were well below the ESBWR CSDRS.

CHAIRMAN CORRADINI: So, the difference between light and dark green is that the model is more recent.

MS. TABATABAI: Only difference B

CHAIRMAN CORRADINI: I was going to say "improved."

MS. TABATABAI: Yes, the dark green curve is the updated EPRI ground motion model using the more recent data.

CHAIRMAN CORRADINI: And the applicant in the dark blue is using the light green model.

MS. TABATABAI: Yes, correct.

CHAIRMAN CORRADINI: And the reason that the light green that you used is different than their blue is what?

MS. TABATABAI: Well, if you go to the previous slide, there are some differences like four hertz in our amplification function, but also I used a different approach to develop the GMRS.

I actually B because we're doing the recommendation 2.1 analyses and we're using a different site response approach which incorporated the uncertainty and amplification function.

So, basically I included that uncertainty to develop a GMRS. So, that's why there's, you know, a bigger difference.

CHAIRMAN CORRADINI: I heard what you said. I don't appreciate it.

MS. TABATABAI: Okay.

CHAIRMAN CORRADINI: Let me try one more time. Maybe if the rest of the Committee gets it, that's fine, but just B

MS. TABATABAI: The applicant in their approach, they just used the B they didn't incorporate amplification uncertainty into

developing the GMRS, you know.

There's uncertainty like you randomize your shear wave velocity profile so you have a suite of amplification functions whereas we actually incorporated that uncertainty, you know, for the different amplification functions into the GMRS calculation. So, that's why there's a difference.

But our conclusion using the 2013 EPRI model is it was still lower than the applicant's GMRS.

MEMBER STETKAR: By the way, just for the record, and this is important because I've raised this uncertainty issue, try as I might applying larger uncertainties at the higher frequencies, it's still B I still have a difficult time getting the site-specific GMRS to exceed the DCD GMRS.

So, we're talking about margins I don't B kind of 20 to 25 hertz we might be close, but I have a hard time, you know, using sort of broader distributions with behaviors that I would more expect, but that's just me.

I still have a hard time getting the

site to exceed the DCD. So, from a licensing perspective, a reasonable assurance perspective, I think the overall conclusion is still justified, you know.

In some sense, the margins between those curves will B well, as you can see, the difference between the light green and the blue, for example, the way you treat some of the uncertainties can affect those.

MEMBER BALLINGER: But it sounds like this uncertainty question is recurring.

MEMBER STETKAR: Oh, yes. We're three out of three now.

MEMBER BALLINGER: So, just so we're clear B

MEMBER STETKAR: This is the first one that I saw on the expected behavior at the low hertz even larger than expected, by the way, but at least the generally expected behavior.

MEMBER RICCARDELLA: Where it would come into play is if you were doing a seismic PRA as opposed B

MEMBER STETKAR: Well, that's B

MEMBER RICCARDELLA: -- to defining the

GMRS.

MEMBER STETKAR: Yeah, uh-huh. Right.

CHAIRMAN CORRADINI: Say it again, Pete. I'm sorry.

MEMBER RICCARDELLA: Where that would be significant is when you're doing a seismic probabilistic risk assessment B

MEMBER STETKAR: Right.

MEMBER RICCARDELLA: -- because then the uncertainties would come into play. But in terms of defining the GMRS, it's really not B

MEMBER STETKAR: Given this amount of margin, you know, or a site that had a lower margin B

MEMBER RICCARDELLA: That also includes the design factor on the GMRS, too.

MEMBER BALLINGER: But it still sounds like somebody ought to tackle this question and B

MEMBER STETKAR: Well, it is. And the only thing I'm trying to do is get on the record for the FERMI, you know, the subject of today's discussion is that, as I said, try as I might, I can't, you know, I can fit in wild uncertainties in there, but I have no basis for that.

I can't get, you know, in terms of a reasonable assurance conclusion, I can't get the site-specific GMRS to exceed the envelope which is, you know, from the staff's perspective and our perspective here in terms of the FERMI COL, the ultimate conclusion.

On a broader perspective, I'd still like to understand that. I think, you know, we may want to discuss this more with the staff in a different venue generically because obviously it does affect, you know, all of the Fukushima response plants.

And certainly any of them, a large number of them are going to be doing site-specific seismic PRAs.

MEMBER BALLINGER: So, this needs to be addressed before B

MEMBER STETKAR: Should have been addressed, you know, a year ago B

MEMBER BALLINGER: Yeah.

MEMBER STETKAR: -- but that's okay.

CHAIRMAN CORRADINI: We're just talking with each other.

MEMBER STETKAR: Remains in the past.

CHAIRMAN CORRADINI: I think you've characterized it appropriately. Thank you.

MS. TABATABAI: So, in summary, our review concludes that the applicant has provided sufficient information to satisfy the requirements of NRC regulations.

We determined that the applicant has adequately addressed COL Item 2.0-27(a) related to vibratory ground motion.

We also determined that the applicant has adequately addressed the Recommendation 2.1 RAI.

MS. GOVAN: That's the last slide for Sarah. Are there any questions?

CHAIRMAN CORRADINI: I think we've asked enough.

MS. GOVAN: All right.

MR. XI: Hello. My name is Zuhan Xi and I'm the geotechnical reviewer of 2.5.4 and 2.5.5.

This slide is a summary of FSAR Section 2.5.4. It presents the stability of subsurface material and the foundation that relate it to FERMI 3 site.

The main review area described as

follow: The engineering practice of subsurface material, foundation interface, geophysical surveys, excavation and backfill, groundwater conditions, response of soil and rock dynamic loading, liquefaction potential and aesthetic stability.

This slide figure shows the plan view for the excavation for ESBWR technical structures including seismic Category 1, reactor building, fuel building, control building, fire water service complex. Seismic Category 2, turbine building and non-seismic radwaste building.

The reinforced concrete diaphragm actually is outside of the B is for the excavation support and safety control system. The reinforced concrete diaphragm will act as the parameter of the soil excavation.

Next slide. Now, this slide is previous showed by the applicant. So, this figure shows one of the cross-section which demonstrates the relationship among structure. So, rock, excavation and backfill.

Okay. The existing glacial till will be removed within the parameter of the soil

excavation and the seismic Category 1 structure.

Bedrock unit encountered at FERMI 3 include Bass Islands Group which is red color, and Salina Group, Unit F, E, C and B.

Seismic Category 1 structures are founded actually partially embedded into the B either into the bedrock, or it's founded on the concrete, fill concrete.

Engineering, this is a B engineering granular fill will be used as a backfill surrounding seismic Category 1 structure.

This is a vertical B this is reinforcing diaphragm wall which extend to the B into the bedrock where it acts as a parameter of the soil excavation and it will provide a vertical excavation support and seepage control.

Next slide. This slide discuss about the shear wave velocity issue for the backfill. Before ESBWR DCD Revision 7, shear wave velocity of 1,000 feet per second for material surrounding the embedded wall was not required.

Newer ESBWR DCD revision requires the minimum shear wave velocity of 1,000 feet per second for both supporting foundation material and

the material surrounding the embedded wall.

So, during the COL review process, the staff asked for several RAIs and held a public meeting to discuss this issue.

The applicant decide that the design for the backfill surrounding the Category 1 structure would not meet the DCD soil property requirement to maintain these 1,000 feet per second of shear wave velocity for backfill surrounding a seismic Category 1 structure.

So, the resolution proposed by the applicant is that in event B in the event that generic soil property requirements cannot be satisfied, that DCD allows performing site-specific analysis to demonstrate the adequacy of the standard plan design.

Actually, specifically Note 6 to DCD Tier 1, Table 5.1-1; and in Note 16 to DCD Tier 2, Table 2.0-1 state for site not meet the soil property requirement, a site-specific analysis is required to demonstrate the adequacy of the standard plan design.

The applicant decide to use granular backfill to surround the Category 1 structure and

to perform a site-specific SSI analysis in accordance with the DCD note to demonstrate the adequacy of the site and in adherence to the standard plan design.

The conclusion is the staff find that the alternative of using site-specific SSI analysis to determine the adequacy of the standard plan design is acceptable in accordance with the ESBWR DCD.

The staff concludes that the 1,000 feet per second shear wave velocity requirement for backfill surrounding seismic Category 1 structure may not be maintained based on the findings for the site-specific SSI analysis documented in the FSAR Section 3.7 and 3.8.

I think that these detailed evaluation will be presented by the structure reviewer for 3.7 and 3.8.

This slide is discuss the issue about potential aging effects on concrete exposed to sulfate-containing solution.

According to the groundwater table of FERMI 3, the foundation and the sub-foundation concrete may be exposed to the groundwater.

During the review, the staff found that all sample results from sulfate concentration from the monitoring well fell into the categories of moderate and severe sulfate exposure for concrete based on the definition of ACI 349.

Initially, the applicant proposed in the COL to use lean concrete to backfill volume between reactor building, fuel building and the control building and to support fire water service complex and the turbine building foundation. However, lean concrete is not designed to resist a groundwater chemical attack.

Then the applicant proposed a resolution. Said that the applicant will implement ACI 349 requirement for concrete exposed to the solution containing sulfate.

The applicant decide to use fill concrete instead of lean concrete to backfill the volume between the reactor building, fuel building and the control building and excavate bedrock and to support the fire water service complex and the turbine building foundation from the top of the bedrock to address the staff's concern about the chemical composition requirement for the sulfate

exposure conditions.

The staff confirm that ACI, that severe sulfate exposure such as the FERMI 3 groundwater condition concrete durability can be achieved following the guidance in the table 3.4 B Table 4.3.1 of ACI 349 by providing concrete containing Type D cement, controlling 0.45 maximum water to cement ratio and maintaining a 45 psi minimum concrete compressive strengths.

Next slide. This slide discuss there is two ITAACs involving in 2.5.4. The first ITAAC is for the fill concrete in the Category 1 structure.

As mentioned in previous slide, the applicant will follow ACI 349 to address the chemical composition requirement for sulfate exposure condition. And ACI 207.2R address thermal cracking control for mass concrete.

This ITAAC assure that the fill concrete was at least 4500 psi mean strength will be used under the Category 1 structures.

The second ITAAC involving is for the backfill surrounding seismic Category 1 structures. Originally DCD requirement additional to the

parameter listed on the slide also include parameters for shear wave velocity and skin friction.

As mentioned in the previous slide, the applicant applied site-specific SSI analysis to demonstrate that the shear wave velocity for granular fill is not necessary for the surrounding B for the fill B for the granular fill surrounding seismic Category 1 structure.

The applicant also eliminate the skin friction parameter for the seismic Category 1 structure between the structure and the granular fill.

Because of the strength of the bedrock and fill concrete, the friction resistance along basemat side between the wall and the granular backfill of the structure is not needed B not need to be credited.

The staff reviewed its calculation in FSAR Subsection 3.8.5 and confirmed that the skin friction resistance force provided by the basemat B basemat side parallel to the direction of the motion is not taken into account in applicant's analysis.

So, which is the applicant B the staff conclude that these skin friction force is not credited in the analysis.

Next slide. This slide is a B concludes the staff's conclusion. NRC staff reviewed Section 2.5.4 of FERMI 3 COL FSAR related to the stability of subsurface material in the foundations.

Based on the review of the applicant's provided information, response to the RAIs, staff evaluations and staff independent confirmatory analysis, the staff found that the applicant conducted its investigation at an appropriate level of detail, provide the design analysis contain adequate margins of safety for the construction and operation of the nuclear power plant, and meet the requirement of 10 CFR Part 50, 10 CFR Part 52 and 10 CFR 100.23. Yeah, this is all the B for the B the slides for the 2.5.4.

So, this slide is discuss about Section 2.5.5, stability of the slope. FSAR Section 2.5.5 addresses the stability of all earth and rock slopes both nature and manmade whose failure under any of the condition to which they could be exposed

during the life of the plant could adversely affect the safety of the plant.

Staff review include evaluation of slope characteristics and evaluation of design criteria and design analysis.

After review of this section, the staff confirmed that no slope failing at the site would adversely affect the safety of the nuclear power plant.

This is based on two facts. One is no nature or manmade slopes, dams, embankments or channels are in the proximity of the FERMI 3 site. The existing water channels located west of the FERMI 3 site will be backfilled as a part of site development.

The second factor is that the finished grade for the FERMI 3 site will be relatively flat and eight percent slope angle down from the periphery of the power block fill area without cut slopes.

Therefore, the staff conclude that the stability of slopes at FERMI 3 site is not a concern for the safety of the plant.

MS. GOVAN: And that concludes our

presentation for Section 2.5.

Any questions?

CHAIRMAN CORRADINI: Questions by the committee?

(No response.)

CHAIRMAN CORRADINI: Okay. Thank you very much.

MS. GOVAN: Thank you.

CHAIRMAN CORRADINI: I propose we continue. And you wanted to take on, if I remember correctly B

MS. GOVAN: Closure of ACRS action items.

CHAIRMAN CORRADINI: We'll call it closure of action items. So, I'm not sure who's going to come up or if you're all going to stay.

MS. GOVAN: No, we're all going to leave.

(Laughter.)

CHAIRMAN CORRADINI: Happily, I assume. Thank you very much. Thank you all. So, the next team will come up.

And just to remind the Subcommittee, so at least from the July meeting primarily, and then

a couple of leftover things from two and three years ago which I know it's burnt in your memories, there's some questions we've asked that we want clarify.

So, we're going to do that now for about a half an hour, then break for lunch. And we'll come back to Section 3.7 and 3.8 in the afternoon.

Adrian.

MR. MUNIZ: Yes.

CHAIRMAN CORRADINI: Good to see you.

MR. MUNIZ: Same here.

CHAIRMAN CORRADINI: Really?

(Laughter.)

MR. MUNIZ: Yes.

(Pause.)

MR. MUNIZ: So, my name is Adrian Muniz and we're going to be discussing now the closure of pending ACRS action items.

I'm going to have actually today with me Yiu Law and Eric Schrader who will be discussing two specific items that I will expand in my next slide -- to discuss with you the closing of those items.

So, the action items that we had still open from previous meetings on Chapter 1, we B when we last discussed it, there was a request from ACRS to provide information in the SER related to a technical qualification review.

We considered that action item closed in that we will be revising that SE to indicate that DTE is technically qualified to hold this license due to them holding a Part 50 license for a nuclear power plant and their demonstrated ability to be able to operate a nuclear power plant through FERMI 2.

In terms of Item Number 2, that was discussed in the previous session related to discussing the B any uncertainties related to the GMRS hazard curves.

I understand that you're taking on the item as a generic item. So, if you don't have any objections, we will determine this to be closed for FERMI specifically.

The third item that was related to discussing the flooding analysis B

CHAIRMAN CORRADINI: So, can I get back to Number 2?

MR. MUNIZ: Yes.

CHAIRMAN CORRADINI: So, again, I haven't discussed it with the Subcommittee, but my approach to this is that we've identified something generic that we don't understand.

We could be wrong. I mean, heaven knows, but we've identified something that's really generic and not necessarily applicable to this.

It may come up in the letter just so that we emphasize it to the staff or --

MEMBER STETKAR: To clarify, it's applicable to this, but B

CHAIRMAN CORRADINI: It's applicable.

MEMBER STETKAR: -- I don't think it will affect the overall B

CHAIRMAN CORRADINI: I'm sorry.

MEMBER STETKAR: -- the licensing conclusion.

CHAIRMAN CORRADINI: Thank you. He said it much better than I.

MR. MUNIZ: Okay.

CHAIRMAN CORRADINI: I was going to say it better, but he jumped in.

(Laughter.)

CHAIRMAN CORRADINI: Thanks, John.

MEMBER STETKAR: You're welcome, Dr. Corradini, sir. Sorry.

CHAIRMAN CORRADINI: Go ahead, Adrian. I'm sorry.

MR. MUNIZ: On Item Number 3, I was discussing the flooding analysis that was reviewed for FERMI 2. That item was discussed in an informal meeting with Member Stetkar on July the 28th. And so, we're carrying that as a closed item.

MEMBER STETKAR: And because we don't close things in informal meetings with single ACRS members, I B

CHAIRMAN CORRADINI: Particularly Chairman Stetkar.

MEMBER STETKAR: Particularly me, for whatever reason, I have a question about B the history of this is how did the revised -- the updated FERMI 2 flooding analysis compare with the flooding analysis done for the FERMI 3?

And in the subcommittee meeting, the last subcommittee meeting, we've had the response that let's just say I wasn't quite sure about.

As I understand it now, the same data B now, there's an input parameters where we use exactly the same data for each of the flooding analysis.

The differences are because of B differences in elevation between the two B between the two footprints of buildings and offsets in terms of shore, you know, from the shore and things like that.

So, if you look at wave height impacts and things like that, that's the only difference. And there are differences, but they're not because of fundamentally different models or input parameters. It's due to physical characteristics of the two different sites, and that's fine. I'll give you that.

MR. MUNIZ: Thank you. Item Number 4 basically was to discuss the evaluation of coping time for beyond site basis internal events. That was raised up in the last subcommittee meeting, as well as Item Number 4 B I mean Item Number 5 for Recommendation 7.1.

There was a question of discussing the environmental conditions for electronics for beyond

design basis event.

We conducted an informal meeting again with Members Corradini and Stetkar, and we are considered those items to be closed. But as John alluded to, we only use those informal meetings to determine that those are closed.

CHAIRMAN CORRADINI: So, let me try this one. Again, Member Stetkar will correct me.

MEMBER STETKAR: You've had notes on this one.

CHAIRMAN CORRADINI: Right, but I'll do it from memory so then you'll correct me. But as we understand it for the first B for the first three days because of the passive plant design, the 72-hour window the staff and applicant B applicant proposes and staff accepts the idea that essentially coping time during that time will be handled by passive features.

From three days onward as I remember from the July meeting, applicant has proposed, staff has put a license condition that they want to see essentially the ability to prove that the B now, I probably have this incorrect. So, jump in after. Is that the applicant is proposing the

three to seven days ancillary diesel and the associated power that it provides can essentially provide coping time.

What I've heard from the staff B what we heard from the staff in July was that in difference to that staff has put on a license condition that the applicant must show the ability for coping time beyond three days.

And the impression that I get from the staff is that that would be due to the regional flex facilities providing that ability to provide operator actions.

Where the ACRS is confused is looking for something is there is no guidance to the applicant on what's appropriate in terms of the allowable operator actions in that time period.

Do I have it close?

MEMBER STETKAR: Close.

CHAIRMAN CORRADINI: Okay. Does staff agree at least that B

MEMBER STETKAR: Let me see if I can try it in a little bit different way. The waiver on the up to 72 hours, I think we all understand that.

The question is, how is the 72-hour to

seven-day period going to be treated in B

CHAIRMAN CORRADINI: And the guidance for that treatment.

MEMBER STETKAR: The guidance, okay.

If indeed the onsite equipment, installed onsite equipment is going to be credited for that three-day to seven-day period, then there are questions about; A, the survivability of that equipment and; B, any operator actions, the feasibility of operator actions for implementing, you know, that equipment.

If the onsite equipment is not going to be credited and if it's, you know, all airlifted stuff coming in from offsite, well, that's a different issue.

But as we understand it, the staff is basically postponed in a B I can't call it a review. It will be an audit of that time period until after the COL was issued.

Is that right, Adrian?

MR. MUNIZ: So, we have Angelo Stubbs here who will be able to provide more information.

MR. STUBBS: Yes, this is Angelo Stubbs for the balance of plant and also reviewer on this.

I think you got pretty close.

For the first 72 hours B

CHAIRMAN CORRADINI: You're the third one at the bat. So B

(Laughter.)

MR. STUBBS: For the first 72 hours, the passive features and the design of the plant as reviewed in original ESBWR review showed a coping capability of our operator action and without bringing in any additional resources for the 72-hour coping capability.

In our review B and we looked at that as the -- at the order as a Phase 1, or a Phase 1 and 2. The Phase 2 is basically there as a bridge to get you to where you can bring offsite resources and equipment to support coping.

CHAIRMAN CORRADINI: That's Stage 2.

MR. STUBBS: Huh?

CHAIRMAN CORRADINI: That's Stage 2.

MR. STUBBS: That's Stage 2, but in the case of a passive plant you could basically accomplish that with your Phase 1. Your installed equipment could take you 72 hours.

So, the licensing condition that we

were issuing is for time beyond 72 hours, which is the final phase mitigation.

And like a lot of the existing plants, what we've seen with that is them coming in with an integrated plan. And at that time, they will give us primary alternative strategies for coping beyond those times periods.

Anything that they're going to credit, if they're going to credit the RTNSS equipment, they're going to credit offsite equipment, they have to come in and show that they meet the NEI guidance.

And the NEI guidance includes things like reasonable protection of equipment. And they include redundancy and N+1.

So, there is additional requirements beyond what you are having your normal design basis in the NEI guidance that tells them how to meet order 12-049. So, at this point, that's part of the licensing condition.

We have a B we have a B we've developed some guidance as far as inspection. There's inspection instruction that they're using for the current -- to do the inspections for the current

mitigating strategy, flex equipment and integrated plants and things like that. That would be extended to the new reactors.

MEMBER STETKAR: So, let me ask you. I think I get it. You're saying after 72 hours, there is a Phase 2. And the Phase 2 could have stages or things, but the B it's up to B given the license condition, it's up to the applicant to come back to you and say, this is what we're going to do in Phase 2 and it has to be in concert or it has to be in agreement with the NEI document.

That's what I heard you say.

MR. STUBBS: Sort of. I don't think there's really a real need for a Phase 2 for the passive -- because you have coping capability that already gets you out to the point where you can supplement your resources with the offsite B

MEMBER STETKAR: Let me try something here. I don't like the Phase 1/Phase 2, because there seems to be specific numbers being associated with that.

MR. STUBBS: Okay.

MEMBER STETKAR: So, just let's think about what you can do with what's in the plant B

CHAIRMAN CORRADINI: Versus what you can do outside.

MEMBER STETKAR: -- until your batteries aren't there anymore. And then what you can do after that out to infinity, because this is supposed to work to infinity.

And I don't care if you call them Phase 1 or Ralph. It's for 72 hours you can survive hands off until the batteries are dead. At 72 hours on this particular plant, the batteries are dead.

That occurs at different times on other plants, but this particular plant that happens to be 72 hours.

At that point from there to infinity, there has to be some type of mitigation strategy either using stuff that is housed onsite and eventually because you B no matter what happens you eventually run out of fuel oil, stuff that you fly in from offsite.

When you need the stuff from offsite, you know, airlifted or whatever, kind of depends on the survivability of the stuff that's onsite.

If it doesn't survive at all, on this

plant you would need it at 72 hours. If it survives for, you know, two and a half days, you would need it at five and a half days.

So, our question is, the staff essentially is saying they're postponing their B and, again, I can't call it a "review," because it's not a review. Their audit of those mitigating strategies until after the COL is issued in the post-72-hour time period however the applicant decides they want to accomplish that using some combination of things that are onsite versus airlifted, I think.

Right, Angelo?

MR. STUBBS: Yeah, pretty much.

MEMBER STETKAR: Yeah, without arbitrarily defining these things as Phase 1, Phase 2, Phase 3.

CHAIRMAN CORRADINI: So, you said it as, usually, precisely. Let me ask a different question then.

The criteria that you point to the NEI document still has at least in this case seismic or flooding assumptions that are yet to be determined.

MR. STUBBS: No.

MEMBER STETKAR: No. The assumptions are they're housed in facilities that can withstand the safe shutdown earthquake.

CHAIRMAN CORRADINI: Which in this case would be the GMRS.

MR. STUBBS: Well, in this case, you know, if they were to propose this equipment, there are B there are B there is information available on where they're housed and their ability B the protection that's provided for those.

Even as part of the RTNSS program there was B RTNSS D program there was information on that.

MEMBER STETKAR: Okay, but that's still safe shutdown earthquake.

MR. STUBBS: Yes.

CONSULTANT SHACK: There's an assumption in the NEI documentation that some of the equipment you have would be more robust than that because it's used at a, you know, the only thing that you have specific things for, it has to be housed in something that withstands the SSE.

Whether the onsite diesels would meet the B it seems to me that at least my B I might

have been totally happy with the way that's expressed in flex, but there seems to be at least an implication that you should be able to do more and you presumably have to demonstrate some margin of those built-in diesels, but I don't know.

MEMBER STETKAR: The problem is we haven't seen the staff's examination of any of that.

CONSULTANT SHACK: Of any of that for any mitigating strategy.

CHAIRMAN CORRADINI: Whether it be a current plant, or the new plants.

MEMBER STETKAR: Or the new plant. And this new plant we have B we don't have the opportunity because they've sliced it at 72 hours and said we'll get to the post-72 hours later.

MR. STUBBS: And the plant can also be used B this -- or an offsite supply generator. So, when we see the plan, we'll have a better idea.

Some of the plans we see for the other design actually as a primary strategy will want to use the RTNSS diesels, but they also have available the capability of using the offsite supply diesels which are located outside of the area that's

assumed to be affected by the beyond design basis event since it's at one of the regional facilities.

CHAIRMAN CORRADINI: So, let me ask you this because I'm still B it's the postponing of it, and then I'm still a bit fuzzy as to how robust is robust.

Let me B I think this is a fair question. For Vogtle and Sumner, I assume what you just said at the end is probably the approach expected, but you have yet to see that there, too. It's also a license condition on those plants.

MR. STUBBS: Vogtle is not a licensing condition. It was part of the B Vogtle had its license and they submitted their integrated plan last year for our review.

And at Vogtle, they do have the B as a primary strategy, they do go to the RTNSS diesels, but they say the RTNSS B in the strategy they say RTNSS diesels or the flex diesels from offsite.

CHAIRMAN CORRADINI: Okay. So, let's go with that just for clarification purposes. But if it's the RTNSS diesels, is it clear as to what those diesels have to stand in terms of B

MR. STUBBS: Well, I think that's the

reason they say or if B that's one of those if available, they will use B

CHAIRMAN CORRADINI: Okay.

MR. STUBBS: Otherwise they will use the B they're showing that they have the coping capability even without the RTNSS diesels in that case.

CHAIRMAN CORRADINI: Okay. All right. But I'm still stuck with a fuzziness here that concerns me in terms of it's kind of maybe out there and it's all being postponed per in a plan given to you with guidelines as long as they fit NEI are apparently going to be okay.

So, I'm sensing still uncertainty here. Am I misunderstanding?

MR. STUBBS: Uncertainty in the B

CHAIRMAN CORRADINI: In terms of what the applicant B what you're going to do once you get a plan and how you're going to evaluate it in terms of the guidelines of the review.

Am I misunderstanding?

MEMBER STETKAR: I think if you presume that the offsite from the regional support centers are guaranteed to be available, guaranteed to be

available whenever requested, whenever I scream for them B

CHAIRMAN CORRADINI: Then we're okay.

MEMBER STETKAR: -- then we're okay if you presume that. If I scream for them that, oh, my God, my building housing my RTNSS diesel generator fell down and I can't get through the (coughing), help me, help me from offsite, if they're offsite is guaranteed to be available at that time B

CHAIRMAN CORRADINI: When you need it.

MEMBER STETKAR: -- whether that's at 72 hours or four hours, because my batteries are only four hours, then everybody is okay because, you know, after the rubble cools, a miracle happens and you save the plant.

72 hours, if you've got 72 hours to figure out that the building fell down, that might be okay. If you've got four hours to figure out that the building fell down, you get on the phones that don't work and the radios that don't work and get the stuff airlifted to there within four hours, maybe not so much.

So, that's where the passive plants do

have this larger margin for evaluating the status of any of the equipment that they might be taking credit for that's physically housed at the site, because they do have that three-day period that they can survive provided the earthquake wasn't too big.

CHAIRMAN CORRADINI: Okay. That clarifies things. Keep on going.

MR. MUNIZ: Number 5, similarly we have B

(Comments off mic.)

MEMBER STETKAR: Go ahead.

MR. MUNIZ: Do you need any discussion on Item Number 5? This is on the same realm of Number 4 that we had an informal meeting to discuss this.

MEMBER STETKAR: Do you remember Item 5?

CHAIRMAN CORRADINI: I'm not remembering Item 5. I apologize, Adrian. I'm sorry.

MEMBER BROWN: Is that the spent fuel pool thing?

MR. MUNIZ: NO.

MEMBER BROWN: Some other subject.

MR. MUNIZ: Yes, it is.

MEMBER STETKAR: I think that was about the radiation.

MEMBER BROWN: The radiation levels and where you got those.

CHAIRMAN CORRADINI: We were not concerned in our side meeting, Mr. Brown. You weren't there. Phone call.

MEMBER BROWN: I was not B

MEMBER STETKAR: This is your chance to B

MEMBER BROWN: I made the point in the meeting, if I remember correctly B

CHAIRMAN CORRADINI: You did.

MEMBER BROWN: -- and they answered with an answer that I didn't particularly care for in that they were meeting a specific set of criteria based on radiation levels from the pool to the instrumentation. And took no account for any other higher level of design basis event radiation environment from the reactor building or some other spillage, if you want to call it spillage, something that contaminated or got through it, you know, to increase that background radiation.

And from a design basis event, I

thought that was not the proper approach based on our experience with the Fukushima experience where you've got very high radiation levels in the areas of the spent fuel pool.

So, to me, that's B I left that as an open item just because there was no answer. There was an answer, but I didn't consider it really the metrics that we've been trying to lay out a little bit for the B so, it's a committee decision whether we have B to decide whether we want to do that. And I would suggest that's where we resolve this.

CHAIRMAN CORRADINI: Okay. Keep on going.

MEMBER BROWN: So, it's still open.

MEMBER STETKAR: Adrian, bring me to September and explain B

MR. MUNIZ: Well, we have the staff member here today.

MEMBER BROWN: Well, the answer is going to be the same, isn't it?

MEMBER STETKAR: I don't know, but we'll hear.

AUDIENCE PARTICIPANT: Well, like I said, the answer basically is we have a guidance

and the FERMI is following the guidance. The guidance does not take into consideration additional radiation sources.

That's, like you mentioned before, what happened at Fukushima is that you have additional radiation. They lost B they had a meltdown, they had a radiation leak out of containment. That's why we B that's the purpose of the radiation strategies to prevent something like that.

Assuming that we have B you're already assuming that we already lost mitigation, that we already have an accident.

MEMBER BROWN: No. No, no. Part of the whole discussion was that the spent fuel pool instrumentation for post-accident monitoring was supposed to be developed. The thought process was to have it in place, not something you have a robot come in and put something in place. I mean, that was part of the earlier discussions.

So, it wasn't B it's a matter of what were the existing designs? The existing design is --

MEMBER STETKAR: Except that level instrumentation is only supposed to tell you when

you start to uncover the fuel. After that, you need to put water in there.

So, higher exposures or higher radiation fields than you get when you start to uncover fuel B

MEMBER BROWN: If you don't know B

MEMBER STETKAR: -- that instrumentation doesn't have to work anymore.

MEMBER BROWN: You don't know it gets uncovered because the other exposures damaged the B

MEMBER STETKAR: What I think they were telling me, telling us, that the instrumentation is qualified for the radiation fields down to B that you would get B

MEMBER BROWN: From the spent fuel pool.

MEMBER STETKAR: With level at the top of the fuel. In other words, zero additional water shield.

MEMBER BROWN: Exactly.

MEMBER STETKAR: Is that correct?

MEMBER BROWN: Yes.

AUDIENCE PARTICIPANT: It's one foot B

MEMBER STETKAR: One foot above B

CHAIRMAN CORRADINI: I think we're back

to, I mean, to summarize it as we left it and that's why I think when we were on the phone with Adrian and the staff, is that we want to not discuss it there, but bring it back here is that that's the design base now.

And at least personally, I'm having problem what the design base could be beyond that and this seems to me personally like a pretty extreme design base for that level of instrumentation to determine a trend and then have an action, but that's why we B

MEMBER BROWN: Well, I guess I would disagree with that, because we have an experience where we did have significant radiation enhancement from adjacent sources that could be much, much higher.

CHAIRMAN CORRADINI: Yeah, but they didn't have the level instrumentation that we're requiring here. They had no instrumentation.

MEMBER BROWN: Well, I understand that, but they had nothing to damage. We have something to damage. And if you damage it and it doesn't work, then you don't know whether the water's gotten down there or not. That was my point.

Now, if the Committee decides B

MEMBER STETKAR: Given a core melt on the --

MEMBER BROWN: Exactly.

MEMBER STETKAR: -- you're concerned that the fuel pool instrumentation might not B

MEMBER BROWN: Be operational. So, you don't know when you get to that point and then you need to add water. That is my point.

And somebody said, well, how do we determine that? It could be infinite. And the answer is, well, we have it B we do have the ability to look at something relative to already experience that gives you some level. How high was it? What were the levels?

Obviously an infinite source, you know, you can damage electronics where there are actually level designs that you can use which are not susceptible to electronics.

This design, I don't remember what they talked about, but it had electronics involved, if I remember. So, that's the thing.

I mean, you can build a level system for this which will tell you that and it's

impervious to electronics. It's nothing but wire and your basic problem is insulation and, you know, in cables and that's about it, but that's not what was being done.

CHAIRMAN CORRADINI: I think we understand.

MEMBER BROWN: Okay.

CHAIRMAN CORRADINI: I might personally disagree with you.

MEMBER BROWN: You never agree with anything I ever say relative to electronics.

CHAIRMAN CORRADINI: I didn't say that.

MEMBER BROWN: Yes, you did. You did that in 2009. I have a long memory.

(Laughter.)

(Comments off record.)

CHAIRMAN CORRADINI: I think we have it characterized.

MEMBER BROWN: Yes.

CHAIRMAN CORRADINI: We're going to have to return it to the full committee because it is open in the sense that I don't think we have all B everybody is on the same page.

MEMBER BROWN: Did I clarify it? I got

the point clarified so we've got it in the B

CHAIRMAN CORRADINI: I think in the full committee, we need to make sure that all committee members and the B

MEMBER BROWN: Yeah, I understand.

CHAIRMAN CORRADINI: -- staff understand precisely what that concerns.

MR. MUNIZ: I will suggest that we B

CHAIRMAN CORRADINI: Whoever's phone is ringing, shut it off, please.

(Pause.)

MR. MUNIZ: All right. So, going to Items 6 and 7, we actually have presentations today to give you.

On the Item Number 6, I'll turn it over to Yiu Law to discuss this action item from Section 3.2.

MR. LAW: Good afternoon, everyone. My name is Yiu Law. I work at Division of Engineering, Mechanical Engineering Branch. I'm the reviewer for Section 3.2 for seismic classification and quality group classification.

Member Stetkar had a question on closing out B on how the staff closed out a North

Anna Open Item 03.02.01-3 in the FERMI SER. There was a confusion as to how this open item was closed.

There are actually two issues. One is a documentation issue, and one is a technical issue. And I want to clarify the documentation issue first.

In the FERMI SER, there was a connection made between Open Item 03.02.01-3 and RAI 03.02.01-2. It seemed like we were trying to close out both those items using the technical issues in the Open Item 03.02.01-3 when in fact those two are completely unrelated topic.

RAI 03.02.01-2 talks about RTNSS equipment versus Open Item 03.02.01-3 talks about a list for OBE. So, I want to make that distinction first and we have since revised the FERMI SER to clarify that connection made.

Okay. Now, going back to the technical issues for Open Item 03.02.01-3 which is actually linked to a North Anna RAI 03.02.01-7 in that the staff requested the applicant to provide a list of OBE B under OBE load, a list of SSE under OBE load. And this is a guidance coming out from Standard

Review Plan 03.02.01 for seismic classification.

The applicant has since through North Anna 03.02.01-7, answered the questions with regulation 10 CFR Part 50, Appendix S. And specifically the section is Section IV(a)(2)(i)(a). It states that if the OBE ground motion is set to one-third or less of the SSE, then the requirements associated with the OBE ground motion can be satisfied without the applicant performing explicit response or design analysis.

And this has been a point of emphasis that the staff has been using to close out this particular item. So, basically the staff found that acceptable because that's what the regulation says.

MEMBER STETKAR: So, if I understand this, if I get through all of this, if my SSE B if I have a 0.3g SSE, you're saying that if my OBE is defined as one-third of that or 0.1g, I don't care whether any of the equipment survives at 0.1g or fails.

CHAIRMAN CORRADINI: I don't understand.

MEMBER STETKAR: According to what that says, I want to make sure I've got that, because

that seems to say that, by law, I don't care whether it fails or not at 0.1g.

It could fail at 0.005g, but I don't care, because I don't have to list it, by law.

MR. LAW: Well, the staff recognize that there is a discrepancy between the regulations and what is currently assessed in the Standard Review Plan.

In the next revision of the Standard Review Plan 03.02.01, we have since modified that particular statement requiring for the list of OBE B requiring for the list of SSE due to OBE.

So, instead of asking for B instead of asking for a list of SSE of the OBE, we changed it to an inspection level earthquake.

So, basically what assesses if an OBE occurs, there needs to be a list not at the design phase, but the applicant, you know, needs to provide a list at their discretion that will serve as an inspection list.

So, basically this B these equipments will have to be inspected if an OBE occurs.

MEMBER STETKAR: Even if they're apart and in pieces on the floor.

MR. LAW: I'm sorry?

MEMBER STETKAR: What you're saying is there's no requirement that the equipment survive the OBE. It's just that after the OBE happens, you have to go look around to see whether or not it's standing or not, right?

MR. LAW: Currently based on the regulations, yes.

MEMBER STETKAR: Right. Okay. As long as we're all clear on that.

CHAIRMAN CORRADINI: Does that make any sense?

MEMBER STETKAR: Of course it does.

(Speaking over each other.)

MEMBER STETKAR: This is like the heater drain tank. It didn't have to survive an SSE. But to keep the plant operating, it ought to survive an OBE, but there's no requirement to evaluate whether your heater drain tank survives an OBE.

Heater drain tank falls apart two stories down in the turbine building, I guarantee you the plant is not going to be operating, but there's no requirement to evaluate that heater drain tank at the OBE acceleration.

And you don't even have to list it. Because if you, by law, defined your OBE at one-third of your SSE, then you don't care. The law presumes that everything survives.

MEMBER BROWN: Even though it may not be designed to survive at that level.

MEMBER STETKAR: Right. And I'm just saying, well, after that OBE happens, you have to go out and look at that stuff.

MEMBER BROWN: Only if it's on the list. Only if it's on the list regardless of whether there's parts laying around. That's what I got from your B

MEMBER STETKAR: Well, I'm not sure about the list.

MEMBER BROWN: But the list is at the applicant's disposal.

CHAIRMAN CORRADINI: Let's let him clarify that. Now, I think I get it.

Did we interpret what you said correctly?

MR. LAW: Based on the regulation, yes.

MEMBER STETKAR: So, what is the staff going to do about it? Because it's goofy. That

was the B see, the genesis of this is that in North Anna they referred to their RTNSS list of equipment.

MR. LAW: Right.

MEMBER STETKAR: And the RTNSS list of equipment is not stuff that B it's supposed to B not all of the RTNSS equipment, some subset of the RTNSS equipment at least in the ESBWR DCD, was qualified to survive NSSE.

I mean, it was characterized to seismic Category 2, but they said they're going to design it -- not all of that RTNSS, but that's RTNSS equipment. That's for not melting the core. It's not for keeping the plant operating at some seismic event.

But North Anna referred to the RTNSS list which led to the original question about, well, how does RTNSS, you know, there's no real nexus between RTNSS and equipment that's supposed to survive in OBE.

That started this whole process way back in the North Anna days and it was just transferred, as the staff mentioned, partly kind of a bookkeeping thing.

But as I understand it, all applicants thus far have referred to this part of the regulation as justification why they don't need to supply a separate set of equipment that should survive an OBE.

MR. LAW: The applications that I have reviewed personally, I have seen the same thing, yes.

CHAIRMAN CORRADINI: So, what is the staff going to do about this?

MR. LAW: Well, the one step that we took was in the next revision of the Standard Review Plan, Revision 3, I believe, that's coming out in 2014 or 2015, you know, we clarified that the list of OBE is not required at the design stage, but a list of B I mean a list of SSE is not required at the design stage, but a list of SSE serve as an inspection list that is per the guidance is required, you know, if an OBE happens. So, that's the one step that we took, you know.

CHAIRMAN CORRADINI: So, let me say it back to you and then B because I want you to move on. I think we need to move on.

So, you're going to B you're requiring

a list. What I'm asking is, this is a generic thing that affects not just FERMI, but affects all of them. So, is there going to be a generic fix to this? Is the staff on its way to a generic fix?

MR. LAW: You mean changing the regulation?

CHAIRMAN CORRADINI: I don't care. Doesn't make any sense. So, who is empowered with starting to do something that makes more sense?

You can come back later about that, but it just strikes me that I understand what you're doing for the moment with FERMI. Fine, but more has to be done than that.

So, I guess we've just added to the generic B

PARTICIPANT: Our generic list of facts, yeah.

CHAIRMAN CORRADINI: Okay.

MR. LAW: All right. So, we're going to go into the last item, the multi-unit emergency planning. We have Eric Schrader here to go over the slides.

MR. SCHRADER: Good afternoon. My name is Eric Schrader. I'm an emergency preparedness

specialist in NSIR here at headquarters and I'm the lead reviewer for the FERMI 3 emergency response plan, Chapter 13.3.

An action was asked of the staff to review a public comment that described assess the failure of mission critical systems at FERMI involving multi-unit issues involving ways in which emergent scenarios would require evacuation of major metropolitan areas located within a 50-mile radius of the facility.

So, the first part of the B to address this, FERMI Unit 2 has an approved emergency response plan, meaning they meet all current regulations. So, there isn't anything to discuss at this point with FERMI Unit 2.

FERMI Unit 3 has submitted an emergency response plan with their COL that the NRC staff has reviewed and found acceptable.

Both plans have an emergency response plan containing two different emergency planning zones. One, a 10-mile EPZ emergency planning zone for which there needs to be a basis for evacuation and evacuation planning and that for B and an ingestion pathway emergency planning zone

consisting of an area of approximately 50 miles for which there is no requirement at this time for any type of evacuation planning or further B well, further planning out to that distance other than what is currently required for the states.

Currently there is no regulation requiring licensees or applicants to address a multi-unit event. Now, having said that, the FERMI 3 plan has two license conditions addressing the Fukushima report, specifically 9.3 recommendation.

One of those is at least 180 days prior to fuel load they will perform an assessment B will have completed an assessment of offsite and onsite communication systems and equipment required to ensure communications capability during a station blackout.

In that same time frame they will have affected any noted and needed changes to address those, that station blackout condition.

And secondly, they will have performed an assessment of the onsite and offsite augmented staff capability to satisfy a response to a multi-unit event and also have affected any changes noted in that assessment.

CHAIRMAN CORRADINI: So, can I ask a different question? So, I have a site with a 500-megawatt electric reactor, and I have a site with a 1,000-megawatt electric reactor.

Is the emergency planning zone different?

MR. SCHRADER: No.

CHAIRMAN CORRADINI: Okay. Thank you.

MR. SCHRADER: Uh-huh.

CHAIRMAN CORRADINI: So, if I had a site with a 2,000-megawatt reactor, would the emergency planning zone be different?

MR. SCHRADER: No.

CHAIRMAN CORRADINI: Okay. You've answered my question.

MR. SCHRADER: Twice.

CHAIRMAN CORRADINI: Well, I mean, a multi-unit site just says let it all happen together. It's just a bigger reactor.

MR. SCHRADER: Exactly.

CHAIRMAN CORRADINI: That's what I B unless I misunderstand the current practice. The current practice says you don't have to analyze for a condition that affects both units at the same

time.

I'm using a smaller scale unit, but it's the same thing. I can go up or down in the scale, but the emergency planning zone assumes that I have a single event at a single site and I plan for that.

Now, I have multiple events simultaneously at a single site.

MEMBER BROWN: With bigger consequences.

CHAIRMAN CORRADINI: If I had a 500-megawatt B I happen to have a few 500-megawatt reactors in my state. And they're in a single site. And that emergency planning zone is the same if I had a thousand, or a 1500 or a 2,000.

MEMBER SCHULTZ: In terms of the EPZ.

CHAIRMAN CORRADINI: Yes.

MEMBER SCHULTZ: But the other point here, and I think it's being addressed with these license conditions, is that you have two reactors of different design. And, therefore, the onsite B well, some of the offsite capabilities that would be required for emergency planning are somewhat different.

That is, you've got a different team

that's going to be evaluating Unit 2 than would be evaluating Unit 3. And they have to work in concert and together and independently to do the evaluation.

CHAIRMAN CORRADINI: So, you're concerned with more coordination here.

MEMBER SCHULTZ: Well, again, it's not my concern.

CHAIRMAN CORRADINI: Well, question.

MEMBER SCHULTZ: My question was really to allow the staff to react to the public comment, because in the forum of the last meeting we didn't have that B staff didn't have that opportunity.

CHAIRMAN CORRADINI: Okay.

MEMBER SCHULTZ: But, yes, and this is a preview to, I think, your next slide which is focusing on the broader issue of rulemaking.

Now, let me ask Mike's question a little differently. So, Unit 3 is being addressed here in terms of its operational capability and accident conditions.

Is there any reason to treat it differently than Unit -- from Unit 2?

MR. SCHRADER: No. The one nice thing,

if you will, about emergency preparedness is that it is really B it's not based on any type of plant design.

You still have to be able to do the same things regardless of what the plant design is.

MEMBER SCHULTZ: And you mentioned that the requirements are focused on the 10-mile EPZ versus a broader range of distance from the plant site B

MR. SCHRADER: Correct.

MEMBER SCHULTZ: -- for emergency planning. Part of the philosophy, though, of emergency planning within the 10-mile EPZ is to establish the onsite as well as the offsite communications and facility support from outside agencies, state, local and federal agencies, to bring to bear resources to the site.

MR. SCHRADER: Right.

MEMBER SCHULTZ: And part of the philosophy or part of the approach is to presume that having that capability to address actions within the 10-mile EPZ could be extended based upon all of the work that is done for the 10-mile EPZ, could be extended outside the 10-mile EPZ if it

were required.

MR. SCHRADER: That's correct also.

MEMBER SCHULTZ: To go with the idea that if you understand why you do it in a 10-mile EPZ, you'll understand how to do it beyond the 10-mile EPZ.

CHAIRMAN CORRADINI: And do current B I don't want to get ahead of you because you're about to do this slide, but do current drills have that scenario that you might have to do it beyond the 10 miles and you do some sort of drill planning?

I think that would be the next question.

MR. SCHRADER: No.

CHAIRMAN CORRADINI: Okay.

MR. SCHRADER: You have that option. Although, most licensees do not choose to exercise that option.

In their plan, they need to have B I have to be careful how I say this. They need to have the ability to extend those protective actions beyond the 10-mile EPZ.

They don't necessarily have to address what those would be, but they do have to have a B

the plan has to allow for them to do that.

CHAIRMAN CORRADINI: Okay.

MEMBER SCHULTZ: The plan also depends upon external agencies to make decisions regarding evacuation, for example.

CHAIRMAN CORRADINI: Sure. Well, all of this has to be coordinated with FEMA.

MEMBER SCHULTZ: Within that coordination at least in my experience, within that coordination in drills and exercises, those discussions about what's happening outside the EPZ do happen between the site and external agencies, or between external agencies and external agencies, but you're right.

The requirements aren't there, but of course those discussions and actions do happen in the context of drills or exercises.

MR. SCHRADER: They do in the aspect of when a protective action recommendation is given.

CHAIRMAN CORRADINI: I'm with you.

MR. SCHRADER: And that is a perfect segue into my next and last slide. Rulemaking described in SRM 14-0046 addresses the idea of multi-unit events.

Part of the idea of a multi-unit event is, as Mr. Corradini said, you have one site or B you have one unit or two units, you have 500 megawatts or a thousand megawatts. The EPZ size doesn't change.

However, what's at the core of these two concerns is the resources that would be required to address it onsite.

So, currently there is no regulation that says you have to be able to handle with your current ERO and with your current equipment and your current capabilities, an accident at both Unit 1 and Unit 2. So, these B basically these two license conditions will bear out those two B those two issues.

This rulemaking will require sites both applicants and licensees to do an analysis of their staffing to ensure the fact that they can handle these beyond design basis accidents simultaneously affecting both units, more than one unit at a given site.

CHAIRMAN CORRADINI: Let me ask a question. Maybe this is off topic for emergency planning.

Does the flex concept consider isolated, single-unit events, or multiple unit events B

MR. SCHRADER: Yes.

CHAIRMAN CORRADINI: -- simultaneously? Yes, multiple?

MR. SCHRADER: It does both.

CHAIRMAN CORRADINI: Okay.

MR. SCHRADER: The flex equipment as I understand it currently and I was fortunate enough to go to one of the demonstrations at TMI, it's up to the licensee to determine what potential equipment they would need for a beyond design basis event.

And then from that listing of equipment, tell the regional response center what equipment they need sent to them.

The regional response center is going to send an awful, awful lot of equipment. So, it's up to the site to prioritize what equipment they need so that that equipment is at the front of the line and not somewhere mixed in, in the back of the line.

Does that answer your question?

CHAIRMAN CORRADINI: Yes.

MR. SCHRADER: Okay.

CHAIRMAN CORRADINI: Thank you.

MR. SCHRADER: So, currently we don't have any regulation to do that. SRM 14-046 directs the staff to work on a consolidated rulemaking package that will address this type of B this type of an event.

So, that's the rulemaking that's expected to come out sometime 2016. And at this point, part of that is the dual unit, multi-unit potential.

Now, again, having said that, the FERMI 3 plan has already in it a description of an EOF and an alternate EOF that is sized big enough to hold both the Unit 2 and Unit 3 emergency response organizations.

So, they're already a little bit ahead of the game saying their EOF is big enough because of the marked difference in their technologies or their reactors onsite.

Whether or not they'll be able to have a single ERO will be up to them. And whether or not that's possible, I don't know. I don't know

that that will be an effort that they undertake or if it would be possible. So, they'll have to at least at this point make arrangements for housing both Unit 2 and 3 EROs.

And also, they've committed to at least once every eight years to test the EOF staff capability to handle an event simultaneously affecting both units.

MEMBER SCHULTZ: Okay. And is that B you call it a required drill. Is that expected to be a graded exercise? Is that what the staff expects that B

MR. SCHRADER: No.

MEMBER SCHULTZ: But it is B

MR. SCHRADER: It will be a requirement for them within their eight-year cycle. So, it could be B it will need to be evaluated, but it could be a drill or an exercise. It does not have to be a federally-evaluated exercise.

MEMBER SCHULTZ: At this point in time, but rulemaking may address this in a different way. The rulemaking that's ongoing for multi-unit events may cause B

MR. SCHRADER: I suppose that's a

potential.

MEMBER SCHULTZ: -- an outcome of a graded exercise.

CHAIRMAN CORRADINI: Okay.

MR. SCHRADER: Thank you.

CHAIRMAN CORRADINI: Thank you. Questions for B I assume we're done.

MR. MUNIZ: We're done.

CHAIRMAN CORRADINI: Questions for Adrian and the current team.

(No response.)

CHAIRMAN CORRADINI: Okay. Thank you very much. I think we know B we will talk at the end anyway about preparation, but I think we know where we sit relative to the leftovers from previous meetings.

So, with that, should we have lunch? So, let's have a recess. We'll be back at 1:30.

(Whereupon, the above-entitled matter went off the record at 12:30 p.m. for a lunch recess and went back on the record at 1:28 p.m.)

A F T E R N O O N   S E S S I O N

1:28 p.m.

CHAIRMAN CORRADINI: Okay. We=re now going to take up our next topic which is the applicant=s discussion of Sections 3.7 and 3.8.

MR. SMITH: Great. Okay, go to the next slide. So I=ve covered most of this previously this morning. Basically we did our SSI to address

the partial embedment in bedrock of the seismic category one structures and to evaluate the backfill of the seismic category one structures as permitted by the DCD. I had mentioned that we had initially done our initial SSI in the 2011/2012 time frame and used the subtraction method which was subject to some discussion regarding results from it. And then about the same time in 2012 the Fukushima term task force recommendation 2.1 which resulted in us re-evaluating the seismic hazard using this CEUS seismic source chart. And then we decided to re-perform all of our analysis which resulted in one set of coherent analysis using CEUS inputs and we used SASSI 2010 wherever possible. So, just to B next slide.

Basically we are just going to continue on and talk again about the ground motion inputs for the SSI. Bob Youngs is going to do that. And then we=ll turn it over to Bob Hooks who is going to talk about the SSI analysis and results and the stability and soil pressures for seismic category one structures. So again just to summarize we did the SSI and SSSI, soil structure interaction and structure soil structure interaction analysis to

demonstrate that our site is well by the ESBWR standard design. Again you see U.S. inputs, counter for the partial embedment although the building control building in the bedrock and valuated the backfill. So, with that I will turn that over to the seismic inputs. Bob.

MR. YOUNGS: Good afternoon. This is again Bob Youngs of AMEC. I will discussing a development of the seismic design inputs for the analysis of the structures. The seismic design inputs were again based on the seismic hazard assessment that was conducted with the site using the CEUS SSC seismic model and the EPRI 2004/2006 ground motion models that we presented this morning. So in terms of developing the inputs necessary for SSI, we need to develop foundation input response spectrum because the inputs are defined at the foundation level of the reactor building, fuel building and as a foundation of the control building. So to do that we provide the site specific amplification functions from the hard rock level down about minus 400 feet up to the

foundation levels of these two buildings. We performed those analysis accounting for the presence of the backfill. An analysis of the site response in the full column that will present at the site, including the 37-feet of engineered granular backfill. Then we obtained amplification functions from the hard rock up to the foundation levels and we obtained those as EPRI motions from within the soil columns. What are called soil columns, amplification functions. We used those to develop the foundation input response factor at the foundation levels of the reactor building and fuel building and at the foundation level of the control building. Once those were developed we then evaluated their appropriateness considering other requirements and actually enhanced the FIRS to satisfy the minimum ground motion requirements specified in 10 CFR Part 50, Appendix S, which would basically involve looking at .1G Reg Guide 160 spectrum in making sure that our FIRS envelope got the spectrum as well as the site specific spectrum. And then we also enhance them to satisfy the requirements in the ISG-17 recommendations for hazard consistent spectrum at the foundation level

and at the surface level. The both of those led to enhancements of the FIRS above what was computed directly from the amplification functions. Once we had developed the enhanced FIRS, we then selected a seed time history and matched that time history to the FIRS for input into the analysis. We selected a record from the magnitude 7.6 Chi-Chi Taiwan earthquake. And we chose that record because we wanted the long duration record representing a large distant earthquake to have a significant contribution to the hazard at the site from a large earthquake. So it=s a long duration record that we used for that. And then we also developed dynamic properties for analysis considering the properties in the rock and then the range of possible properties in the granular, engineered granular backfill. So that=s basically a description of the analysis and this will show the results of what we mean by the FIRS and then the enhanced FIR. So on this figure we see on the left is the horizontal and on the right the vertical spectra for the reactor building and fuel building. So the red line, red curves are the ESBWR horizontal and vertical certified design response spectrum. The

blue curves are the FIRS, response spectra that we computed using correctly the amplification from hard rock up to the surface, sorry up to the foundation levels and then the black curves are the enhancements we did to meet the additional requirements of the minimum ground motion levels and satisfying hazard consistency between ground motions at the foundation level and at the ground surface. And as you can see the black curves are significantly above the blue curves so there was a significant amount of enhancement but they are still well enveloped by the CSDRS for the reactor fuel buildings.

And the next slide shows the same comparison for the control building, which is at a slightly different elevation and therefore we performed a separate analysis to develop amplification functions to the foundation level of the control building.

And the third category, one structure of importance, the third category in the structure is the fire water service complex. As was discussed this morning, the fire water service complex is to be founded on fill concrete placed

above the bedrock and therefore it represents a surface structure. We developed amplification functions from base rock, hard rock at elevation my depth of -400 feet up to the top of the fill concrete to get the motions at the level of the foundation of the fire water service complex. And in that development amplification function we took into account the fact that its not as a 1D type structure because the fill concrete will only be placed beneath the fire water service complex and the fill concrete will have granular backfill on the side. So with the 2D effect we incorporated into developing the amplification functions for evaluating the FIRS for the fire water service complex and then B

CHAIRMAN CORRADINI: So maybe I don=t appreciate this. Is the 1.35 based on some procedural approach or is it judgment based on the structure?

MR. YOUNGS: It=s specified in the DCD.

CHAIRMAN CORRADINI: Okay.

MR. YOUNGS: The DCD specifies that the fire water service complex design motion is

1.35 times the ESBWR CSDRS.

CHAIRMAN CORRADINI: Okay.

MR. YOUNGS: So its accounting for services but it is specified in the DCD. When we compare the FIRS that we developed for the fire water service complex its well enveloped by the ESBWR CSDRS times 1.35 and all the requirements for the fire water service complex are satisfied. So no further SSI specifically for that structure were needed and we did not need to develop time histories for that structure. So the next slide, just shows a comparison of the FIRS developed for the fire water service complex shown by the blue lines. And then again the ESBWR CSDRS times 1.35 and as indicated the FIRS is well enveloped.

So, in conclusion all of the site specific FIRS are enveloped by the design motions for the ESBWR.

MR. SMITH: So now I will turn it over to Bob Hooks to continue on with 3.7.2.

MR. HOOKS: Good afternoon. My name is Bob Hooks. I am with Sargent & Lundy. I=ve been involved as the technical project director for the

seismic analysis and structural that Sargent & Lundy did. Javad Moslemian was the technical manager for this. And Dr. Surendra Signh is most of the most experienced seismic analyst I know. So, when we get into the three seismic analysis we basically collect the data that we talked about this morning in terms of seismic response input, soil properties put together the seismic model. The seismic model being or the structural piece of that model being the models from the DCD for the reactor building and a control building. We undertook these analyses to evaluate the partial embedment into the Bass Islands Group and to address the ESBWR requirements for side backfill. With all the methodology presented in the DCD Appendix 3A with those ESBWR structural models for the reactor building, fuel building and control building. SSI and SSSI analyses were performed using SASSI 2010. Previous runs have been done with SASSI 2000 at a size limitation of about 410,000 interaction nodes. SASSI 2010 is effectively the same software but its been modified so that it can handle much larger problems up to about 20,0000 interaction nodes. They have allowed

us to use the direct method for a larger variety of the models that we had to run. And we use the direct method of analysis wherever possible.

CHAIRMAN CORRADINI: So the difference is really the ability to have more degrees of freedom in the calculation? Is that the big difference or are there also --

MR. HOOKS: Within, what drives the core requirements the analysis itself, the mathematics of it is the number of interaction nodes.

CHAIRMAN CORRADINI: Okay.

MR. HOOKS: So by the, with the subtraction method you get rid of the interaction nodes inside the structure. With the surface nodes and you could run, it would take the run time and the ability to solve the various matrix operations.

CHAIRMAN CORRADINI: Okay.

MR. HOOKS: To something doable. With the upgrade to SASSI 2010 improved the ability to the arithmetic so to speak to solve those operations within it for a model that had more detail to it, than using the subtraction method.

So we use the direct method wherever it was physically possible with the current version of the software. And we use the modified subtraction method of analysis where the number of interaction nodes exceeded that capacity of SASSI 2010, using the direct method. Before we embarked upon those analyses, we benchmarked the individual models where we used a quarter model or a half model of the structure. We analyzed it with the direct method. And then we put together the same modified subtraction model, method model, and ran that and compared the results. And we had very good correlation between the ones we used for the final analysis which were full models. The differences on the order of about one percent between the two. So the analysis for the reactor building and the control building were performed with and without the engineered backfill. The results of these analyses for both the sole structure interaction and the structure interaction analyses showed the forces in the numbers, the accelerations and the floor response spectra well enveloped by the ESBWR. Standard plant design for both the reactor fuel buildings and the control building. Graphically

the blue bar or the blue columns are the DCD and the red is the SSI work that we did. And this is for, if you will, the tightest margins we had. Most went through all the forces and moments, compared them, took the one that had the least margin and illustrated here. Similarly with the accelerations and with the oscillator accelerations which are measurable items from the DCD.

Similarly with response spectra we went through frequency by frequency and determined where we had the least margin and those are represented by the two, by the vertical response spectra for the reactor and fuel building and the horizontal response spectra for the reactor and fuel building. And again there=s, they are well enveloped. We go on to the control building. Similar comparisons with respect to forces and moments, accelerations, oscillator accelerations. For the control building we had also had structure to structure, structure soil structure interaction analyses which are shown in green. Again, we are well enveloped in all three of these categories. Similarly, for the response spectra. These redlines are envelope of all of the analyses we did. That completes 3.7.3

or 3.7.2, I=m sorry.

CHAIRMAN CORRADINI: So I mean, so as expected everything fell within the envelope?

MR. HOOKS: Right. And given the input we had.

CHAIRMAN CORRADINI: No surprises?

MR. HOOKS: Correct.

MEMBER SCHULTZ: Bob, is there any significance to the term, some of the charts say that the response spectra is enveloped and some say its well enveloped. Is there any intention to differentiate between those two terms? Does well enveloped mean anything different than enveloped in your presentation?

MR. SMITH: No.

MEMBER SCHULTZ: Thank you.

MR. HOOKS: It may mean that I missed it when we were doing the editing to put another well in there.

MEMBER SCHULTZ: Oh I won=t go further than that. Sometimes there is an intention between terminology.

MR. HOOKS: No.

MEMBER SCHULTZ: I didn=t expect it to

be included here but I thank you.

CONSULTANT HINZE: Was there any iteration on the design at all? In other words did you calculate it, find that it didn=t do so well then redesign?

MR. SMITH: This is the DCD plant and we did not touch the DCD design that is incorporated by reference.

MR. HOOKS: 3.7.4, that section is incorporated by reference of seismic instrumentation from the DCD. Within the DCD there=s a commitment that needs to be made on the part of the applicant and that is that the seismic monitoring program included the necessary tests and operating procedures will be implemented prior to the receipt of fuel onsite.

So 3.8.4 we get into what we did with the results of the seismic analysis into the structural design. For the reactor building, control building category one structures, lateral earth pressures from the applicable SSI and SSSI analyses were evaluated. Quantitative assessment of the sidewall design was performed, induced out-of-plane bending moments and shear forces in the

walls are enveloped by the ESBWR design. For the foundations you need to take a look at the stability at this site. Results from the stability evaluations demonstrate that the minimum factors of safety for sliding overturning a rotation meet the SRP 3.8.5 requirements. And the three site specific soil dynamic bearing demands are considerably below the allowable dynamic bearing capacities of the bedrock.

CHAIRMAN CORRADINI: Questions by the committee? Okay. Thank you very much.

MR. HOOKS: Thank you.

CHAIRMAN CORRADINI: Ms. Govan you are up.

MS. GOVAN: Good afternoon. Again my name is Tekia Govan. I am the project manager for the review of the fuel application sections 3.7 and 3.8 inside of seismic design and seismic category one structures respectively. Today the staff is here to present their findings for their review of phase four which resulted in an advance final safety evaluation. The advance final safety evaluation for sections of Chapter 3 have been presented to the ACRS previous. Last month we

presented Section 3.9 and in August 2012 we presented the remaining chapters for Chapter 3. So this presentation for 3.7 and 3.8 will conclude our presentation for Chapter 3 entitled Design of Structures and Components, Equipments and Systems. The project review team included myself as project manager, Jim Xu as the chief, branch chief Manas Chakravorty, the technical reviewer and who will be the main presenter for this afternoon, Carl Constantino and Manuel Miranda, contractors from Brookhaven National Lab. And with that I=ll turn it over to Manas.

DR. CHAKRAVORTY: Thank you Tekia and good afternoon. My name is Manas Chakravorty and a little bit of background. I have 30 years of nuclear experience in compass design analysis operations and also independence. I have a doctorate degree in engineering from MIT. I joined NRC in 2007 and since then I have been gaining some regulatory experience. I worked with 3.7 and 3.8 of COLA and I was assisted by the staff, particularly Dr. Manuel Miranda and I would like him to tell a little bit about his background.

DR. MIRANDA: Good afternoon everyone.

My name is, as Manas said, my name is Manuel Miranda. I am with Brookhaven National Lab. I have civil structural seismic experience for the past 15 years. For the past five years I have been in BNL, essentially assisting the staff with safety reviews of both generic designs and COLA.

DR. CHAKRAVORTY: Thank you Manuel. Let=s go to the next slide. I outlined the presentation so background, applicable regulations, some topics of interest, conclusions and questions. Now most of this stuff probably already have covered so far. So as we go along you will see some of those already covered. Fermi 3 site conditions and backfill. It consists of, there have been a lot of presentations on these things. Basically the topsoil on the rock with 37 feet of backfill material. Again, shear wave velocity the DCD prescribed was not met here. That=s one of the reason that we had to do a soil structure interaction analysis. Fermi 3 incorporated the DCD by reference. It is supplemented information. I am going to address design certification backfill requirements and also a special condition of

partial embedment and the control building. Supplemental information includes seismic input of category one structures, also site specific SSI analysis and structural design. Basically the structure evaluated the seismic input then we calculate the seismic demand to SSI analysis and then the final step is to assess the capacity of the DCD. We also had some information on the verification and validation regards in this situation they have to modify the original SASSI 2000 program which was used in the DCD. Because of the limitation requirement of the model. So that part is covered in the supplementary information. And so that=s basically the reason that this supplemental information provided and an SSI analysis was done and the staff primarily focused on this supplementary information.

Next slide is the applicable regulations. Now GDC 1 is primarily quality standards of the safety functions. GDC 2 is designed for what is standing the most severe natural phenomenon, that=s the SSE that has been postulated at Fermi 3. And then Appendix B is primarily quality assurance requirement and

Appendix requires the minimum in the horizontal direction. 52.80 basically says that what site specific ITAAC needed and NUREG-0800 we use as our guidance to review the application. And also there is the incoming guidance, ISG-1 and ISG-17. ISG-1 basically deals with the high frequency ground motion and has a consistent seismic input covered by ISG-17. Of interest as mentioned the basic seismic input, site-specific SSI and SSSI analysis. Now these are acronyms. I am talking about, in the last slide or slide 14 somewhere I tried to describe what the acronyms mean. If you are in confusion you can go to that slide and take a look. But SSI is soil structure interaction. SSSI is structure soil and then another structure. It is interacting between the structure to soil. We had reactor building and the fuel buildings, that=s in one complex and then the control building. Besides that is the service complex.

Now if you go to the next slide, site-specific seismic input. We have heard discussions on this, this morning. They are primarily foundation input response spectra. Because if you think of it, structure sees whatever is and the

foundation. That=s where the most impact goes on into this structure. We are very much concerned of what it is. And they developed as you heard this morning on the section 2.5 and part of section 2.7 all this geological investigation and analysis and all that evaluation. And then also we need some, from that we need some structural, primary soil properties that we will input in our soil structure interaction model. So that=s also in the seismic input. And when we do this, the site analysis, remember we don=t do the probabilistic. We do the deterministic. So the deterministic soil profiles and then have a best estimate and then upper bound and lower bound and we try to envelope the whole thing to come up with the final response spectra. On range of property of the granular backfill. They have considered that. It was mentioned in the morning. And staff also did some evaluation and found that the foundation response spectra that we are using is indeed okay. It was mentioned just in the previous presentation why we needed 2D geometry for storage complex because the conflict up underneath that was really not infinite, it was limited. So that=s why the original one, the

analysis did not reflect the 2D characteristics of the actual condition. And eventually the applicant performed that and as a result there was some in the foundation in the spectra. But it is accounted for and still it was bounded by the certified design spectra, CSDS. Those characteristics are requirements of the DCD and that=s why we did not do any SSI analysis. We did check the stability of the storage complex and the interior of the concrete down below. We didn=t have to do an SSI analysis to do that.

So in conclusion we confirmed first that it meets their Appendix S requirement and bounded by the CSDIs for all the category one structures.

Next slide is site specific SSI and SSSI analysis. Again we made it where, we have done the SSI analysis in the control building. The second one is this site specific SSI analysis for the storage complex which I just explained why. Applicant followed frequency of domain response approach consistent with the methodology of the DCD Appendix S, which is the interaction analysis

program. And they use the same computer program or similar. Maybe a little more defined for capacity. Also in addition the applicant did an SSI sensitivity study, which basically in one case they used the backfill material and in another place they did not. Just to see how sensitive it is as to the backfill. As it turns out it was not very sensitive as far as the response was. And also additional SSSI analysis was performed basically to do a couple of things because the building has some effect on the control building. So they tried to see what that effect is to consider in the input. And also the structure to structure interaction between the control building and the fire water storage service complex. So they did build analysis just to make sure that all these conditions are covered. And in conclusion I think the SSI and SSSI methodology is consistent with the DCD Appendix T. Staff is focused on site specific SSI models because they use the building models as DCD models. So the only changes are on the foundation. So that=s why we also focused, made sure that the model is okay in that part. And backfill material is relatively soft and because of

that the amount of capacity need to increase because it has to be able to translate certain minimum frequency like in this situation, about 40 to 50 hertz. So for that model the size for the soil has to be final. And we consider that. So in general I think that they have done sufficient analysis and investigations on the SSI and SSSI analysis to develop the seismic demand at the site. Because we have to compare this is the DCD demand. So we must make sure that the DCD structure from the site.

So next slide. We did look at the verification and validation program also in detail. There are several test problems. And this one they have done was consistent with SRP, current SRP 3.7.2. SRP 3.7.2 recognizes that there is a problem with the use of direct subtraction method versus modified subtraction method. Now these V&V that we looked at, came out with some, there are some limitations because MSM cannot be just exactly the DM. But in some situations can apply for DM because depending on how many nodes you are taking and what is the situation at hand. Now there are some limitations that we have found for this

verification and validation problem like aspect ratio of the model. So when they implemented that on the side we made sure those limitations are implemented. Staff actually DM concluded that SASSI 2010 is acceptable for application. That was the conclusion that we came up with.

Next side please. Site-specific seismic lateral soil pressure. That=s where we had some, we were seeing some changes or in another words some differences between DCD and the Fermi. Lateral pressures they use directory, the SSI and SSSI analysis which is fine. That=s what we are relying on. Site specific soil pressures exceeded DCD soil pressure. Now at 7.1 basically when you are embedding into hard rock, there is a discontinuity between soft material and hard and most of the pressure gets into the hard rock. So you will see a peak there. So, at that location the site specific pressure that they are calculating exceeded DCD pressure. Because DCD did not have this discontinuity. So, that site specific pressure succeeds corresponding pressure considered in the standard design. There are some reservations near the top of the rock. And then on

the, applicant performed additional evaluations to determine the impact of the exceedances on the design numbers. Now design numbers doesn=t mean that they load, load with structure elements. And the elements see the forces, stresses. Now in the DCD they are always enveloped. These additional pressures are the member forces that were developed by this additional peak was enveloped by the seismic induced member forces in the DCD design. So the design was okay.

Next slide please. The next thing we did is the site specific stability analysis. Stability analysis Section 3G of the DCD. So the same was used. A stop primarily focused on sliding evaluation because that was the limiting there. And as mentioned earlier in the geo-technical presentation that conservative a lot of stability in existing forces in the sliding existing forces were not considered because slide friction, things like that. And so the reactor building and the fuel building, the friction alone at the bottom of the map can take the whole seismic load, appropriate factor of safety. That is specified in the report. The fuel building never delivered from

the side bearing on the left. And we checked the bearing capacity of these rocks and they are substantially higher than what was demanded.

CONSULTANT HINZE: So there=s a concrete between the reactor building and the fuel building?

DR. CHAKRAVORTY: Right.

CONSULTANT HINZE: Is that determined by the DCD or what?

DR. CHAKRAVORTY: It was not. It was special.

CONSULTANT HINZE: And what does that provide?

DR. CHAKRAVORTY: It just provides some support.

CONSULTANT HINZE: So there=s additional support?

DR. CHAKRAVORTY: Yes.

CONSULTANT HINZE: Between those two buildings?

DR. CHAKRAVORTY: But the reactor building did not count on that, right? Manuel?

DR. MIRANDA: Yes, I can explain.

There=s a block of concrete in between the control building and the reactor building. So, from the point of view of the reactor building, which is the heavier structure.

DR. CHAKRAVORTY: Deeper.

DR. MIRANDA: Deeper also, yes. Friction alone at the base is sufficient to resist the entire base shear. So its stable with a factor of safety specified in the SRP, which is 1.1, using that resisting force alone? Now for the control building, there is a little bit of additional force that needs to be provided in order to ensure stability at the factor of safety specified. So there is transfer of load that=s required from the control building into that concrete block, through bearing a little bit. And they evaluated how much that was. Then they looked at that block of concrete, given that horizontal force imparted to it by the control building and saw whether that block of concrete was stable or not. So they did a sliding evaluation of that block itself.

DR. CHAKRAVORTY: So the reactor building --

DR. MIRANDA: So the reactor building

is not going to feel that. It=s not going to feel it. So the concern was whether to control building, pushing on that block would make that block push into the reactor building. That wasn=t the case. They verified that. And the other way the reactor building will not push into that block.

DR. CHAKRAVORTY: That=s why it was not a concern. And the last one we checked the bearing pressure, the seismic bearing pressure developed at the pharmacy side and felt it was really bounded by the capacity of the rock there. So that was not an issue.

Let=s see the conclusion. In conclusion, the applicant incorporated DCD seismic design of structures by reference. Applicant provided supplemental information to address the partial embedment of the reactor building as well as the control building in the rock and DCD backfill. Staff reviewed and determined that supplemental information aside specific SSI is adequate and staff includes that the applicant has provided sufficient information to meet the relevant ESBWR DCD requirements as well as the applicable NRC regulations. And that basically concludes my

presentation and I am glad to thank you for listening. If you have any questions.

MEMBER STETKAR: Yes, I have a couple. Let me ask you. All of the seismic category two structures are postponed until ITAAC. Is that correct?

DR. CHAKRAVORTY: That=s correct.

MEMBER STETKAR: Okay. So for example, turbine building, reactor building, are all ITAAC?

DR. CHAKRAVORTY: ITAAC.

MEMBER STETKAR: I would first off all if there are any other seismic structural questions because it=s somehow included in the ESBWR.

CHAIRMAN CORRADINI: You=re asking other people to go ahead of you?

MEMBER STETKAR: Yes. I=m trying to be polite. This is the last time in my life. Perhaps anytime in my life.

CHAIRMAN CORRADINI: Do you want to say that louder so we get it on the record.

MEMBER STETKAR: Now in the SER there is under Section 3.8.4 subtitled other review topics designed for hurricane missiles for witness

related structures. And I looked back in my notes. I don=t know why I didn=t ask this question during the DCD. I didn=t. It=s noted that witness related structures are not required to withstand tornado missiles. However, they are required to withstand hurricane missiles. And the essence of this little section of the review says that they did an evaluation of hurricane, site specific hurricane using the methodology in Reg Guide 1.221, determined that the hurricane wind speeds from the site are bounded by the hurricane wind speeds used in the DCD. So therefore the missiles are bounded by the hurricane missiles in the DCD. Given the location of the site, I can sort of buy that. Why don=t you worry about tornado missiles at the Fermi site?

DR. CHAKRAVORTY: Well, I really don=t know why but I have some hypothesis.

MEMBER STETKAR: Now, this is not hypothesis. Why don=t you worry about tornado missiles.

DR. CHAKRAVORTY: The reason myself, because tornados are local B

MEMBER STETKAR: Have you ever seen an

F5 tornado? Ask the people who live in Vilonia and Kathy, I always forget the other town in Arkansas.

MS. HANSON: Mayflower.

MEMBER STETKAR: Mayflower, thank you. But you have stuff that happened a mile wide. So its on a map on a globe they look like a little point. On the other hand, people in the middle of an F5 tornado think that its like a quarter of a mile each way from the eye of that tornado. Bigger than the footprint of all the buildings on the site. So, the idea that=s it=s a point that only affects perhaps one building at a time doesn=t fly, not for big tornados. So maybe that hypothesis doesn=t work. Also if you see the fuel that got tossed around in those F5 tornados they tend to look like all big trucks, parts of buildings, heck of a lot of trees if you=ve got trees in the area. So the question is why at the site don=t you evaluate tornado missiles for these structures? The DCD, as I said, I wouldn=t ask that question had I stumbled across the footnote in the DCD. There=s a footnote on the table.

DR. CHAKRAVORTY: I think the tornado missiles I used, --

CHAIRMAN CORRADINI: Let me ask you.

MEMBER STETKAR: Hurricane missiles, this speaks for the hurricanes here. They have hurricane missiles because of the later findings for coastal sites you may not be dominated by tornado wind speeds. You may in fact be dominated by hurricane wind speeds. They designed a couple of buildings here for tornado wind blowing. Some of the buildings are not for tornado wind blowing. But they only design them for the hurricane missiles.

CHAIRMAN CORRADINI: Let me ask the staff. Do you have the right people here to answer this.

MS. GOVAN: No we do not.

MEMBER STETKAR: That=s what I said. It=s off the wall. It shows up in this section of the SER.

MS. GOVAN: Yes, I would think we would need Brad Harvey and I think he=s gone somewhere. I think you asked this question in August, well something similar to this in August.

MEMBER STETKAR: I don=t know. I looked through my notes and I try not to ask the

same question.

MEMBER STETKAR: No, it definitely wasn=t the same question but something very similar and I think Brad Harvey would be the person that can provide input.

MEMBER STETKAR: I remember asking him about the wind loadings. But this is B wind loadings I remember talking to Brad about before. I=m kind of okay on that.

MS. GOVAN: All right.

MEMBER STETKAR: This is in particular the missile loading, the missile damage.

MR. XU: This is Jim Xu. This is a good question but I think it is an old question, that is probably not prepared during this COL reveal. But nonetheless if you know the answer we can take it back and provide a response.

MEMBER STETKAR: I apologize that I didn=t, it either didn=t connect when I, if I read the footnote it didn=t connect at the time or maybe I didn=t read it because it is only in a footnote of the table.

MR. XU: The action item COL applicant evaluated hurricane site specific of hurricane to

determine hurricane wind and hurricane missiles.

MEMBER STETKAR: Yes, and that=s certainly, I mean that arose the correlation that it was discovered that indeed tornados may not be limiting for near coastal sites in the south and the southeast part of the U.S. By not evaluating, by claiming that everything is bounded by the tornado, that might not be true for those sites.

MR. XU: The perception.

MEMBER STETKAR: You are not going to get large hurricanes at the Fermi site?

MR. XU: I understand your concern.

MEMBER STETKAR: The bigger concern is this is specifically focused on witness structures and if we=re in our post Fukushima beyond design basis accident litigation strategies focusing on witness type equipment and structures to be available, the Category 5 tornado hits the site, those witness things might not be available. Now I know everybody thinks well Fukushima so it has to be an earthquake or it has to be a flood. I don=t think that way. I think big things that we haven=t thought about hitting the site, one of

which could be a really big tornado.

MR. XU: I would be surprised if the DCD did not address this.

MEMBER STETKAR: There is a footnote in the table.

MR. XU: But I don=t remember DCD when they review B

MEMBER STETKAR: Anyway, it=s clear B I looked back through my own notes.

MR. XU: Category one structures, witnesses is a separate B-

DR. CHAKRAVORTY: A tornado wind is covered.

MEMBER STETKAR: Tornado wind is covered to some extent in terms of B even there are statements that say that the, this is in Chapter 19. You have to look at Chapter 19 and a table in Chapter 2 in the DCD. In table 19A.4 of the DCD it notes that the ancillary diesel building and the turbine building are designed for tornado wind loading. But other buildings that house witness equipment, like the electrical buildings, service water building, are only designed for hurricane wind loads. So they are not B even if they house

equipment. But despite what the build loading is, none of those buildings are designed for tornado missiles. They are supposed to be designed for hurricane missiles.

DR. CHAKRAVORTY: They are specifically excluded and I don=t know why.

MEMBER STETKAR: Like I said I need to get back on the re-read words and the DCD but there=s a footnote in the table that says tornado missile design criterion is not applicable to seismic category NS and seismic category two buildings, which covers all that stuff.

DR. CHAKRAVORTY: Now they went ITAAC on those category two building. There I don=t remember none.

MEMBER STETKAR: Well it can=t be anything more restricted than the DCD.

DR. MIRANDA: Yes, the category two buildings are going to be essential.

MEMBER STETKAR: That structure may not be missile, you know, in wind loading, and maybe not necessarily missile protections.

CHAIRMAN CORRADINI: So your concern is that you are not bounded by hurricane missiles

at this site?

MEMBER STETKAR: They are designed against hurricane missiles but you may not be bounded by hurricane missiles for tornados.

MS. GOVAN: We=ll get back to you on that.

CHAIRMAN CORRADINI: Any other questions? Okay. Let=s go to the last part of this which is topics to be discussed at full committee. I think we have two hours scheduled.

MS. GOVAN: I think it=s an hour and a half, but I=m not sure. It maybe two.

CHAIRMAN CORRADINI: On Thursday. I guess I wanted to get, well you have to get public comments. In fact, I want to get back to talking about how to prepare for the meeting with the full committee. But maybe we will get public comments now because I want to go around the table and talk to them, to get the members and consultants opinions on how to potentially organize ourselves for the full committee. So can you ask if we can open the line if there is somebody on the line? So the line is being opened now. If anybody is out there, can somebody just at least acknowledge their

presence so we know the line is open? We have an hour and a half.

MS. THOMAS: Ruth Thomas Environmentalists, Inc.

MR. KEEGAN: Michael Keegan

CHAIRMAN CORRADINI: Okay. So let me know turn to public comments. I think we just had somebody from Michigan that identified themselves. Can you repeat your name please sir?

MR. KEEGAN: Yes, Michael Keegan. I am the intervener. I have a couple of concerns from this morning. In particular discussion B

CHAIRMAN CORRADINI: I think we lost you sir.

MR. KEEGAN: No I=m waiting for the paper. I have concerns about the voids. I felt the discussion was totally inadequate. The prospect of 40,000 square feet, 200 feet by 200 feet, one blow hole and not finding a void in that hole and that there aren=t any voids is the stuff B I find it disturbing that there were other methodologies available that were not utilized at the time and I would also like to harp on the fact that we are challenging the quality of all those

and all that work. So, I need a remedy on those voids and the remedy B could somebody stop rattling papers please. I can=t hear myself. Thank you. And the remedy suggested is that the excavation and then they will look at to see if there is any voided, but there=s been no criteria established for helping the void to constitute the concerns. One economic momentum has occurred, they are not going to turn back. So, there=s no criteria about which they would say this site is. So I find that particularly disturbing. If you can comment on that, I would appreciate and then I=ll have some other comments as well.

CHAIRMAN CORRADINI: It=s our practice to make sure that we get the public comments but we do not engage to ask questions nor to comment on the comments. We are trying to record everything you are saying so that we get it in the public record and on the transcript. So you should keep on going if you have other points you want to make.

MR. KEEGAN: Okay. Well, I=ll keep on going. Now that=s just started because you=ve done one core boring methodology. I also found the fact that triggered earthquakes were not considered into

the model and seemed to be missed. I would like to remind that Lake County, there were a number of earthquakes that occurred because of fracking. And this again is moving towards fracking. So there will be much closer potential for triggered earthquakes in Michigan for that and I find those particularly disturbing. The fact that the utility only identified two earthquakes and the NRC found earthquake events speaks to you are not working off the same page. So there are some of my concerns right there.

CHAIRMAN CORRADINI: Sir, my I interject on this one. I think from a factual standpoint I think the exact opposite we clarified earlier by both applicant and the staff that all earthquakes were considered whether they were triggered or spontaneous. So all the earthquakes in that region of the 200, I can=t remember the exact distance, but all the earthquakes were considered.

MR. KEEGAN: There was a Canadian geological, U.S. geological, people are working off of different books. And everything seems to be getting rolled into one big methodology and the

smoothing out of methodology averaging. That is just a way to lose data. You are losing information when you do that. You=ve got to fair it out and then do a multivariate analysis with different styles. So I have problems with the methodology and such. Regarding the most recent afternoon conversation about seismic qualifications, I have concerns about 4,000 tons of water being across a reactor and how that will respond during an earthquake event. It will be amplified by being higher up. I sat through the meetings and I never did get a satisfactory answer to that. Just a lot of unresolved questions. The ACRS has very good questions and I=m not sure how much of this will make it to the full ACRS committee. It seems to be watered down and washed away at this point. Those are my comments.

CHAIRMAN CORRADINI: So let me get back to process to make sure you understand where we sit. So we=ve taken note of your comments. They are in the transcript and on the record. Those will be brought up amongst all the other comments we have at the full committee which will be in September to discuss essentially the

applicant=s FSAR and the staff=s analysis of it in front of the full committee. So, that=s kind of the next step in the process. But I would say B

MR. KEEGAN: I B

CHAIRMAN CORRADINI: Go ahead sir.

MR. KEEGAN: From the last month I had some concerns about the amount of AC power that all transmission lines are on the same corridor and that there=s potential for, right in the path of a major missile airport. I am concerned that all three of those lines could be taken out in one event. And what is relied upon is the fact that this is suppose to be a passive plant with gravity driven water but that has not been proven. Ed Lyman with Union of Concerned Scientists has raised concerns about this. So, a lot of unresolved problems. I will conclude with that.

CHAIRMAN CORRADINI: Okay, thank you sir. I want to make sure B

MR. LEWIS: Mark Lewis, I am a member B

CHAIRMAN CORRADINI: I=m sorry. Can you repeat your name sir? This is a new individual?

MR. LEWIS: I did not speak before

because I forgot my mute was on.

CHAIRMAN CORRADINI: Okay, so can you repeat your name please sir?

MR. LEWIS: Martin, M-A-R-T-I-N Lewis, L-E-W-I-S.

CHAIRMAN CORRADINI: Okay, go ahead sir.

MR. LEWIS: All right. Well one of my major problems is that water in the engineered field was not addressed. Namely I feel that this is a site like artificial island or the Hope Creek and what have you. These plants are on a field if saturated, turned to quicksand and why the reactor. It=s kind of hard for a reactor when B it was not addressed and I don=t believe in previous in these hearings, public meetings. And thank you very much for allowing me to point that out. Thank you.

CHAIRMAN CORRADINI: Thank you sir. Do we have anybody else from the public?

MR. SCHONBERGER: Yes.

MS. THOMAS: Yes.

CHAIRMAN CORRADINI: Okay.

MS. THOMAS: Two yeses.

CHAIRMAN CORRADINI: So, the first yes

can go and identify yourself please.

MS. THOMAS: This is Ruth Thomas. It is unclear from the full audit that the site could support the proposed nuclear power plant.

CHAIRMAN CORRADINI: I=m sorry. You kind of stopped there. Can you repeat your comment please?

MS. THOMAS: It is unclear from the soil audit that this site could support the proposed nuclear power plant.

CHAIRMAN CORRADINI: Okay.

MS. THOMAS: I don=t expect an answer on that but I thought I would like to put that in for the record.

CHAIRMAN CORRADINI: Okay, thank you maám. Was there somebody else that wanted to make a comment?

MR. SCHONBERGER: Yes sir.

CHAIRMAN CORRADINI: Go ahead sir.

MR. SCHONBERGER: Yes sir. My name is David Schonberger. D-A-V-I-D, S-C-H-O-N-B-E-R-G-E-R.

CHAIRMAN CORRADINI: Yes sir, go ahead.

MR. SCHONBERGER: Speaking as a member of the public and I want to comment on the applicant=s presentation and staff presentation and I believe I=m referring to Bob and Sarah from earlier. There was a lot of credibility given today to the CEUS SSC, the seismic source characterization. However, all parties agreed not long ago that the seismic risk at the Fermi Unit 3 site will ultimately need to be assessed using the NGA East next generation attenuation East ground motion characterization model which I believe is an ongoing project scheduled for completion this year or next year. I know it is agreed that the state has practiced for addressing seismic hazards is evolving and that the CEUS FSC model does not include any demonstration sites applicable to the Fermi site and therefore the impact of the CEUS FSC model and the Fermi seismic hazard is not known. The applicant proposed in 40.12 to resolve this problem by completing the NGA East site specific assessment post COL. And the applicant concluded

that implementation of the applicable Fukushima NTTF recommendations to address the evolving stand practice of an assessing seismic at Fermi 3 can be effectively regulated via license condition or ITAAC for the purpose of confirmation that the GMRS and FIRS use for the Fermi 3 SR remains valid after issuance of the NGA East ground motion characterization model. So as a concerned member of the public I strongly oppose the applicant=s response support the GMRS and FIRS developed using the CEUS SSC model and revised CAV filter cannot be used as a valid comparison, cannot be used as a valid comparison to show that the Fermi Unit 3 SR provides reasonable assurance. I believe that confirmation of seismic qualifications must be a pre-requisite for ACRS sub-committee endorsement of this COLA and I think its ironic that even as the applicant uses a post Fukushima CAV filter to comply with recommendation 2.1 that the more basic and fundamental confirmation of seismic design qualification is subordinated. I also have a comment pertaining to using remote sensing versus surface mapping. I hope you pursue, I hope you pursue using remote sensing even though its not

part of the license condition. And I have a concern about the SSI analysis. My question to be put on the record would be has the ACRS subcommittee investigated whether the ultimate cause for the applicant=s straying from using the gold standard best practices direct method for all cases was not the embedded structures but rather the applicant=s proprietary interest, perhaps such as substituting engineered backfill in place of a more expensive conventional concrete foundation. In other words, I wonder would a more conventional concrete foundation still have required using the modified subtraction method rather than the direct method or could the direct method have possibly been applied in all cases? And if my applied allegations are correct, I wonder if the ACRS subcommittee is aware of the significant consequences of endorsing that precedent. I also have a comment about Eric Schrader=s statement for the NRC staff in response to my question pertaining to multi-unit events and scenarios. First I dispute his claim that Fermi Unit 2 is a settled matter because it is currently being contested as we speak. So, it=s not a settled matter. And as a

member of the public I believe that the Fermi 3, applicant=s emergency plan is inadequate and that the ACRS therefore should not endorse the COLA as it stands now. The applicant=s analyses rely on a scientifically inappropriate probalistic model and evacuation plan that ten mile EPZ and a minimal shadow evacuation zone even after Fukushima proved that the ten-mile EPZ should be significantly expanded. And the applicant=s evacuation time estimates ETE in parameters failed to consider instances of severe Michigan snow conditions beyond 20 percent impairment. So evacuation time is based on no more than 20 percent impairment due to a severe Michigan snow conditions, which is totally unrealistic as well as also highly questionable local preparedness, response capabilities. The applicant assumes that a radiological release will affect only a small, relatively small area. However proper inputs specific to the Fermi site indicate a far larger affected area, potentially including the densely populated centers of metro Detroit, Ann Arbor, Monroe, Toledo and Windsor. Such realistic scenarios would result in longer evacuation times and greater costs and consequences

that the applicant has assumed. Ironically while the RADOS-V software programs simulation model is capable of calculating deposition at receptors in the 50 mile ingestion pathway which appears to include in the U.S. about eight counties in Michigan and eight counties in Ohio in the 50-mile radius. That is like 16 counties there. The applicant=s emergency plan however, executes arrangements in support of emergency preparedness with only two county governments, Monroe County and Wayne County, Michigan. And while I believe that a proper severe accident and assessment significantly affects whether local communities would receive commensurate safety enhancements and therefore as a concerned member of the public I appeal to the ACRS for an independent and rigorous review of the Fermi 3 emergency plan. A clearly further analysis is called for despite what Eric Schrader would have you believe. So, I also finally would like to talk about Section 3.8 which states that, Section 3.8 states as a site specific maximum dynamic soil bearing pressures for the RB, FB and the CB exceed values reported in the DCD for the hard site conditions, which is the DCD condition that most

resembles the rock at the Fermi 3 site. So, its presumed that the Fermi 3 site is a hard site condition and as a member of the public I dispute that analysis because there is expert testimony on the public record suggesting that the applicant=s geological boring and soil samples are suspect and therefore the geotechnical data gathered prior to the applicant=s official designation as an applicant cannot be trusted. And I hope the ACRS subcommittee pursues that with an independent investigation. Thank you.

CHAIRMAN CORRADINI: All right, thank you sir.

MS. THOMAS: This is Ruth Thomas again.

CHAIRMAN CORRADINI: Yes maám.

MS. THOMAS: I have been observing this talk and there=s all kinds of interruptions that were going on when the regular meeting was progressing to the NRC and the licensing. Now I don=t whether the transcript will respect all this gentleman said but I would like somehow or another to get a copy of his testimony.

CHAIRMAN CORRADINI: Yes maám. The transcriber is with us here and hasn=t indicated

any issues with hearing what we have said. And you can get a copy. That is readily available. Did you hear me?

MS. THOMAS: I will call in afterwards and give my address. I don=t know whether the gentleman wants to say who he is or identify himself but I would like his comments sent to me. And so I will give my address when I call back. Thank you.

CHAIRMAN CORRADINI: Yes maám. All of the B the transcript is always publically available and available for the members of the public. But if you want to call separately and give us your name, that is perfectly fine. Any other members of the public that want to make a comment? Hang on one second. Let me make sure I have people on the phone line. Anybody else on the phone line? Okay. So its still clicking and clicking. Can we remove the phone line. And now we have a member of the public here that wants to make a comment.

MR. KAMPS: Thank you Dr. Corradini and members of the ARCS committee. My name is Kevin Kamps. I am a radioactive waste specialist at Beyond Nuclear. And we are also an intervener against the Fermi 3 COLA. I think I=ll focus my comments for now on the question of natural disasters that was raised at the end of the previous session. Earlier today the New Madrid, Missouri earthquake hotline was mentioned. And it=s been 200 years ago since the 1811/1812 magnitude 8 or greater earthquakes. A thought that came to my mind about that issue is that as we=ve learned in the Fermi 3 COLA proceeding and as we=ve learned in the Fermi 2 license extension proceeding, which is the deadline for intervening was a couple of days ago and many of our groups did. The Native American tribes of the area have now been consulted very thoroughly. So for example, the Walpole Island First Nation which is 50 miles north of Fermi. Because it inhabits unseeded territory between the two counties, the U.S. and Canada, it=s not been consulted, it=s not in receipt of notification that these proceedings are underway. And my point is that these native

nations were around in 1811. So a lot of the information we had about the new Madrid, we=ve learned through their role tradition. So I think that the NRC staff and other decision makers would be wise to consult as they are required to by law and treaty with these first nations. I think there=s a lot of information to be gained that way. And I wanted to touch on the Youngstown, Ohio earthquake. It was New Year=s Eve, 2011, a 4.0, fracking injection related. And I heard from discussion that there was ongoing debate about the cause of such earthquakes. But Governor Kasich in real-time within hours was confirming for the public that it was a fracking injection related earthquake at the time. So, tremendous concern amongst members of the public near Fermi, near Davis-Besse, whether fracking mining activity, hydraulic fracturing near Davis Besse, for example and other First Energy reactors like Beaver Valley were fracking, perhaps not in junction wells but fracking itself, was taking place within a quarter of mile of Beaver Valley Nuclear Power Plant. And ironic to a shift onto tornados. Being a survivor of an F3 in Michigan in 1980 myself, I just wanted

to call to the attention of the ACRS if they weren=t aware already that in June 2010 Fermi was struck by a tornado. I didn=t have a chance to look up the magnitude of that tornado but significant damage was done to the turbine building in that tornado strike. Perhaps more safety significant incident occurred just across the lake, June 1998. And again I happened to get caught in that one, on Interstate 94 in Ann Arbor. So I had never seen quite a shade of green like that in the sky and the hail was quite large. About June 1998 a tornado that the funnel cloud passed between the container building and the cooling tower at Davis-Besse and that was a very serious near miss because of failures involving the emergency diesel generators. And in fact the last remaining leading generator broke down just one hour after the grid was restored, a couple of days after the tornado strike. And these natural disasters, these emergency diesel generator concerns are actually the basis for contentions, specially at Fermi 2, a couple of days ago. So, tremendous concern in that regard as well. And I recall earlier in the day there was a question about tsunamis on Lake Erie

and I wanted again to call to the attention of the ACRS something that I didn=t know about until last September when I traveled up to ecological depository hearings in Kincardine, Ontario near the Bruce Nuclear Generating Station. So I never heard about the White Hurricane of 1913 also referred to as the Big Blow, the Freshwater Furry, November 1913. Sustained 70 miles per hour winds over day, gusting up to 90 miles per hour. It was an extra facical cyclone cyclonic blizzard. And in Goderich, Ontario just to the south of the Bruce Nuclear Generating Station a 40 foot wave hit that community. So it turns out that this White Hurricane of 1913 was the biggest natural disaster causing deaths in The Great Lakes that=s known in history with hundreds of deaths. Many of them on boats but some of them on shore as in Goderich. So yes indeed giant waves on the Great Lakes are possible. Imagine the old tradition of the Anishinaabe in Michigan and the New Maverick quakes of 1811/1812 did cause giant waves on the Great Lakes, according to the tradition of the Anishinaabe. And another real phenomenon I guess you could say is the phenomenon of the seiches on

the Great Lakes. Again the sustained winds blowing the waters upon on one share. And again Davis-Besse comes to mind during the construction phase in the 1970s. Severe flooding on the Davis-Besse site pre-operational but severe flooding caused by a seich. So because of the proximity of Davis-Besse and Fermi certainly a concern that needs to be addressed. I guess the final point, there=s been discussion of emergency preparedness. Mr. Keegan raised the issue of the common transmission line corridor. I believe he did. These are concerns, these are contentions we=ve raised before the Atomic Safety and Licensing Board at both Fermi 3 and now at Fermi 2. The problems to be had with a common mode failure of the common transmission corridor shared by both Fermi 2 and Fermi 3 and I know Mr. Keegan mentioned Dr. Lochbaum=s concerns, Union of Concerned Scientists, about any claims that the so-called passive design at Fermi 3 would be trustworthy for days on end without outside electricity or even emergency diesel generators. He specifically pointed out during the design controlled document hearings on the ESBWR that because of lower power behind such things as

gravity as compared to the suction provided by active pumping, that that=s a very questionable supposition. And I would like to close on a point that=s phrased by David Lochbaum on the Union of Concerned Scientists that multi-unit risks of having not only a breakdown phase reactor, Fermi 2, but also a break-in phase reactor, Fermi 3 on the same site immediately adjacent to each other. And what comes to mind for me is the finding of the Japanese parliament which looked at the Fukushima Daiichi disaster did an independent investigation, the first in its history. And determined that the root cause of the catastrophe was not the earthquake, was not the Tsunami but was the collision between regulator, elected official and nuclear industry that left that site so vulnerable to natural disasters. I think even some of the things I=ve heard here today, unanswered questions referred to as goofy, as questionable, as fuzzy. We live in the shadow of this facility and our very concerned about the many unanswered questions that remain at this late stage of the game on Fermi 3. Thank you.

CHAIRMAN CORRADINI: Thank you. Is

there anybody else in the gallery that has comments? Okay. So I would like to thank all of the members of the public that provided their comments. Just to repeat what I said to one of the folks online. All the comments are being transcribed and will be available to both ourselves, the subcommittee and the full committee when we take up the reference COLA in September. So what I would like to do is, Tekia, where did she go? Oh there she is. I=d like to have you come back up and to do a little bit of planning for the full committee meeting. And to do that I would like to first ask if we could go around the table and get comments from the members and consultants relative to today=s discussion as well as I think everybody, most everybody was here, also for the July 7 discussion. So, but at least for today, Steve, do you have comments you want to?

MEMBER SCHULTZ: I don=t have any further comments.

CHAIRMAN CORRADINI: Bill?

CONSULTANT SHACK: I wasn=t here for the July.

CONSULTANT HINZE: Well I had some

concerns about clarification of items and issues and I think the staff and particularly the applicant has done a good job of clarifying those and I have been relieved that we have a better knowledge as a result of that discussion.

CHAIRMAN CORRADINI: Are there any outstandings, Bill, that you wanted to bring up? I caught most of the things relative to triggered seismic events, clarification if they were included or not, included, I have one on the license condition relative to the voids and the proper mapping and characterization upon, if upon execution. But others?

CONSULTANT HINZE: That=s solvable.

CHAIRMAN CORRADINI: Okay.

CONSULTANT HINZE: I think that=s solvable.

CHAIRMAN CORRADINI: Okay.

CONSULTANT HINZE: Nothing substantive other than I think we really do need to have a comment from the staff on that, there are seven earthquakes that they have found within the 200 mile radius between 2009 and 2012 is magnitude and not moment magnitude that needs to be put into that

figure eight of the 2.5.2. And I do need to, there does need to be a clarification that there were no earthquakes that were deleted on the basis of conjunction wells and their history. I don=t know if we want to use the word triggered or not because that=s kind of a alerting term. I also, well there are a couple of other things.

CHAIRMAN CORRADINI: If I might just repeat what, the last one you said though. The point is do we want to get clarification as to the classification that all things that were, all events that were registered have been included in the catalogue.

CONSULTANT HINZE: All that are in the CEUS SSC catalogue as well as in what is called the ANSS, which is the USGS catalogue. If I understand correctly the staff used all of those between 2009 and 2012.

CHAIRMAN CORRADINI: Okay. Thank you. Anything else?

CONSULTANT HINZE: I=ll give you a brief report.

CHAIRMAN CORRADINI: Any comments?

MEMBER RICCARDELLA: No comments.

CHAIRMAN CORRADINI: John?

MEMBER STETKAR: I don=t have anything additional other than the last thing I mentioned about the tornado missiles will need to some feedback.

CHAIRMAN CORRADINI: Some feedback from the staff. Okay. Ron?

MEMBER BALLINGER: I=m fine.

CHAIRMAN CORRADINI: Charlie? Okay. So let me go over a couple of things here. My plan B I would propose that the staff come back with the applicant, however you want to put it together, for the full committee meeting and focus primarily on site related issued and Fukushima issues. I don=t remember anything from the 2011 meeting nor the two 2012 meetings that aren=t site related that we want to bring up. I think there are two particular things that Adrian noted. I=ve got to find them here. Hold on a second. That I think would be good to at least alert the full committee that we=ve taken account of relative to the, relative to things in the site. Precipitation, we have some n precipitation questions that have settled, things

related to flooding etc. that were settled back in 2012. You had comments to the committee which have been reported. I think the full committee has got to hear about those, site related. But except for two or three items, everything has been pretty well covered. Everything has been discussed in the July meeting and the August meeting relative to site and the Fukushima related issues. So I propose that=s what you focus on. What I count in, a few generic things which go beyond just ESBWR and I will put the one out there that I think John said better than I, but I think I captured it properly. That if we look at the seismic, if we look at the GMRS, it is clearly less than the ESBWR DCD site independent seismic curve. And even though we are still unclear about uncertainties, its still is likely which gives us assurance but I think I want to discuss that and I want the full committee to understand our uncertainty there, at least our questions. And I=m trying to think of something else that we were talking about. That=s the main one that has come to mind. I think there were generic points relative to the spin nuclear fuel pool seismic capability or not capability but the

instrumentation and we want to bring that up in front of the full committee I think. Members are still debating amongst themselves. I think that=s it. But I think all of the items that you want to bring up are primarily related to site or Fukushima related issues. Is there something that you all want to discuss with us? DR. MIRANDA: So going back to the item on the SSE list.

CHAIRMAN CORRADINI: Say it again I=m sorry.

DR. MIRANDA: Yes. The issue on the open item on the SSE list. I think when we discussed it, it left out B

CHAIRMAN CORRADINI: That=s the earthquake.

DR. MIRANDA: We left out what I thought was B

MEMBER STETKAR: That=s another generic sort of B

DR. MIRANDA: Right.

CHAIRMAN CORRADINI: Yes, I don=t view that necessarily as a Fermi alone issue. I view that as a generic issue that was raised relative to

Fermi but it goes beyond.

DR. MIRANDA: So, do you want us to come back in the full committee and discuss it or not?

CHAIRMAN CORRADINI: Yes, I think you should. I had on the action items, I=m sorry, I said them quickly. But I had them from the action list the postponing of discussion of all of the things after the 72 hours and leaving in as a license condition with all site reasonable responses. The ultimate solution I had spent fuel pool instrumentation design base and what is the radiation dose that is now being designed? And I had the North Anna question which led to essentially discussion of the operating basis earthquake as the three things that I think want to be discussed. I think John brought up something that I=m pretty sure we did. I think we had one interim letter on the other chapters back in, I have to check, in 2012, I think, that we will take and give to the full committee so they know essentially the background. But my memory is that sometime I think in February of 2012 we had an interim letter. But that=s all I have. I think if

we focus on that, we can fit within the time window and then give enough time for the committee to get questions asked of you all and then we can have discussion. Okay? I don=t have anything else. Does any other members of the committee have anything else? Okay. With that B

MS. GOVAN: I was looking at our branch chief.

CHAIRMAN CORRADINI: He doesn=t want to talk? So we will adjourn for the day. Thank you.

(Whereupon the above-entitled meeting was concluded at 3:04 p.m.)

DTE Energy®

Fermi 3 COLA
Presentation to ACRS Subcommittee
Opening Remarks

Presentation Overview

DTE Energy

Presenting summary information for Sections:

2.5 Geology, Seismology, and Geotechnical Engineering
3.7 Seismic Design
3.8 Seismic Category I Structures

Section 2.5

- Basic Geology and Seismic Information
- Vibratory Ground Motion (Central and Eastern U.S. Seismic Source Characterization [CEUS SSC] applied to establish site seismic response)
- Surface Faulting
- Stability of Subsurface Materials and Foundations
- Stability of Slopes

Presentation Overview

Section 3.7

- Developed Fermi 3 seismic inputs to support Soil-Structure Interaction (SSI) and Structure-Soil-Structure Interaction (SSSI) Analyses:
  - Partial Embedment of Seismic Category I Structures
  - Evaluate side backfill for Seismic Category I Structures as permitted by DCD
  - Used Direct Method where possible

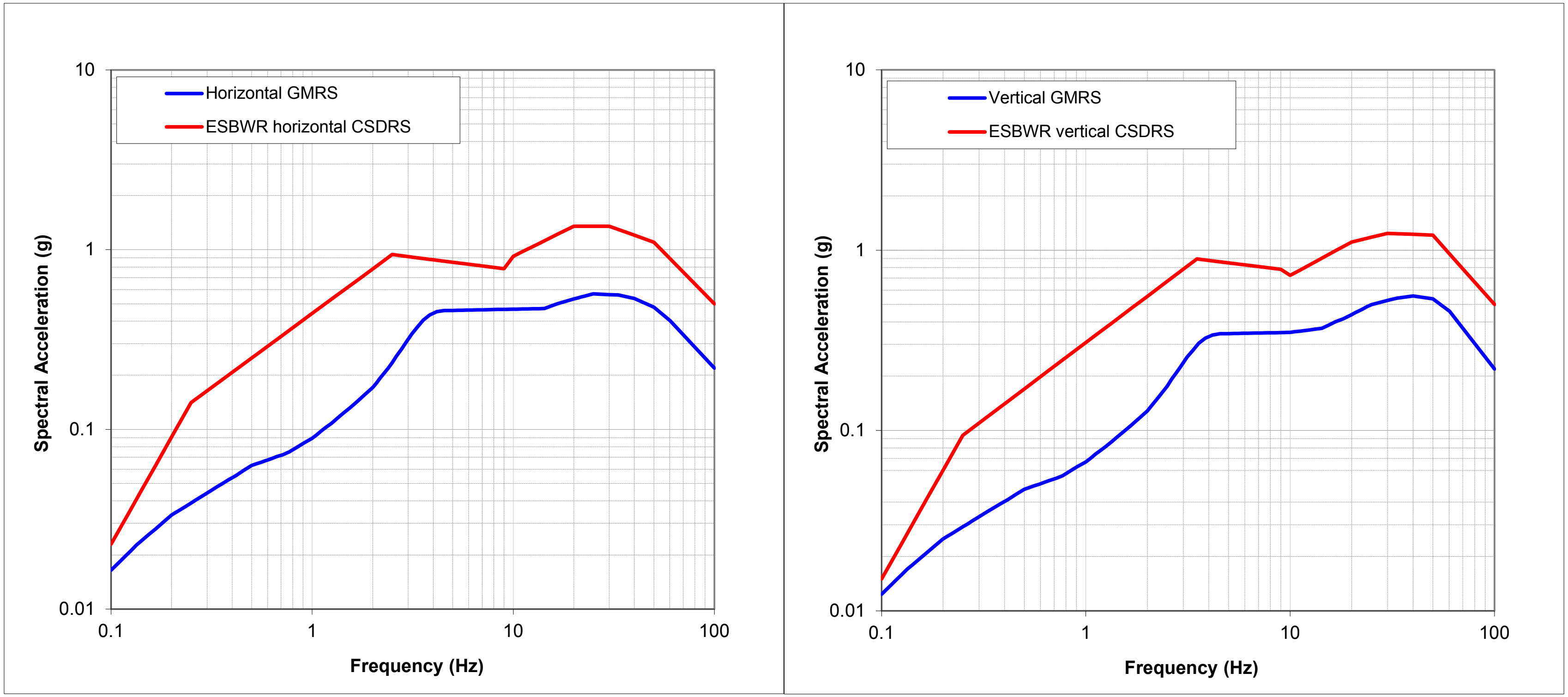
- Discuss results of SSI and SSSI

Section 3.8

- Discuss foundation stability and lateral soil pressures

Conclusion

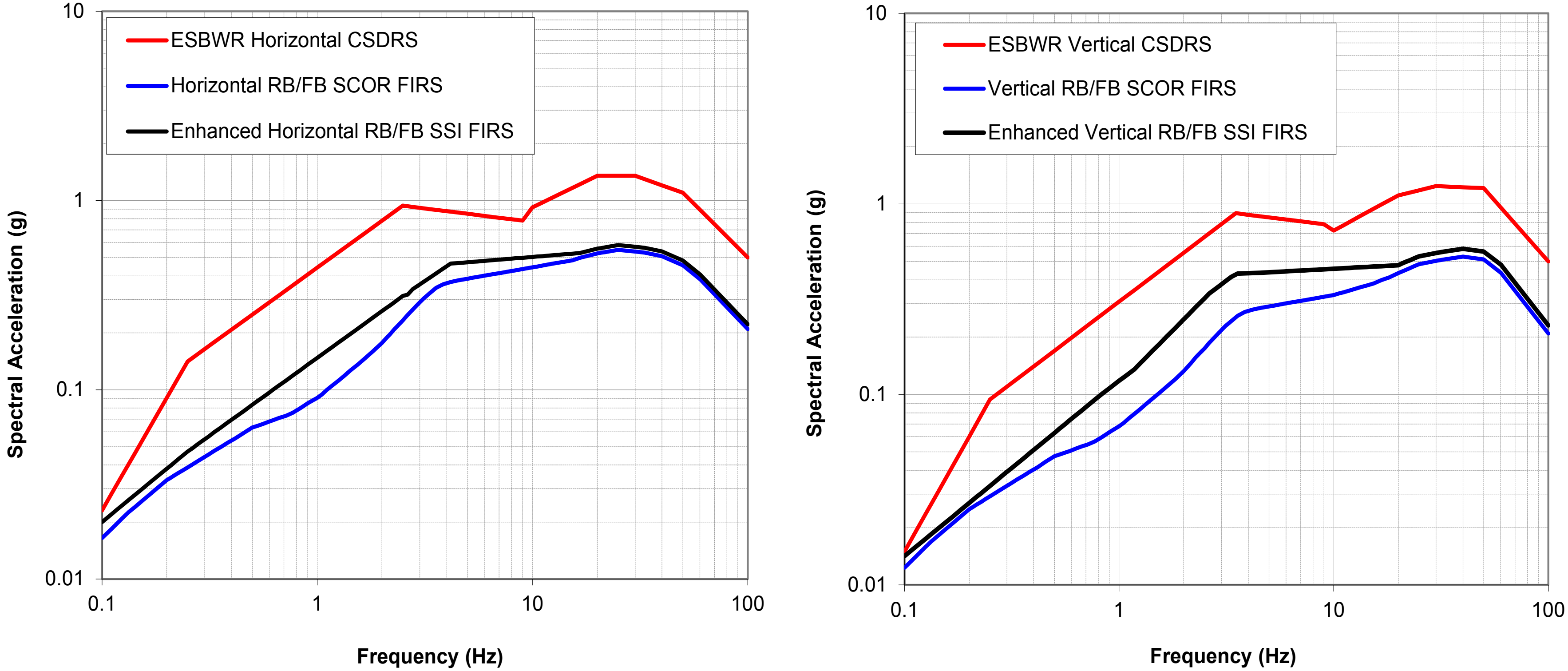
Fermi 3 GMRS compared to ESBWR CSDRS (5 percent damping)



GMRS for Fermi 3 site is well enveloped by the ESBWR horizontal and vertical Certified Seismic Design Response Spectra (CSDRS)

Conclusion

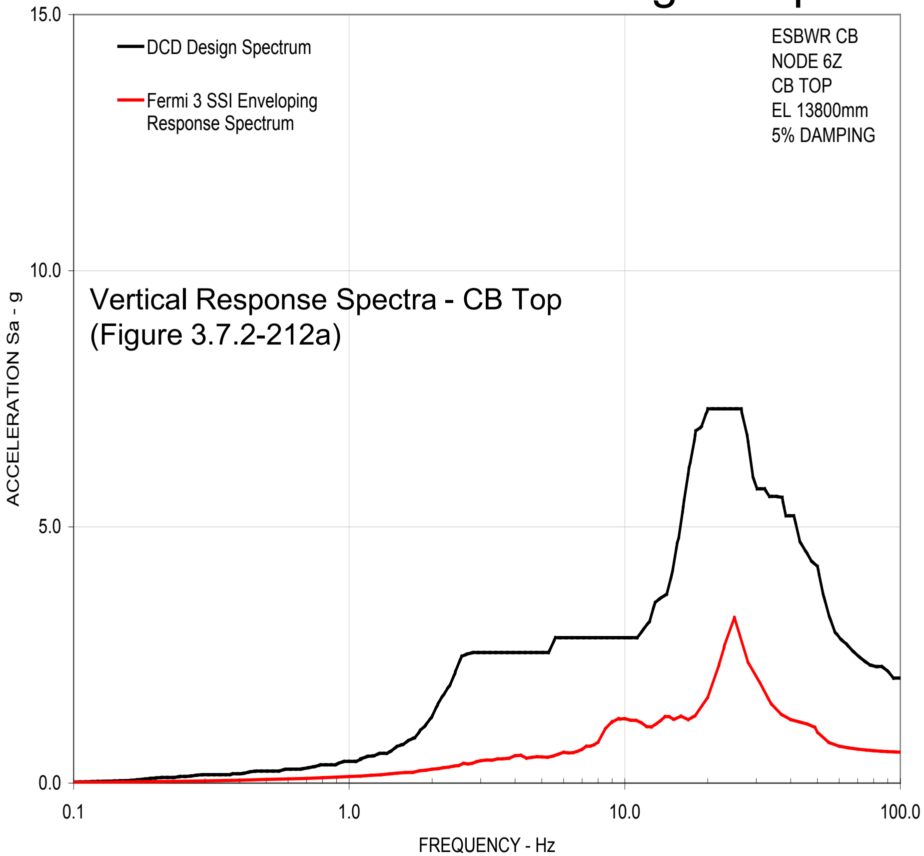
Fermi 3 RB/FB FIRS compared to ESBWR CSDRS (5 percent damping)

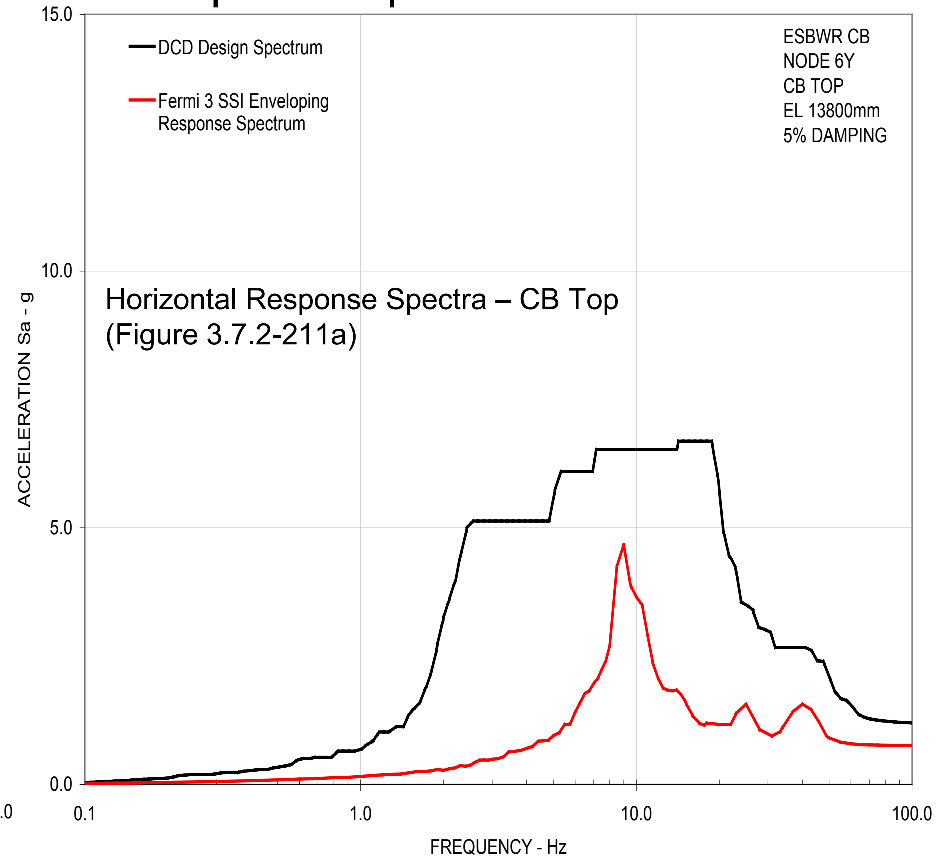


FIRS for Fermi 3 RB/FB, CB, and FWSC are enveloped by the ESBWR horizontal and vertical CSDRS

Conclusion

Governing Comparison for Response Spectra





Response spectra for Fermi 3 RB/FB and CB are enveloped by the ESBWR design response spectra

Conclusion

The Fermi 3 site is well enveloped by the ESBWR standard plant design

DTE Energy®

FERMI 3 COLA
Presentation to ACRS Subcommittee
Section 2.5

Section 2.5 - Introduction

Geology, Seismology, and Geotechnical Engineering

- Section 2.5 describes geologic, seismic, and geotechnical characterization and assessment of the Fermi 3 site
- Presentations will summarize main points for each subsection
- Results demonstrate the Fermi 3 site is well enveloped by the ESBWR standard plant design

Section 2.5 - Introduction

DTE Energy

Topics addressed include:

- Section 2.5.1 - Basic Geology and Seismic Information
- Section 2.5.2 - Vibratory Ground Motion
- Section 2.5.3 - Surface Faulting
- Section 2.5.4 - Stability of Subsurface Materials and Foundations
- Section 2.5.5 - Stability of Slopes

DTE Energy

Technical Advisory Board

Dr. G. Castro	Dr. I.M. Idriss
Dr. A. Setlur	Dr. J.C. Stepp

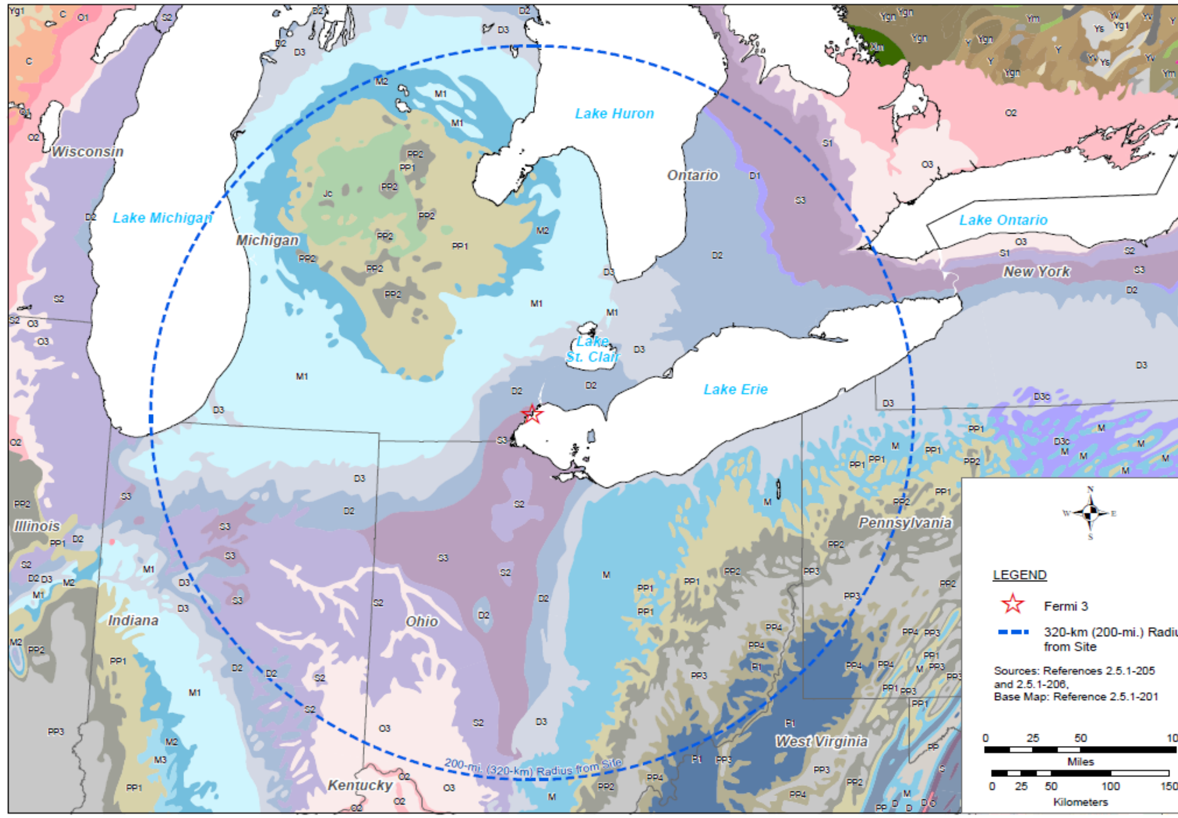
Section 2.5.1 – Purpose

Basic Geology and Seismic Information:

- To characterize the geological, geophysical, and seismological conditions of the Fermi 3 site region (320-km [200-mi] radius), site vicinity (40-km [25-mi] radius), and site area (8-km [5-mi] radius) for use in the following:
  - Determine the geologic and seismic suitability of the site
  - Determine if new tectonic or ground motion information could impact seismic and plant design bases
  - Provide the bases for ESBWR standard plant siting
- To evaluate the geologic, seismic, and related anthropogenic hazards in the site vicinity

Section 2.5.1 – Regional Geologic Setting

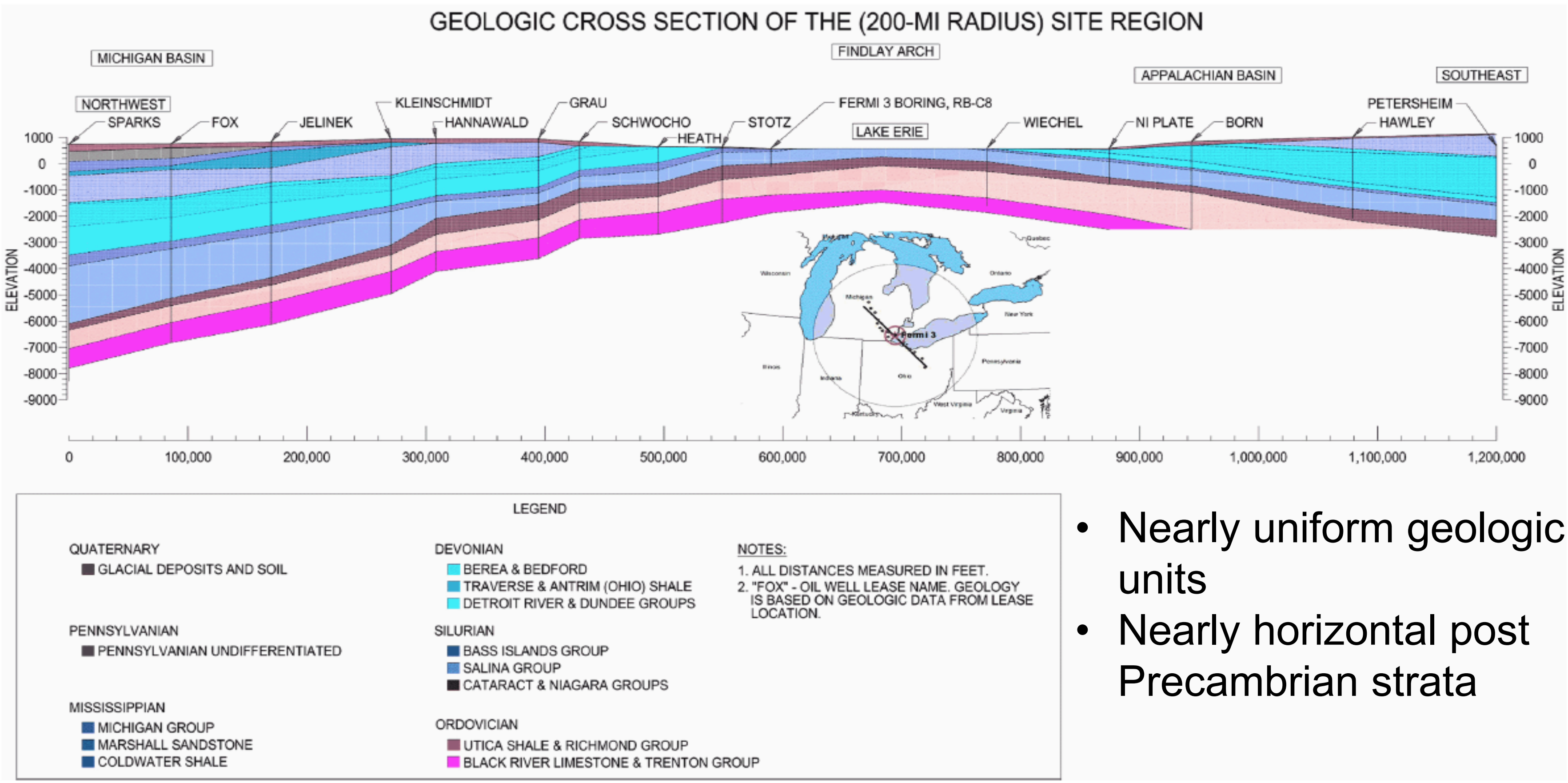
- Central Stable Region tectonic province
- Gently dipping (nearly horizontal) Paleozoic sedimentary rocks and broad gentle folds
- Located on the southeast flank of the Michigan Basin and Findley Arch
- Simple pattern of minimally deformed cover rocks above Precambrian basement



Regional Geology 320-km (200-mi) Radius

Section 2.5.1 – Regional Geologic Setting (continued)

DTE Energy

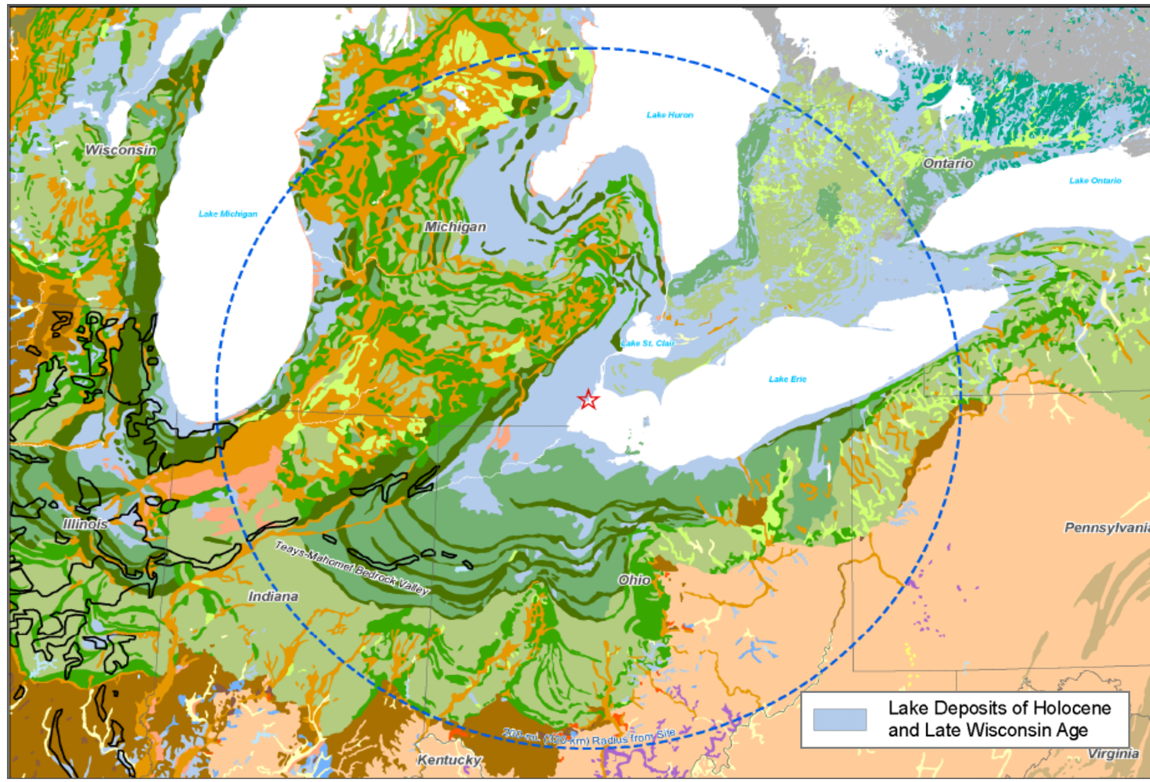


- Nearly uniform geologic units
- Nearly horizontal post Precambrian strata

Vertical Exaggeration = 26x

Section 2.5.1 – Regional Surfacial Geology

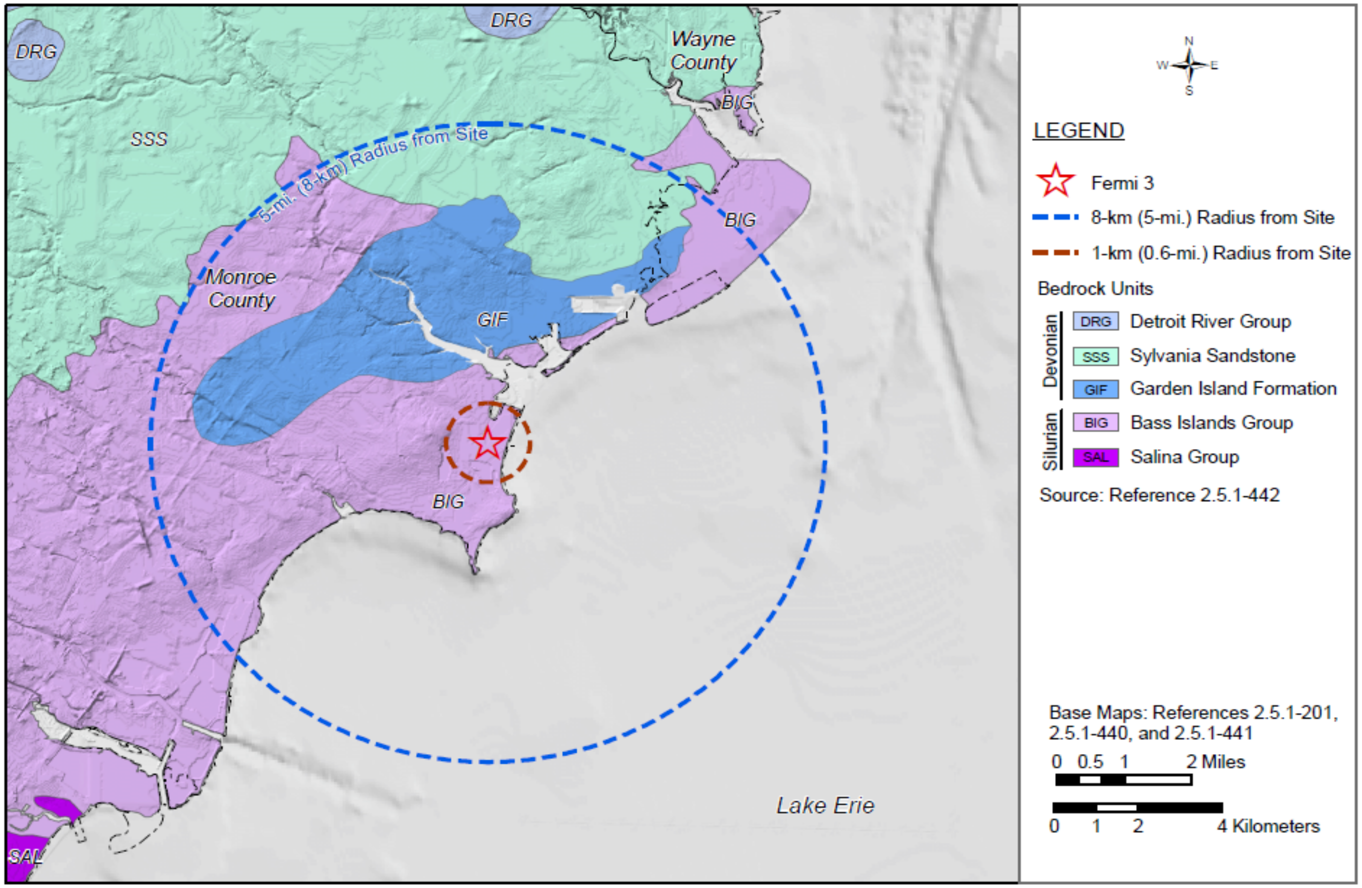
- Bedrock is overlain by Quaternary glacial deposits and alluvial sediments
- Quaternary geologic history is dominated by the advance and retreat of the continental glaciers
- Glacial features and paleoshorelines related to proglacial lakes were used to evaluate evidence for Quaternary deformation



Regional Quaternary Geology

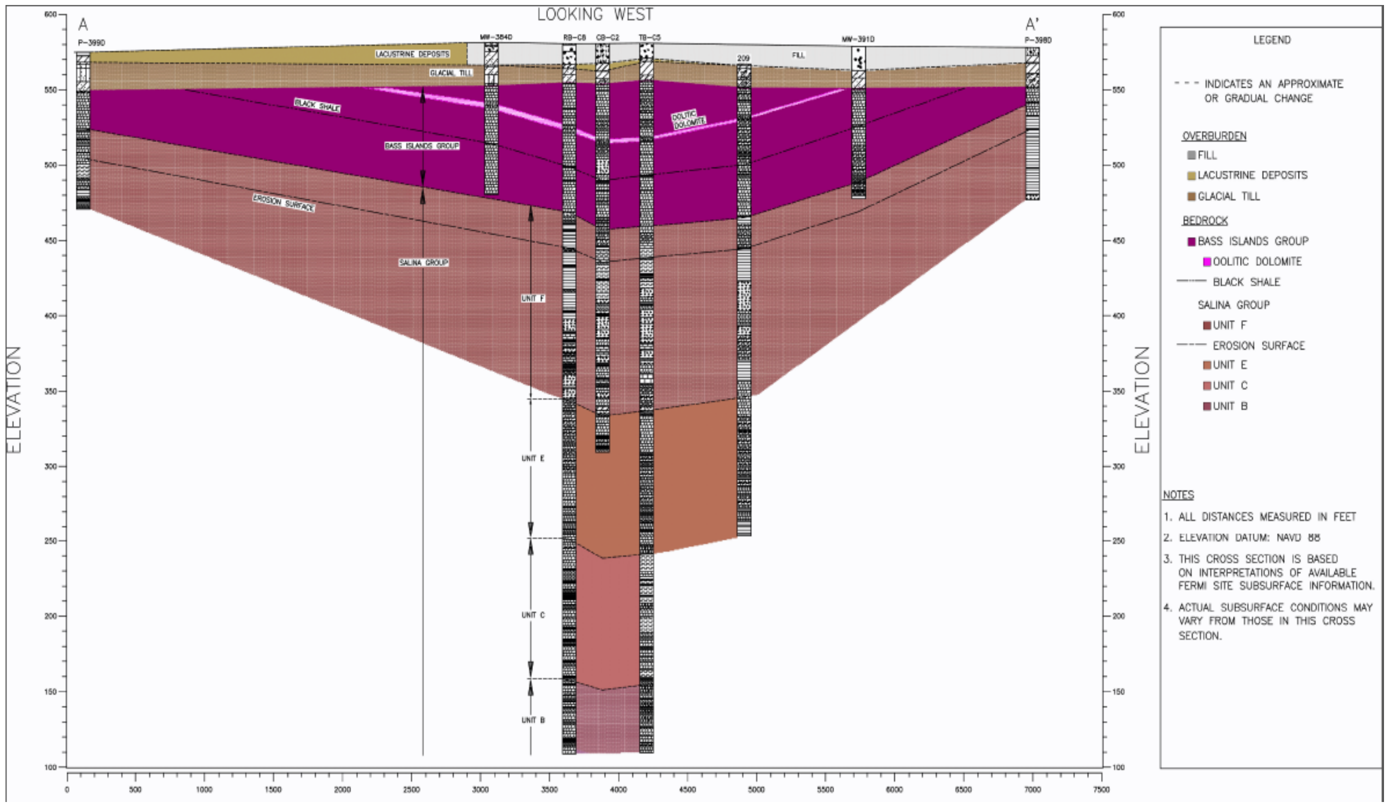
Section 2.5.1 – Site Area/Location Geologic Setting

Fermi 3 Site is located within the Bass Islands Group



Site Area/Location Geology

- Fill is from Fermi 2 site development
- Quaternary units are lacustrine and glacial sediments
- Bass Islands Group dolomite underlies the Quaternary units
- Salina Group dolomites and shale are beneath the Bass Islands Group



Vertical Exaggeration = 10x

- Gentle folding highlights the minimal deformation

Section 2.5.1 – Conclusion

Comprehensive data gathering process and findings support the assessments that demonstrate the geologic and seismic acceptability of the Fermi 3 site.

- No capable tectonic sources within 320-km (200-mi) of the site
- No known surface faults within 40-km (25-mi) of the site
- Geologic and related anthropogenic hazards in the site vicinity are negligible

Section 2.5.2 – Purpose

Vibratory Ground Motion:

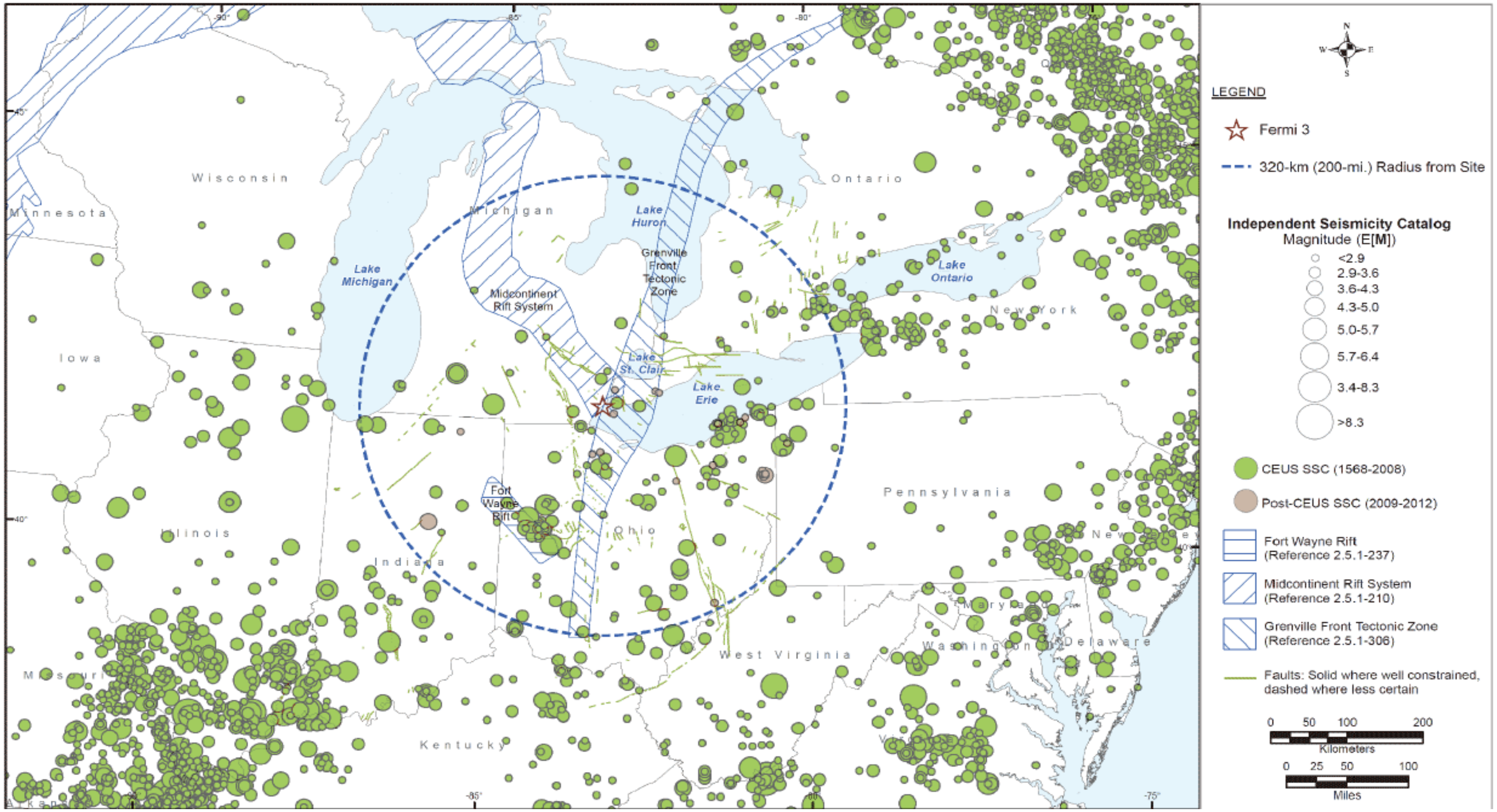
- Characterize sources of potential earthquake hazard in the site region
- Characterize seismic hazard at the site
- Characterize the seismic response of the site to develop the Ground Motion Response Spectra (GMRS)

Section 2.5.2 – Methodology

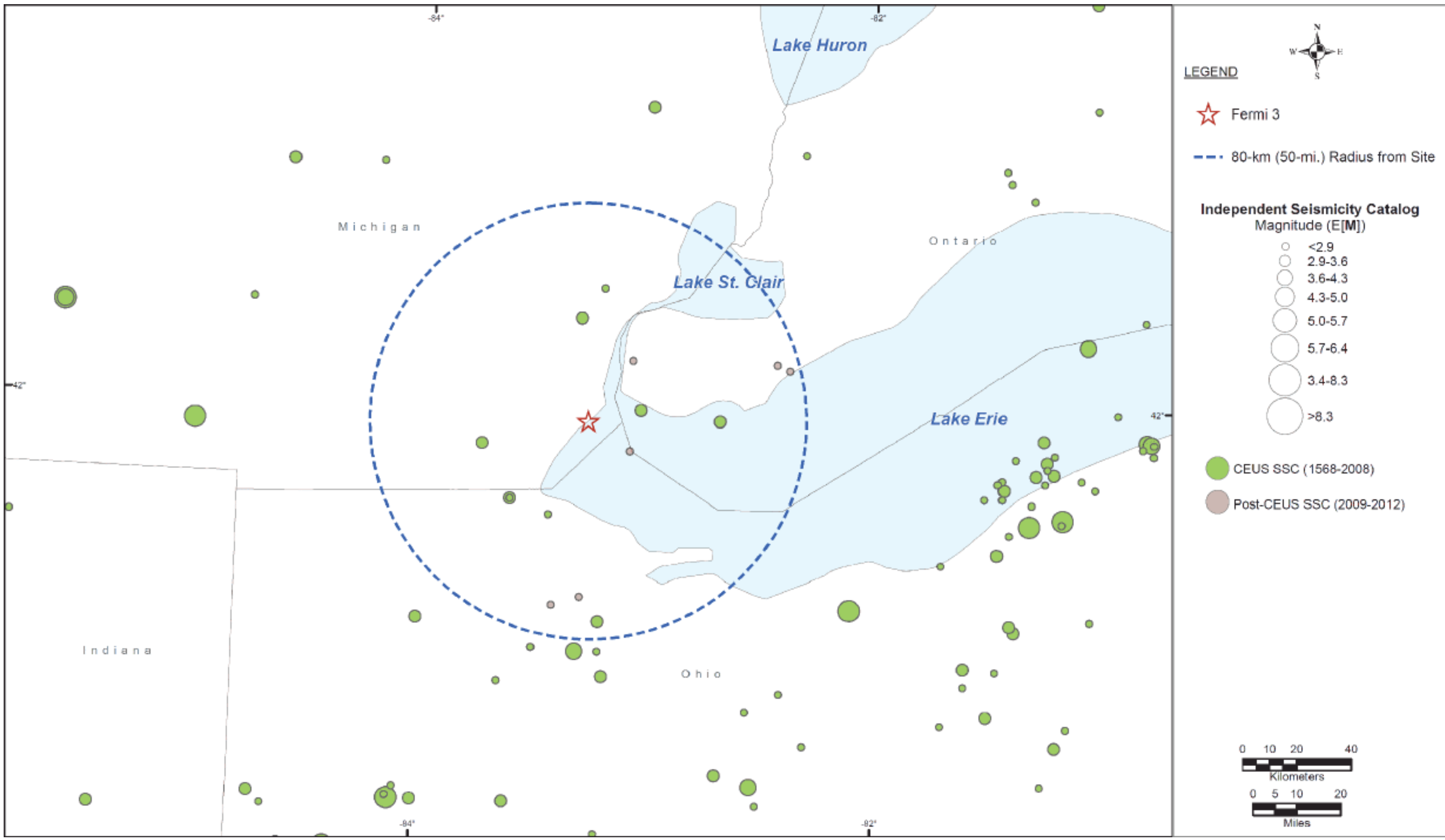
- Used Central and Eastern United States Seismic Source Characterization (CEUS SSC) model (NUREG-2115)
- Used EPRI 2004/2006 Ground Motion Models
- Followed NUREG-2117 guidance to incorporate new information into seismic hazard model
- Developed bedrock seismic hazard
- Developed site-specific site amplification functions
- Determined horizontal and vertical GMRS following RG 1.208

Section 2.5.2 – Earthquake Locations

Earthquakes within 320-km (200-mi) of the Fermi 3 Site

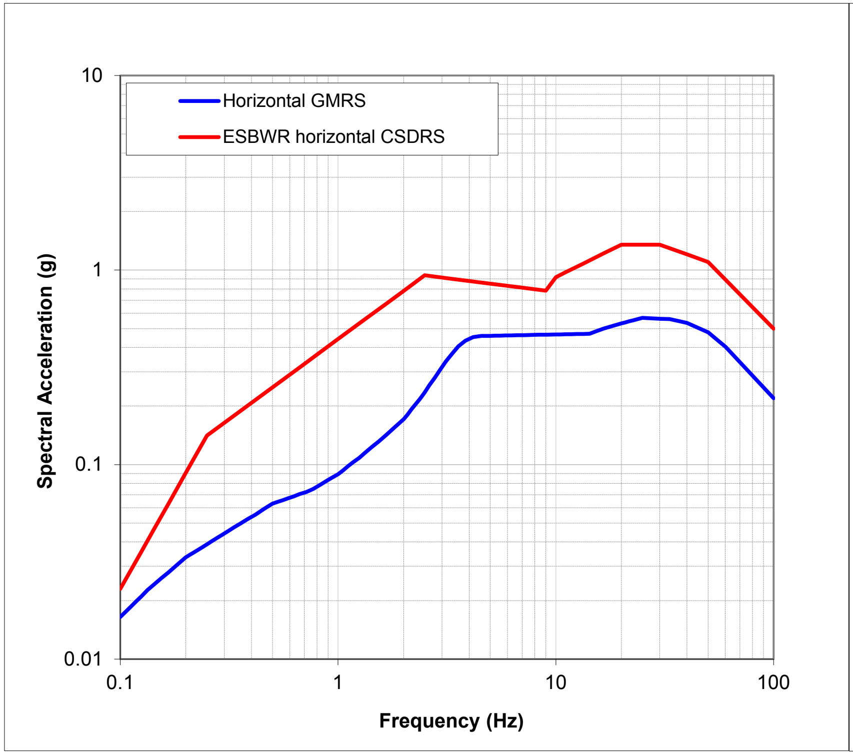


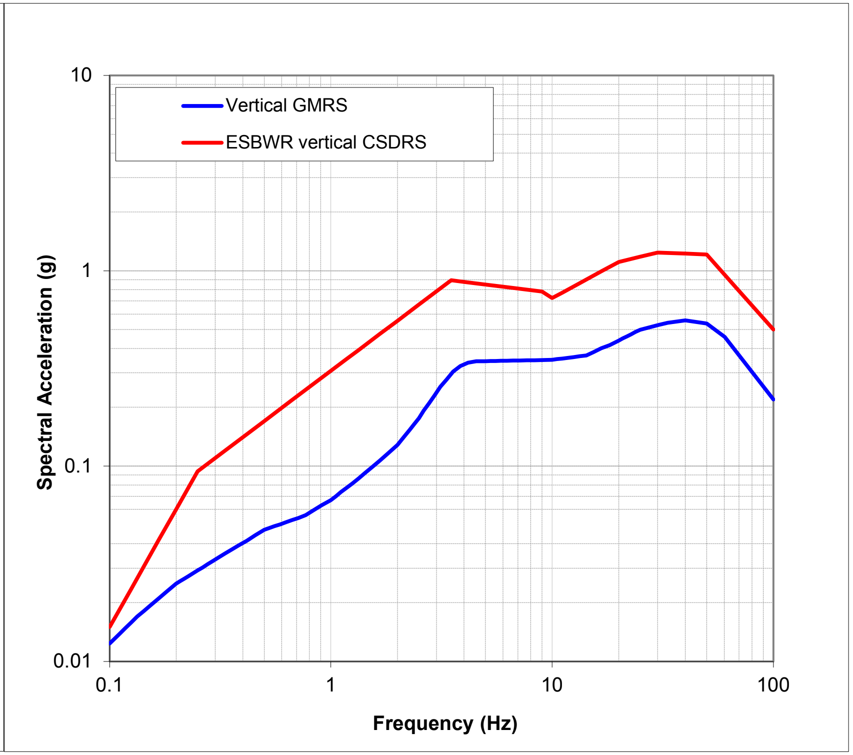
Earthquakes within 80-km (50-mi) of the Fermi 3 Site



Section 2.5.2 – Conclusion

Fermi 3 GMRS compared to ESBWR CSDRS (5 percent damping)





GMRS for Fermi 3 site is well enveloped by the ESBWR horizontal and vertical Certified Seismic Design Response Spectra (CSDRS)

Section 2.5.3 – Purpose

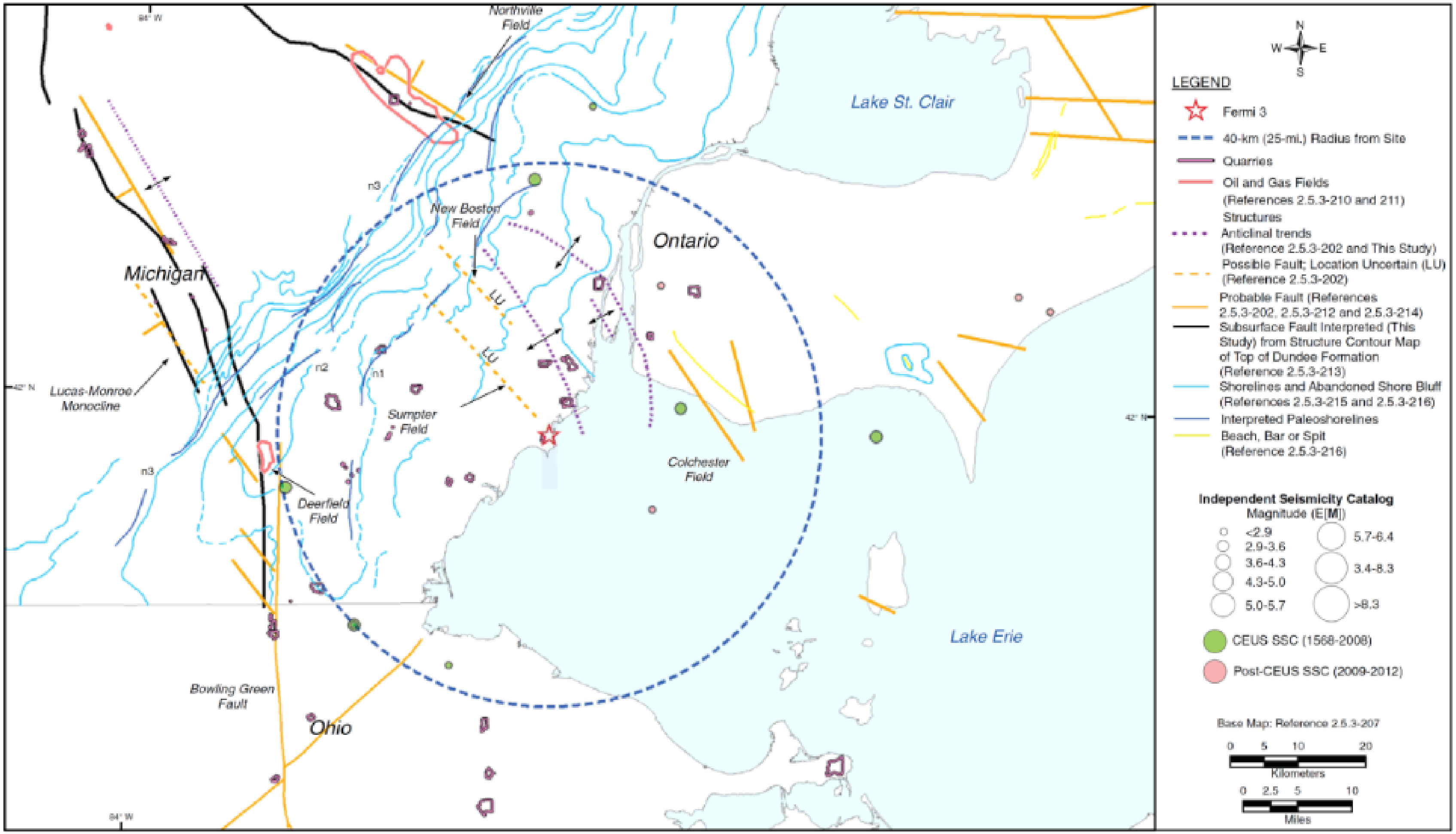
Surface Faulting:

Evaluation of the potential for surface deformation associated with capable tectonic sources and non-tectonic processes

Section 2.5.3 – Methodology

- Reviewed site-specific (Fermi 2 UFSAR and Fermi 3 COLA) data and results
- Reviewed published and unpublished literature and data
- Reviewed seismicity data (updated catalog and published information)
- Reviewed and interpreted aerial photographs and remote sensing imagery
- Evaluated paleoshoreline features
- Performed field and aerial reconnaissance
- Performed detailed mapping and evaluation of timing of most recent faulting of minor structures observed in a quarry approximately 16-km (10-mi) from Fermi 3 site

Section 2.5.3 – Mapped Structures and Seismicity in the Site Vicinity



Section 2.5.3 – Conclusion

- There are no capable tectonic fault sources within the site area (8-km [5-mi] radius) or vicinity (40-km [25-mi] radius)
- The potential for non-tectonic deformation at the site is negligible

In accordance with License Condition (2.5.3-1)

- Detailed geologic mapping of excavations for safety-related structures and evaluation of geologic features discovered will be undertaken.
- The NRC will be notified once excavations for safety-related structures are open for examination by NRC staff.

Section 2.5.4 – Purpose

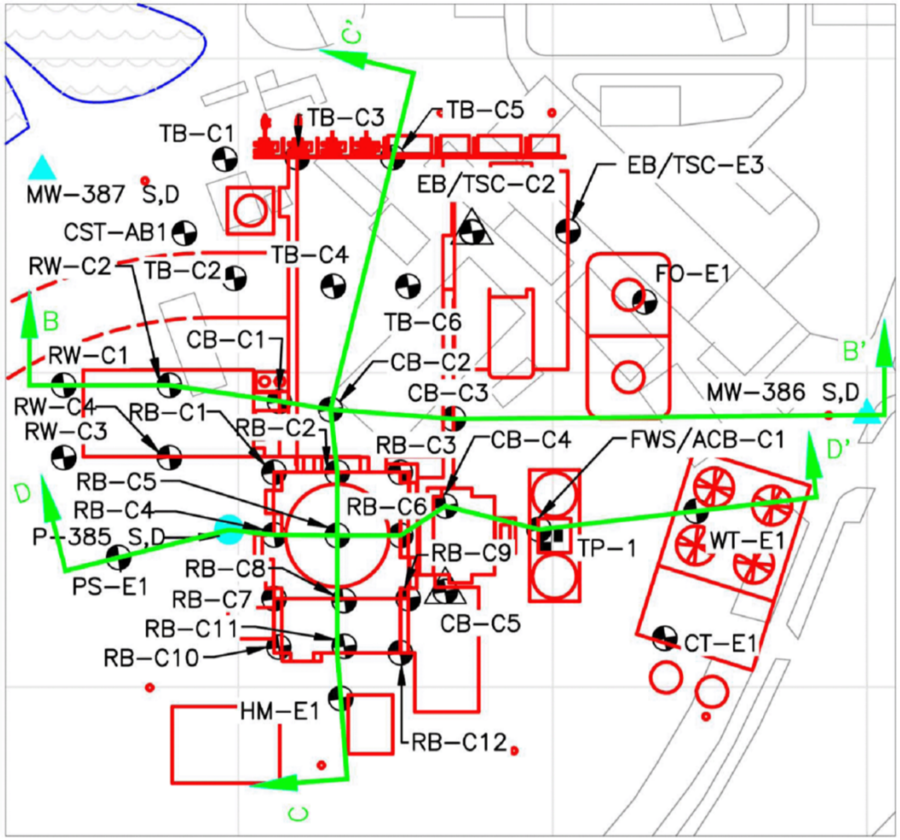
Stability of Subsurface Materials and Foundations:

- Discuss the subsurface investigation performed to characterize the Fermi 3 site
- Present the properties of soil and rock
- Illustrate the interface of the ESBWR with the Fermi 3 subsurface conditions
- Present analyses results
- Confirm the Fermi 3 site is well enveloped by the ESBWR standard plant design

Section 2.5.4 – Subsurface Investigation

DTE Energy

- Performed April to September 2007
- Soil, rock, and groundwater investigation
- In-situ testing and measurements
- Geophysical surveys
- Laboratory testing on soil and rock samples

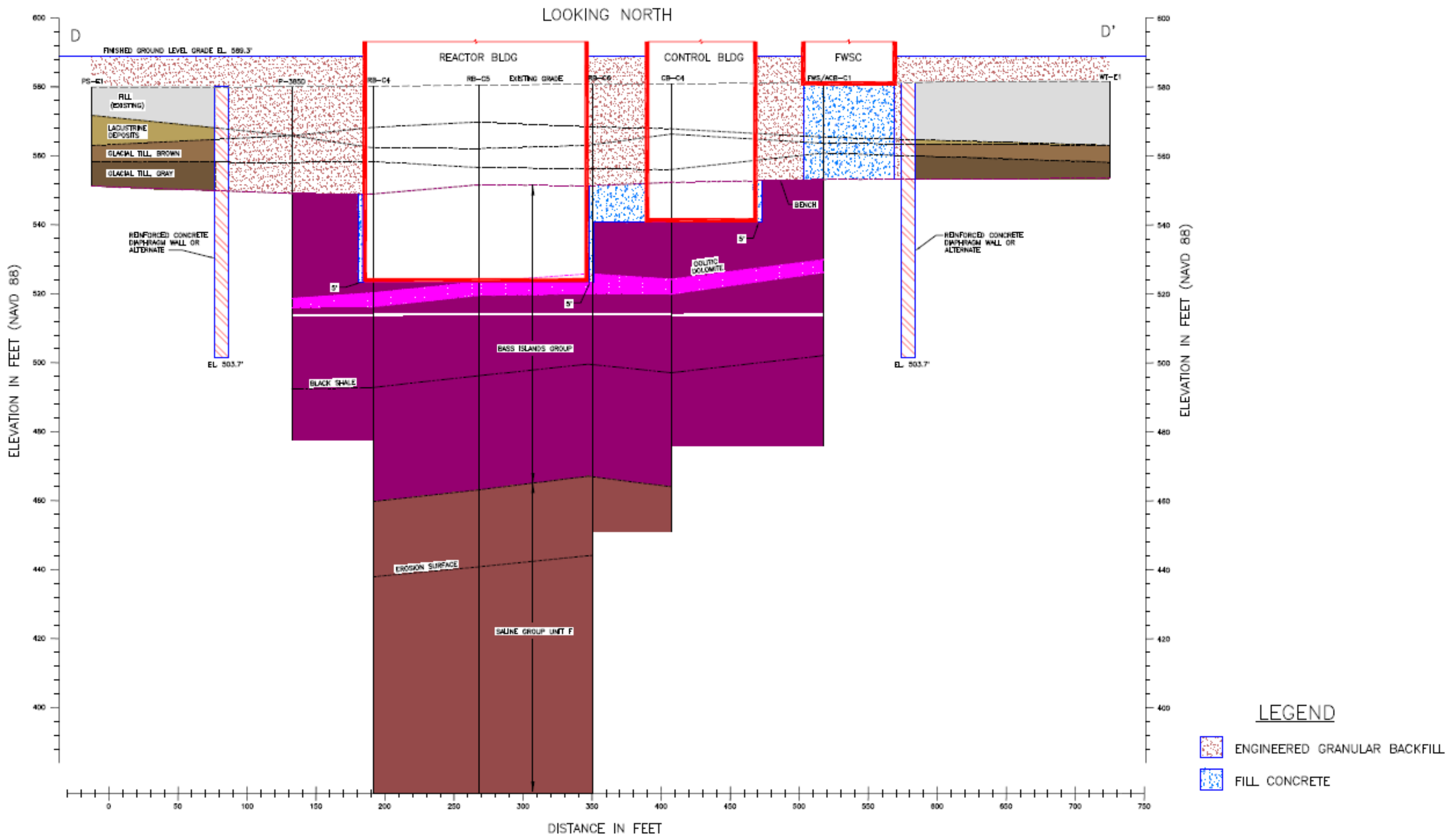


Section 2.5.4 – Subsurface Investigation Results

Results used to:

- Understand the subsurface conditions
- Establish the static and dynamic subsurface material engineering properties
- Calculate the static and dynamic bearing capacities
- Calculate excavation rebounds and foundation settlements
- Calculate the static and dynamic lateral earth pressures
- Outline construction considerations
- Address source of Engineered Granular Backfill
- Describe instrumentation and monitoring programs for Seismic Category I structures

Section 2.5.4 - Foundation Interfaces, Excavation, and Geologic Cross Section



Vertical Exaggeration = 2.5x

Section 2.5.4 – Conclusion

- The site is characterized by horizontal layers of soil and rock
- Uniform soil and rock properties across the site
- RB/FB and CB are founded on bedrock
- Fire Water Service Complex (FWSC) is founded on fill concrete that extends to bedrock
- Static and dynamic bearing capacities are greater than the ESBWR standard plant design demands, and the site-specific soil-structure interaction (SSI) static and dynamic bearing demands
- Foundation rebounds, settlements, and differential settlements are within ESBWR standard plant design criteria
- No liquefaction potential

Section 2.5.4 – Conclusion (continued)

The Fermi 3 site is well enveloped by the ESBWR standard plant design

Section 2.5.5 – Purpose and Conclusion

DTE Energy

Stability of Slopes

- Confirm the stability of permanent slopes
  - The site development is relatively flat with maximum permanent slopes of 12.5 horizontal to 1 vertical
  - There are no safety related embankments for cooling ponds, an ultimate heat sink, retaining walls, bulkheads, dams, or jetties

- The permanent slopes are stable

DTE Energy®

Fermi 3 COLA
Presentation to ACRS Subcommittee
Section 3.7 and 3.8

Background

- Fermi 3 site-specific Soil-Structure Interaction (SSI) was performed to address:
  - Partial embedment of Seismic Category I structures
  - Evaluate side backfill for Seismic Category I structures as permitted by DCD
- Initial SSI (2011-2012) analysis used the subtraction method
- In 2012, Fukushima Near Term Task force Recommendation 2.1 required evaluation of the Central and Eastern US Seismic Source Characterization (CEUS SSC) model
- DTE Energy elected to re-perform all prior Fermi 3 site-specific SSI analysis using CEUS SSC based inputs
- Resulted in a coherent set of analyses which demonstrate the Fermi 3 site is well enveloped by the ESBWR standard plant design

Introduction

Discussion Topics:

- 3.7 Seismic Design
  - Seismic Design Parameters: Design ground motion with comparison to Certified Seismic Design Response Spectra (CSDRS)
  - Seismic System Analysis: SSI
- 3.8 Seismic Category I Structures
  - Other Seismic Category I Structures
  - Foundations

DTE Energy

Site-Specific SSI and Structure-Soil-Structure Interaction (SSSI) analyses were performed to demonstrate the Fermi 3 site is well enveloped by the ESBWR standard plant design

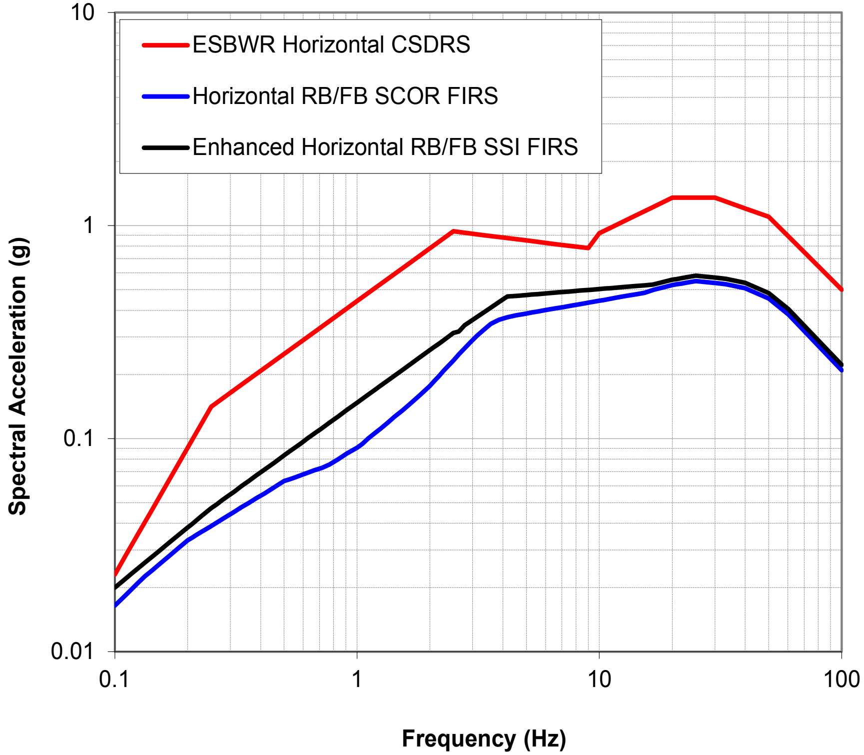
- Updated site-specific seismic inputs based on CEUS SSC model
- Accounted for partial embedment of the Reactor Building/Fuel Building (RB/FB) and Control Building (CB) into the Bass Islands Group bedrock
- Evaluated side backfill for Seismic Category I structures as permitted by DCD

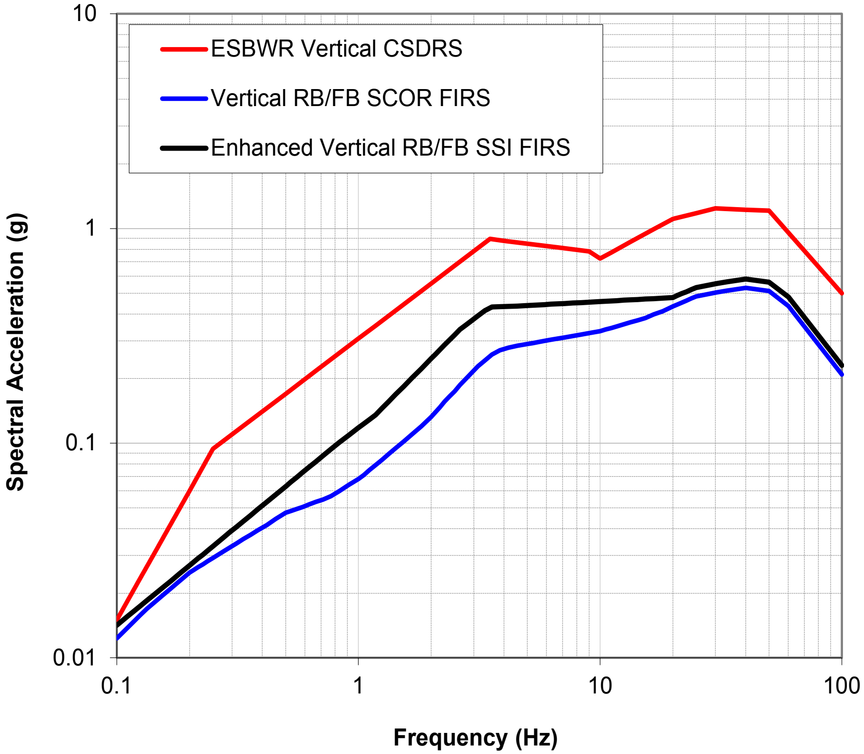
Section 3.7.1 – Seismic Design Inputs

Seismic Design Parameters:

- Computed site-specific amplification functions to develop Foundation Input Response Spectra (FIRS)
- Determined horizontal and vertical FIRS for the RB/FB and CB
- Enhanced the FIRS to satisfy minimum ground motion requirements specified in 10 CFR Part 50, Appendix S and to satisfy ISG-17 recommendations for hazard consistent spectra
- Developed ground motion time histories and subsurface material properties for SSI analyses

Fermi 3 RB/FB FIRS compared to ESBWR CSDRS (5 percent damping)

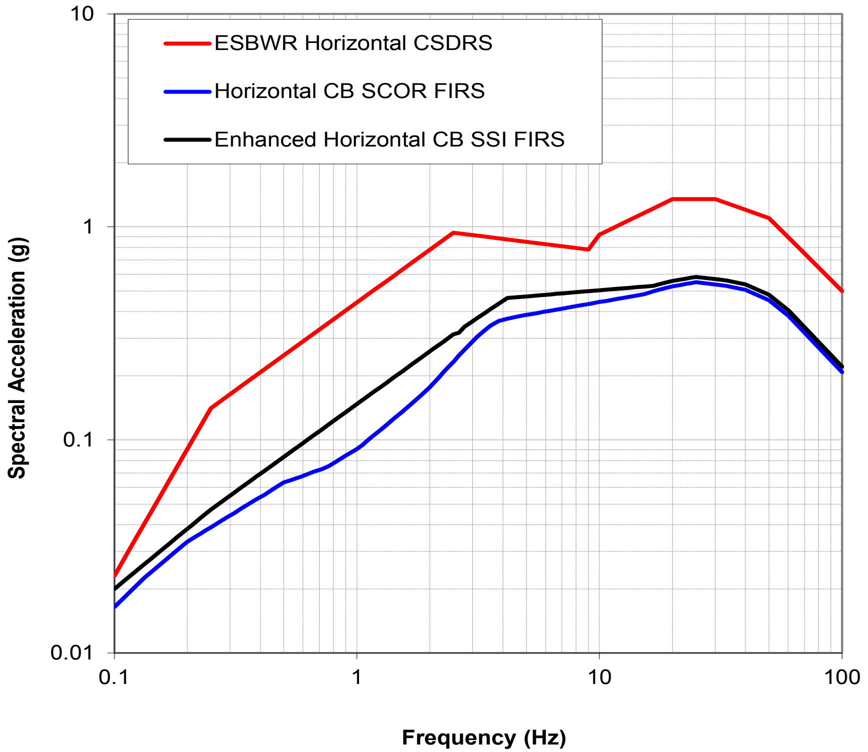


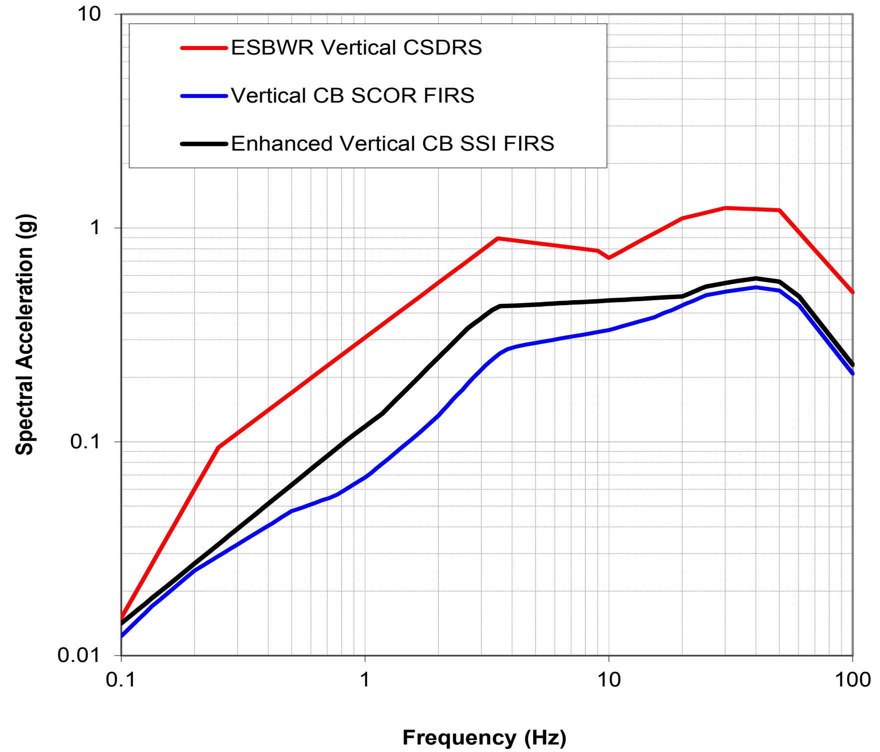


FIRS for Fermi 3 RB/FB are enveloped by the ESBWR horizontal and vertical CSDRS

Section 3.7.1 – Seismic Design Inputs (continued)

Fermi 3 CB FIRS compared to ESBWR CSDRS (5 percent damping)



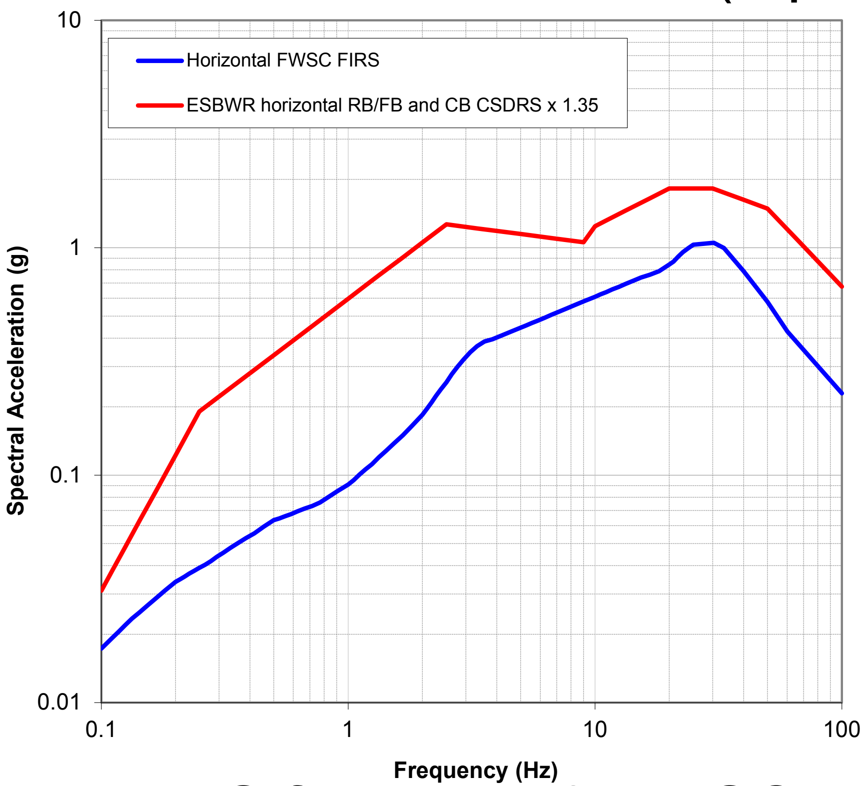


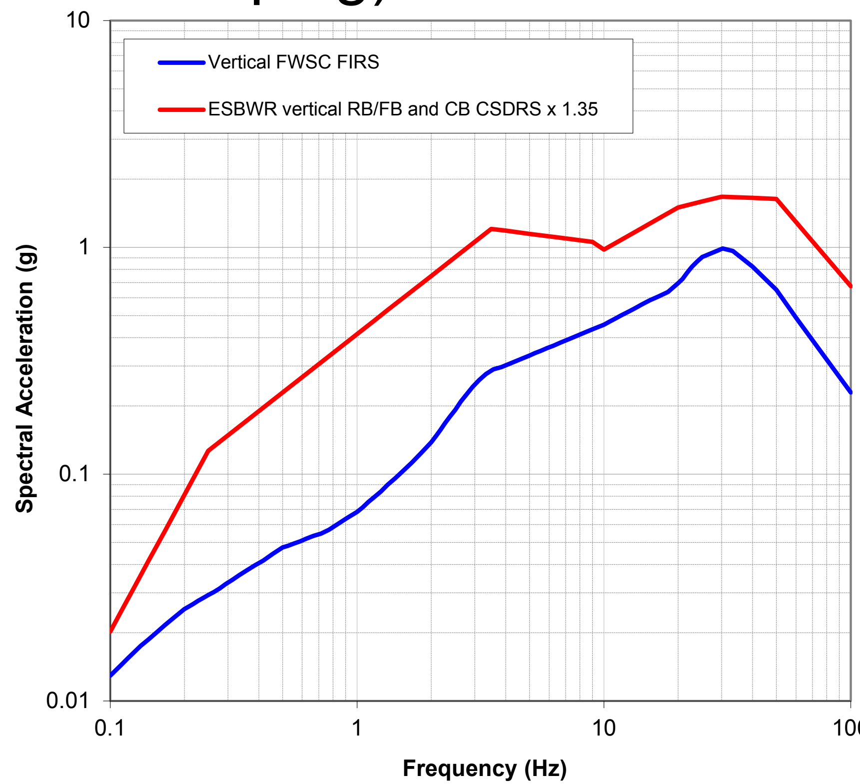
FIRS for Fermi 3 CB are enveloped by the ESBWR horizontal and vertical CSDRS

Section 3.7.1 – Seismic Design Inputs (continued)

- Fire Water Service Complex (FWSC) is a surface founded structure on fill concrete above bedrock
- FWSC FIRS is well enveloped by ESBWR CSDRS x 1.35
- All FWSC requirements are satisfied

Fermi 3 FWSC FIRS compared to 1.35 times ESBWR CSDRS (5 percent damping)





FIRS for Fermi 3 FWSC are enveloped by the ESBWR horizontal and vertical CSDRS

Section 3.7.1 – Conclusion

Site-specific FIRS are enveloped by ESBWR CSDRS design motions

Seismic System Analysis:

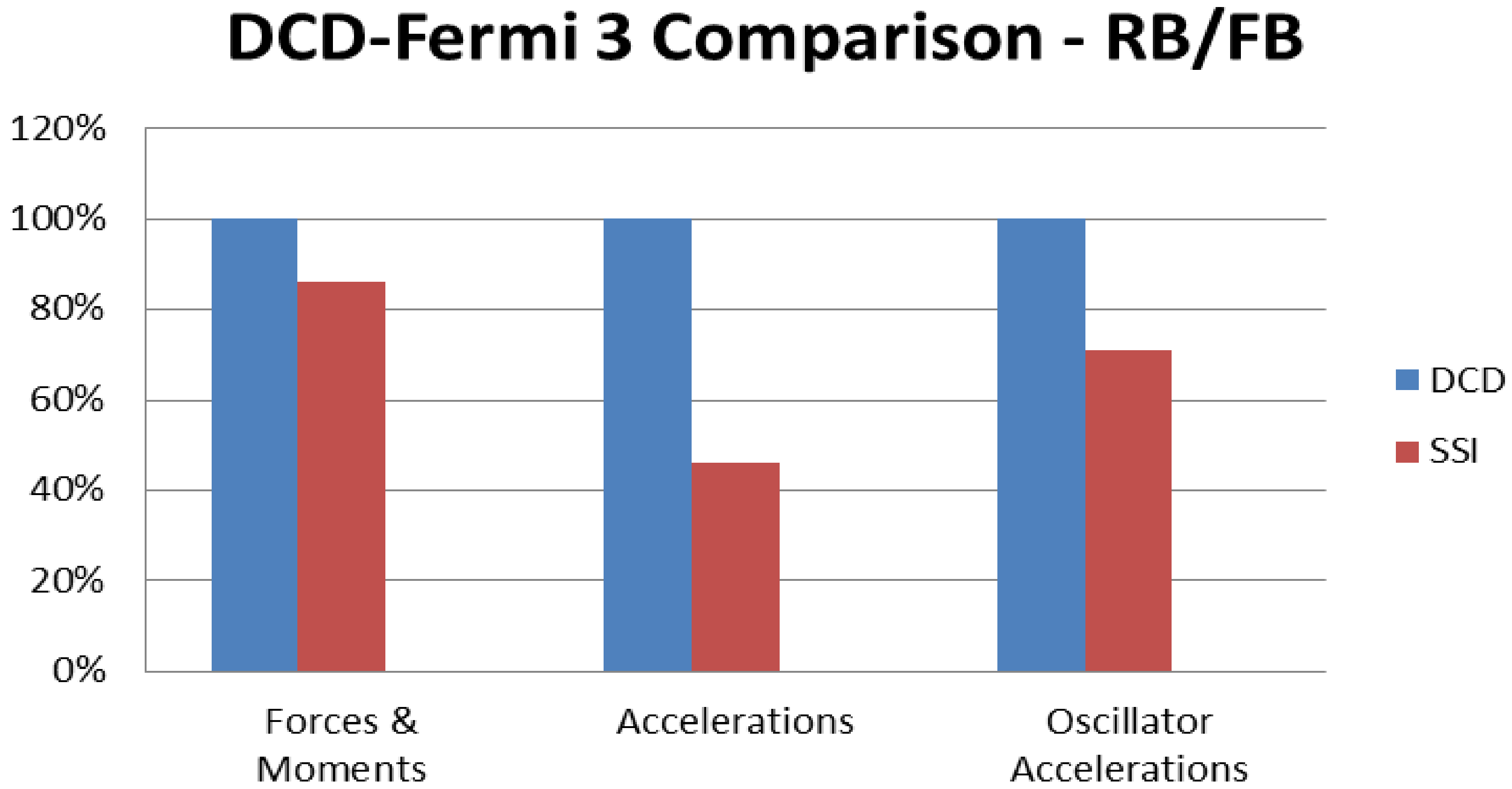
Fermi 3 site-specific SSI analyses were performed to evaluate partial embedment and to address ESBWR requirements for side backfill

- Followed methodology presented in DCD Appendix 3A with the ESBWR structural models for the RB/FB and CB
- Fermi 3 site-specific SSI and SSSI analyses were performed using SASSI2010:
  - Used the direct method of analysis wherever possible
  - The modified subtraction method of analysis was used where the number of Interaction Nodes exceeded the capacity of SASSI2010 using the direct method
  - Benchmarked the modified subtraction method against the direct method

Section 3.7.2 – Conclusion

- Analyses for RB/FB and CB were performed with and without the engineered granular backfill

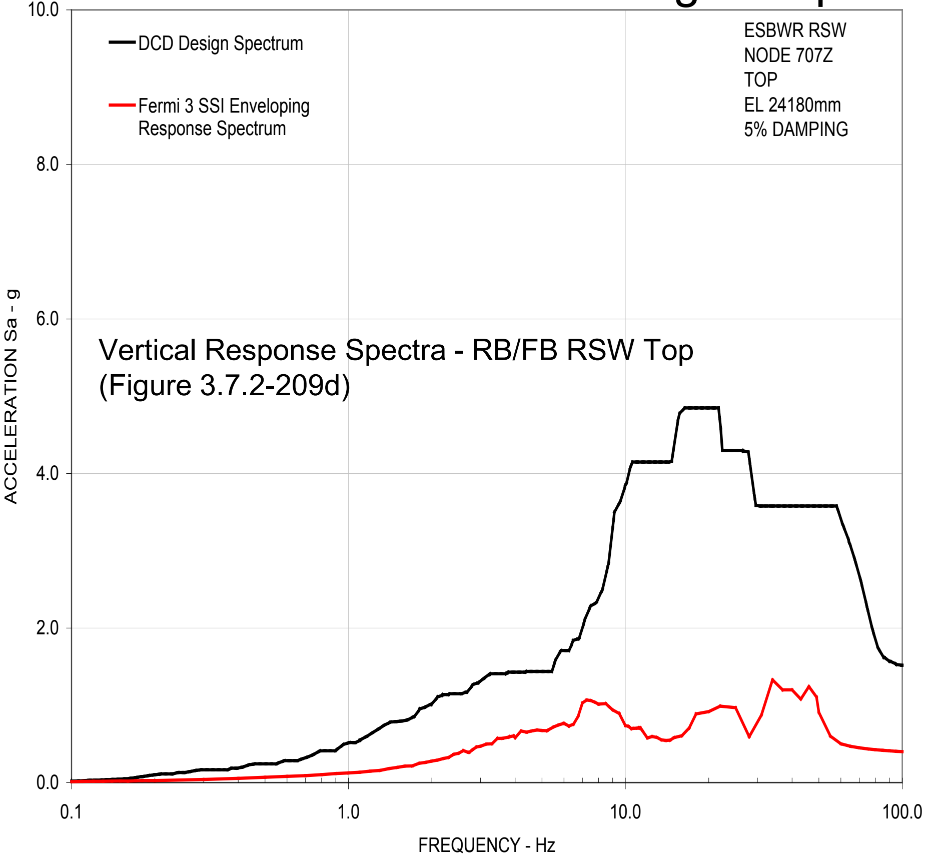
- Results from the Fermi 3 SSI and SSSI analyses show the seismic forces in members, accelerations, and floor response spectra are well enveloped by the ESBWR standard plant design for both the RB/FB and CB

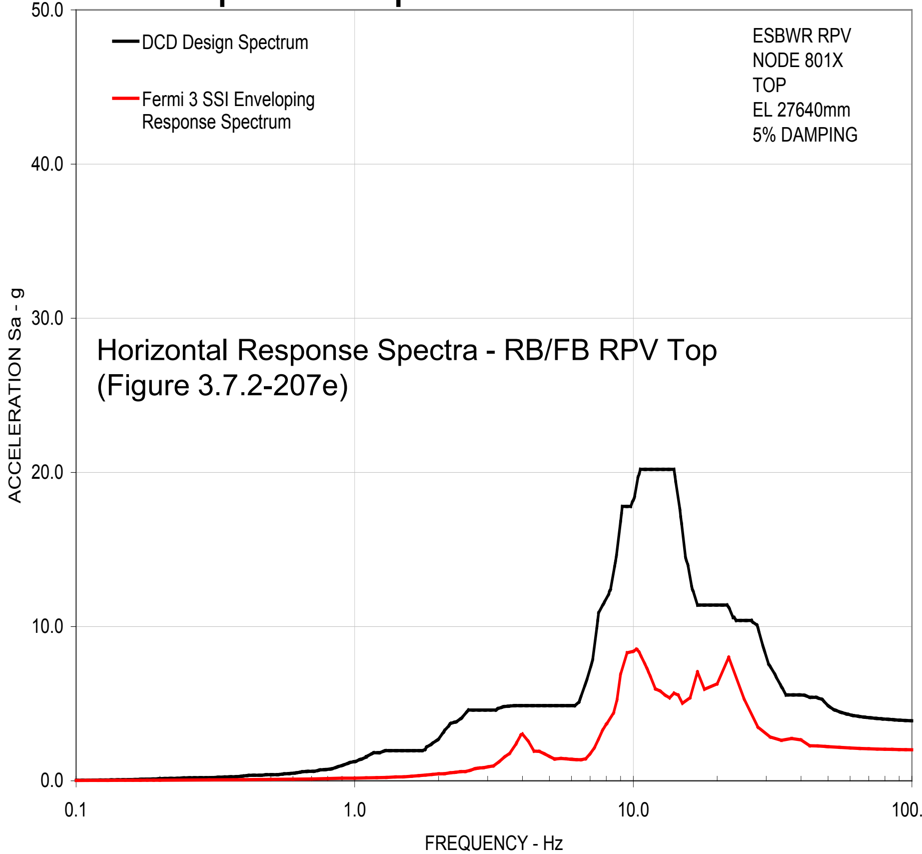


The Fermi 3 RB/FB is well enveloped by the ESBWR RB/FB standard plant design

Section 3.7.2 – Conclusion (continued)

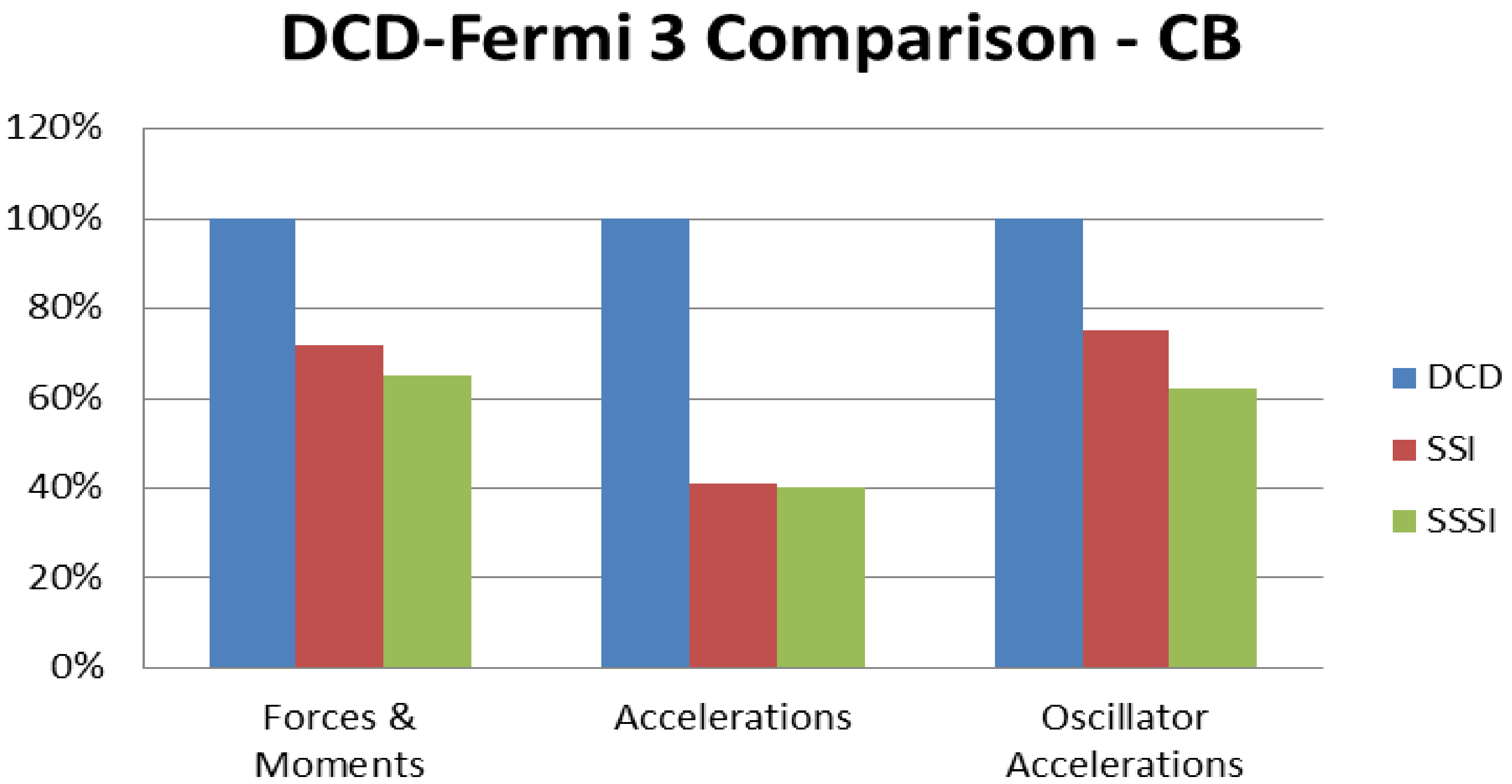
Governing Comparison for Response Spectra





The Fermi 3 RB/FB is well enveloped by the ESBWR RB/FB standard plant design

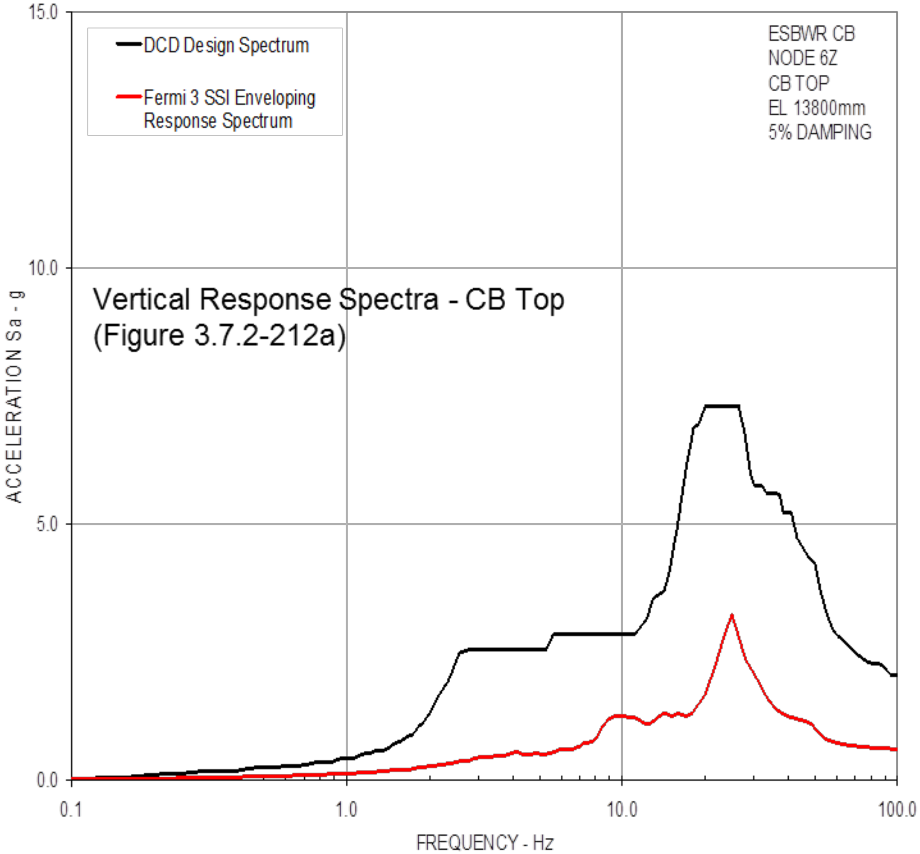
Section 3.7.2 – Conclusion (continued)

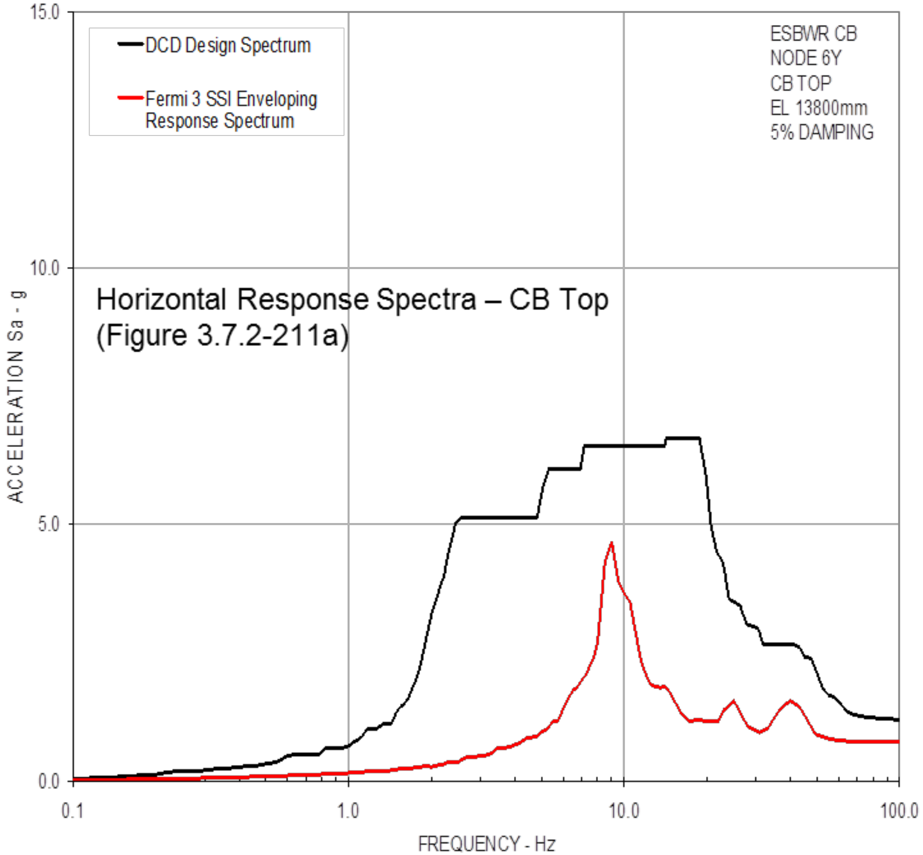


The Fermi 3 CB is well enveloped by the ESBWR CB standard plant design

Section 3.7.2 – Conclusion (continued)

Governing Comparison for Response Spectra





The Fermi 3 CB is well enveloped by the ESBWR CB standard plant design

Section 3.7.4 – Commitment

Seismic Instrumentation:

- The seismic monitoring program described in this subsection, including the necessary test and operating procedures, will be implemented prior to the receipt of fuel on site. (COM 3.7-001)

Section 3.8.4 – Purpose and Conclusion

Other Seismic Category I Structures:

- Lateral soil pressures from the applicable SSI and SSSI analyses were evaluated

- A quantitative assessment of the sidewall design was performed

- The induced out-of-plane bending moments and shear forces in the walls are enveloped by the ESBWR standard plant design

Section 3.8.5 - Conclusion

Foundations:

- Results from the Fermi 3 site-specific foundation stability evaluations demonstrated that the minimum factors of safety for sliding, overturning, and flotation meet SRP 3.8.5 requirements

- The Fermi 3 site-specific soil dynamic bearing demands are considerably below the allowable dynamic bearing capacities of the bedrock

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Presentation to the ACRS Subcommittee

Fermi Unit 3
COL Application Review

Advanced Final Safety Evaluation
Section 2.5,
"Geology, Seismology, and Geotechnical Engineering"

August 20, 2014

Section 2.5
Geology, Seismology and Geotechnical Engineering

Staff Review Team

- **Project Manager**
  - Tekia Govan

- **Technical Staff**
  - RGS, Chief, Diane Jackson
  - RGS, Technical Reviewer, Laurel Bauer
  - RGS, Technical Reviewer, Sarah Tabatabai
  - RGS, Technical Reviewer, Zuhan Xi
  - RGS, Technical Reviewer, Luissette Candelario

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 2.5.1
Basic Geologic and Seismic Information
and
Section 2.5.3
Surface Faulting

Presented by:
Laurel Bauer

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 2.5.1 Basic Geologic and Seismic Information

- Summary of FSAR Section 2.5.1:
  - Section 2.5.1 of the FSAR addresses regional and site geology including stratigraphy, geologic history, tectonic setting, principle tectonic structures, and a site geologic hazard evaluation.

- Staff’s Review included:
  - COL information item EF3 COL 2.0-26-A: Addresses basic geologic and seismic information for the Fermi 3 site.
  - Evaluation of the Quaternary geologic history of the site.
  - Evaluation of principal faults within the site region.
  - Evaluation of potential deformation due to glacial isostatic adjustments (GIA).
  - Evaluation of localized deformation features at a nearby quarry.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 2.5.1 Basic Geologic and Seismic Information

Staff Conclusion

- NRC staff reviewed the Fermi 3 COL application and confirmed that the applicant has adequately addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section.
- The staff conducted its review of the Fermi 3 COL application following relevant NRC regulations, the guidance in Section 2.5.1 of NUREG–0800, and applicable NRC regulatory guides.
- The staff determined that the applicant has adequately addressed COL Item EF3 2.0-26-A related to basic geologic and seismic information and concludes that the applicant provided a thorough characterization of the geologic and seismic characteristics of the Fermi 3 site in accordance with the NRC regulations.

Section 2.5.3
Surface Faulting

- Summary of FSAR Section 2.5.3:
  - Section 2.5.3 of the FSAR describes the potential for surface deformation due to faulting, and addresses the following topics related to surface faulting: geologic, seismic, and geophysical investigations; geologic evidence, or absence of evidence, for tectonic surface deformation.

- Staff's Review included:
  - COL Information Item EF3 COL 2.0-28-A : Addresses the potential for surface faulting at the Fermi 3 site.
  - Evaluation of the potential for surface or near-surface tectonic and non-tectonic deformation within and 8 kilometer (5 mile) radius of the Fermi 3 site.

Section 2.5.3
Surface Faulting

Staff Conclusion:

- NRC staff reviewed the Fermi 3 COL application and confirmed that the applicant has adequately addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section.
- The staff conducted its review of the Fermi 3 COL application following relevant NRC regulations, the guidance in Section 2.5.3 of NUREG–0800, and applicable NRC regulatory guides.
- The staff determined that the applicant has adequately addressed COL Item EF3 2.0-28-A related to surface faulting and concludes that the applicant provided a thorough characterization of the potential for surface deformation at the Fermi 3 site in accordance with the NRC regulations.

Section 2.5.3
Surface Faulting

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

License Condition 2.5.3-1

The licensee shall perform detailed geologic mapping of the excavation for Fermi 3 nuclear island structures; examine and evaluate geologic features discovered in excavations for safety-related structures other than those for the Fermi 3 nuclear island; and notify the Director of the Office of New Reactors, or the Director's designee, once excavations for Fermi 3 safety-related structures are open for examination by NRC staff.

Section 2.5.2
Vibratory Ground Motion

Presented by:
Sarah Tabatabai

Overview

- Summary of FSAR Section 2.5.2:
  - Describes the development of the site-specific GMRS, which is based on a detailed evaluation of earthquake potential that takes into account the regional and local geology, Quaternary tectonics, seismicity, and site-specific geotechnical engineering characteristics of the site's subsurface material.
- Staff's review included:
  - COL information item EF3 COL 2.0-27A (Vibratory Ground Motion): Addresses the provision for site-specific information related to the vibratory ground motion aspects of the site including: seismicity, geologic and tectonic characteristics, the correlation of earthquake activity with seismic sources, a probabilistic seismic hazard analysis, seismic wave transmission characteristics, and site-specific GMRS.
  - Applicant's response to RAI 01.05-1, which addressed the Fukushima Recommendation 2.1 (R2.1) seismic hazard reevaluation

Section 2.5.2
Vibratory Ground Motion

Outline

- Background Related to the R2.1 Seismic Hazard Reevaluation
- Central and Eastern United States Seismic Source Characterization (CEUS-SSC) Model Summary
- Summary of FSAR Section 2.5.2 and the R2.1 Seismic Hazard Reevaluation
- ACRS Subcommittee Action Item: Discussion of Hazard Curve Uncertainty
- Summary of the Staff's Evaluation
- Additional Staff Confirmation
- Staff Conclusions

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Background Related to the R2.1 Seismic Hazard Reevaluation

- Fermi 3 COL FSAR Section 2.5.2 Ground Motion Response Spectra (GMRS) was originally based on an updated EPRI-SOG (1986) seismic source model and the EPRI (2004, 2006) Ground Motion Model.
- NRC issued RAI 01.05-1 in May, 2012, which addressed R2.1 of the Fukushima Near Term Task Force:
  a) Evaluate the potential impacts of the CEUS-SSC model (NUREG-2115) on the seismic hazard
  b) Modify the site-specific GMRS and Foundation Input Response Spectrum (FIRS) if it's determined that changes are necessary given the evaluation performed in part a) above

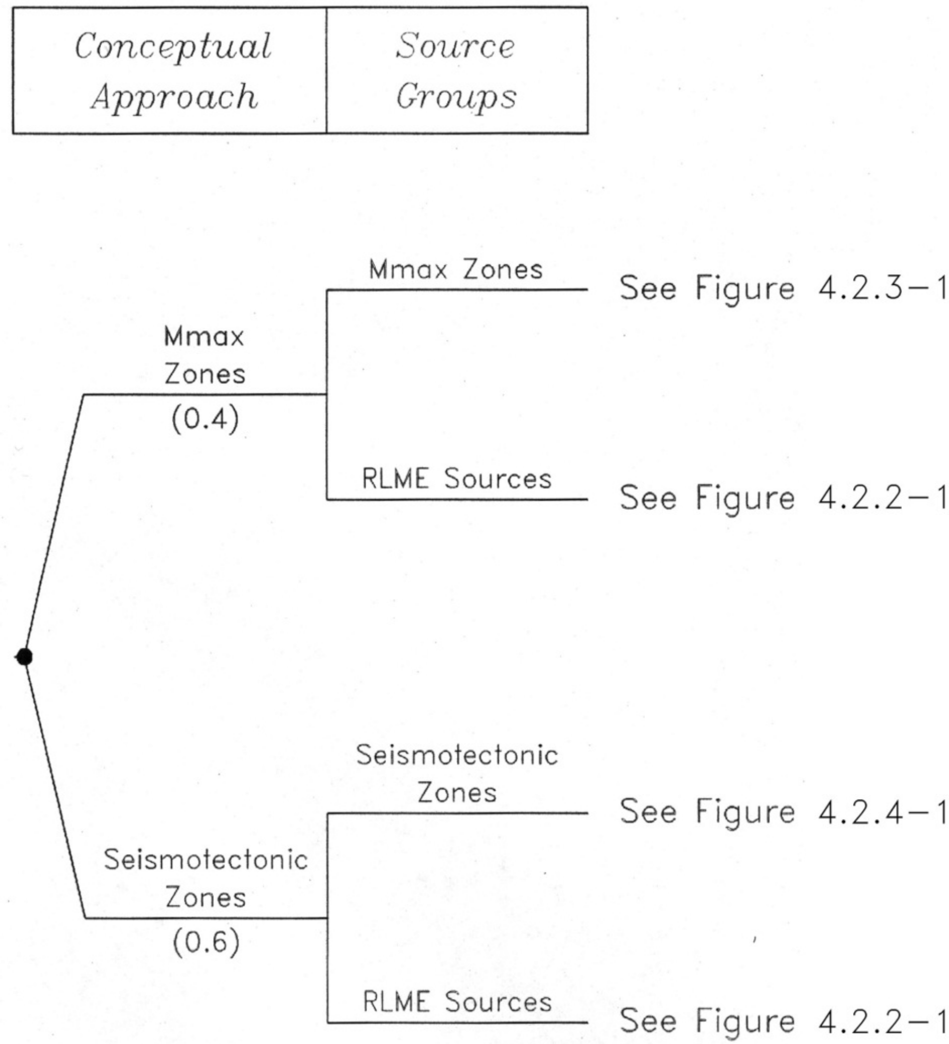
Background Related to the R2.1 Seismic Hazard Reevaluation (Continued)

- In response to RAI 01.05-1, the applicant made major revisions to FSAR Section 2.5.2, which included an updated probabilistic seismic hazard analysis (PSHA), site response analysis, and GMRS reflecting the use of the CEUS-SSC model.
- The staff’s review of the applicant’s RAI response is detailed in SER Section 2.5.2

CEUS-SSC Model Summary

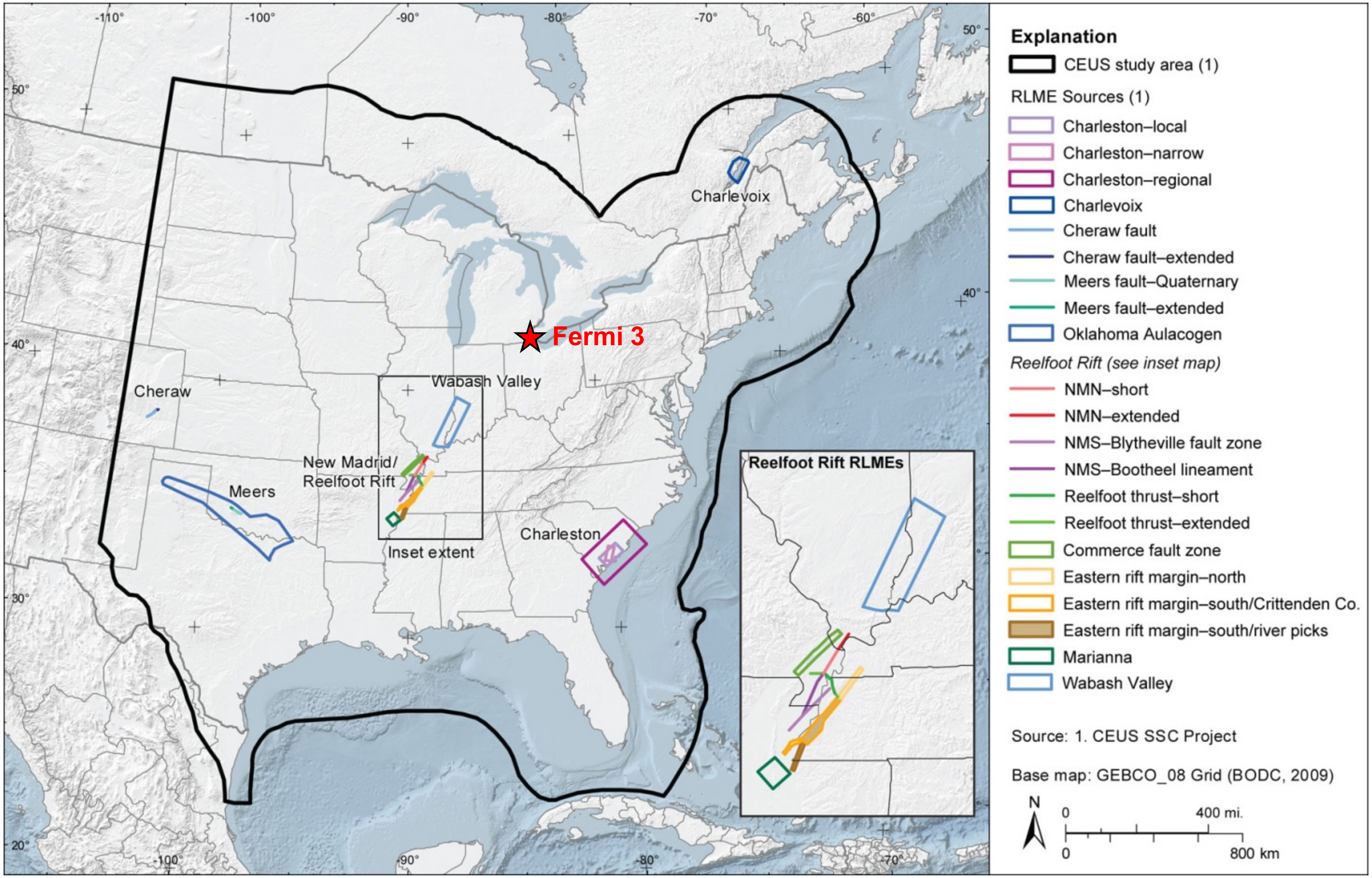
Three types of seismic sources models:

- Mmax Zones
- Seismotectonic Zones
- Repeated Large Magnitude Earthquake (RLME) Sources



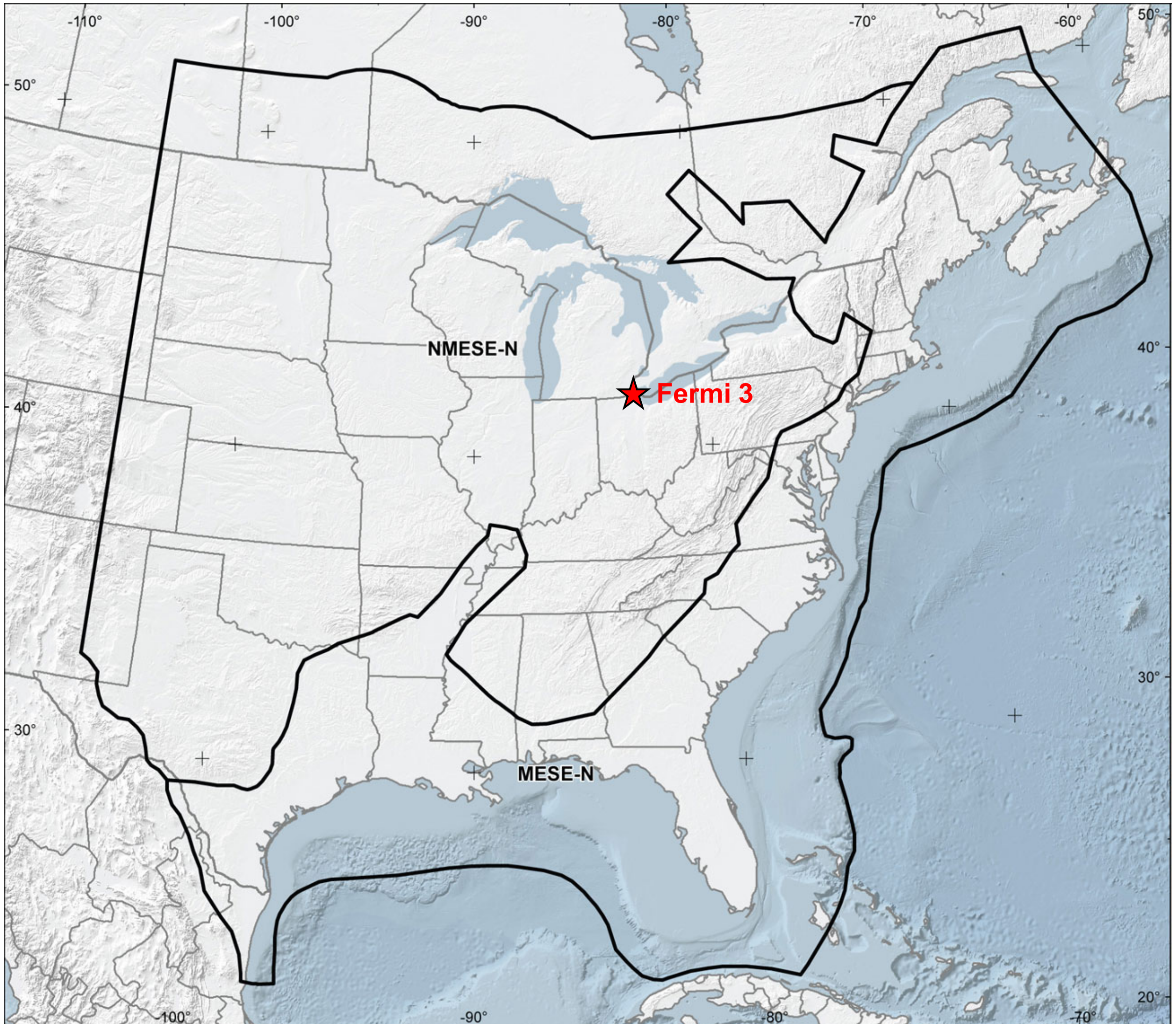
CEUS-SSC Master Logic Tree (Taken from Figure 4.2.1-1 of NUREG-2115)

CEUS-SSC Model Summary (Continued)



Repeated Large Magnitude Earthquake (RLME) sources are defined as having had two or more earthquakes with **M** ≥ 6.5.

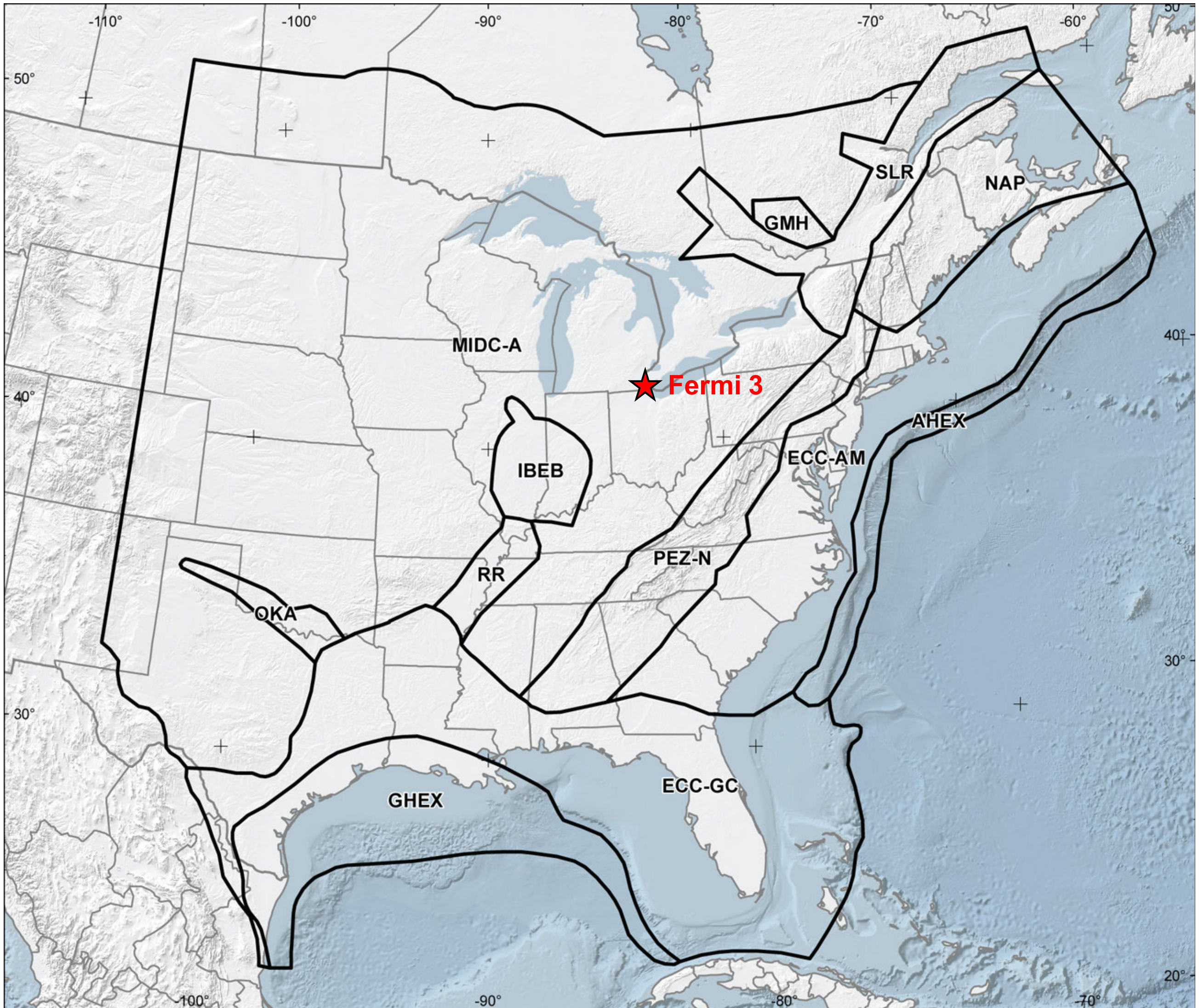
CEUS-SSC Model Summary (Continued)



Mmax zones are based on average or "default" characteristics that are representative of large areas of the CEUS and are based on historical seismicity and broad-scale geologic and tectonic data

Section 2.5.2
Vibratory Ground Motion

CEUS-SSC Model Summary (Continued)



Seismotectonic zones are based on historical seismicity and regional-scale geologic and tectonic data to characterize seismic sources zones at a finer scale than the Mmax zones model.

Summary of FSAR Section 2.5.2 and the R2.1 Reevaluation

- CEUS-SSC earthquake catalog (FSAR Section 2.5.2.1):
  - Updated for time period from 2009 to 2012 (CEUS-SSC catalog covers earthquakes in CEUS region from 1568 through 2008)
  - Based on results of sensitivity calculations, the applicant concluded that the updated CEUS-SSC catalog did not require any significant revisions to the CEUS-SSC model (i.e. geometry, seismicity rates, Mmax distributions)
- CEUS-SSC model source zones (FSAR Section 2.5.2.2):
  - Included all or parts of each distributed seismicity source zone within 1000 km (620 mi) of the site
  - Included all RLMEs that contributed to greater than ~1% of the total mean hazard

Summary of FSAR Section 2.5.2 and the R2.1 Reevaluation (Continued)

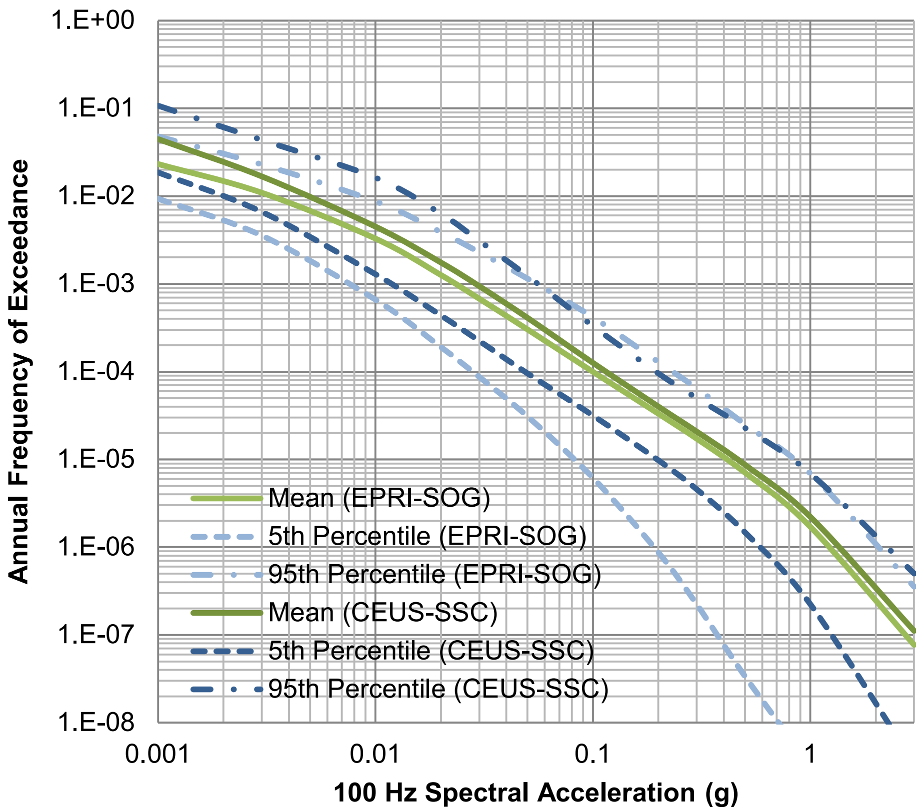
- Used the above CEUS-SSC source zones and the EPRI (2004, 2006) GMM to perform an updated PSHA (FSAR Section 2.5.2.4)
- Performed updated site response calculations using ground motion inputs based on the new PSHA results (FSAR Section 2.5.2.5)
- Calculated an updated GMRS using the revised hazard curves and amplification functions (FSAR Section 2.5.2.6)

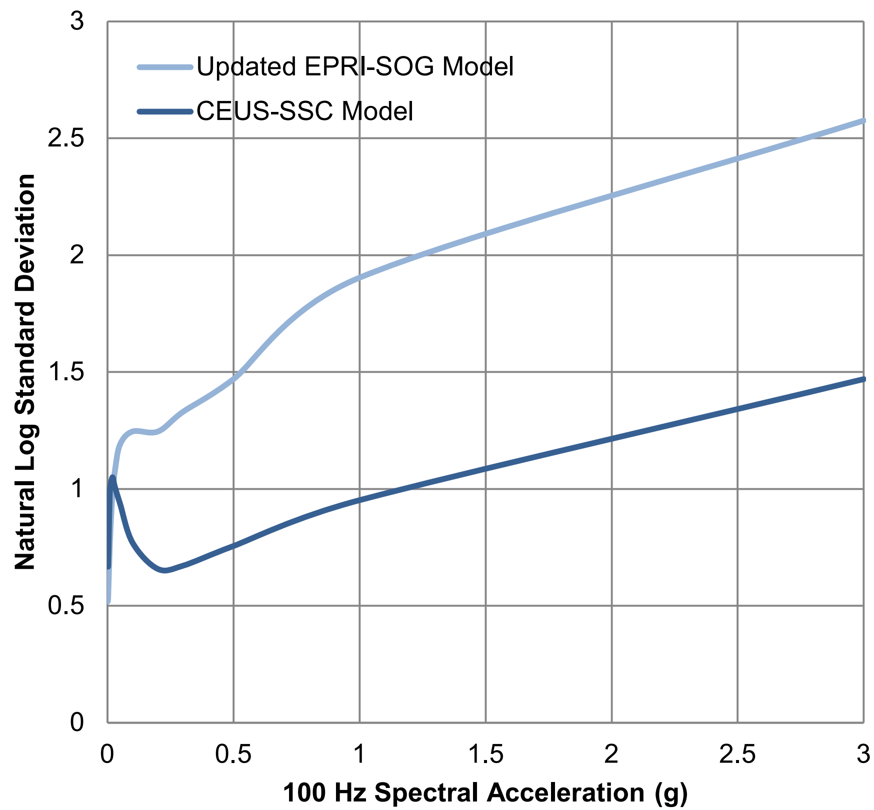
Hazard Curve Uncertainty

- ACRS Subcommittee Action Item: Discuss uncertainties related to the GMRS hazard curves
- In response to the R2.1 RAI (RAI 01.05-1), the applicant provided hazard curves (mean and percentiles) for CEUS-SSC and updated EPRI-SOG models
- Comparisons between the applicant's EPRI and CEUS-SSC rock hazard curves and corresponding uncertainty are shown on the next few slides
  - Uncertainty increases in both models as spectral acceleration increases (as measured by the 5th and 95th percentile hazard curves)
  - EPRI-SOG hazard curve uncertainty is larger

Hazard Curve Uncertainty (Continued)

Comparison of Applicant's EPRI-SOG and CEUS-SSC Results

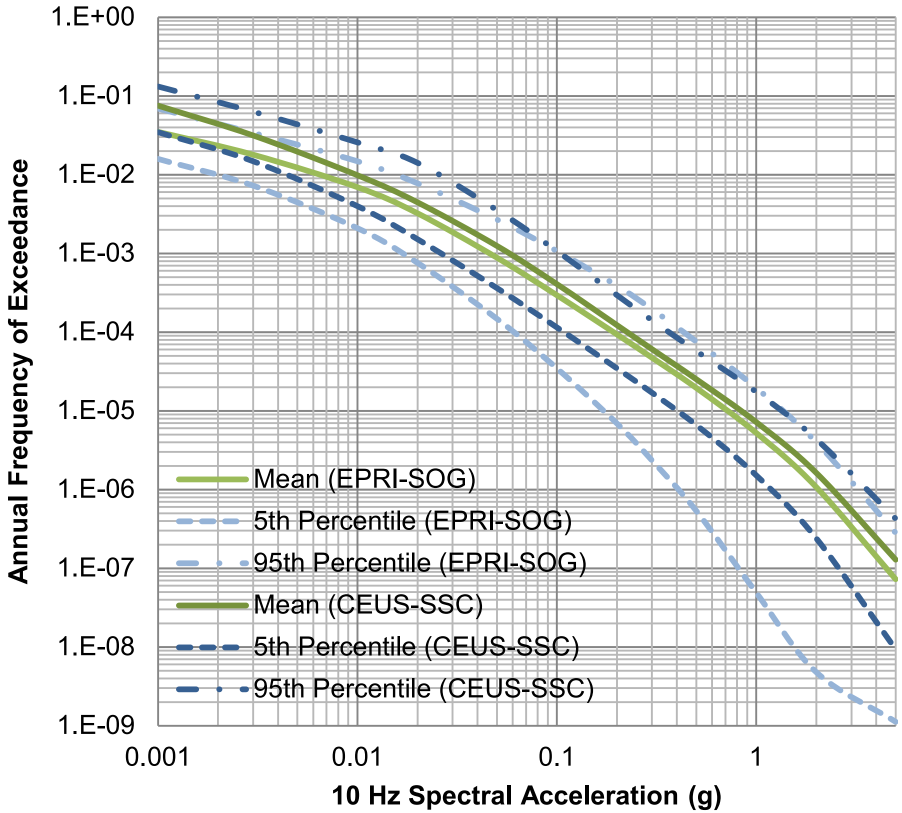


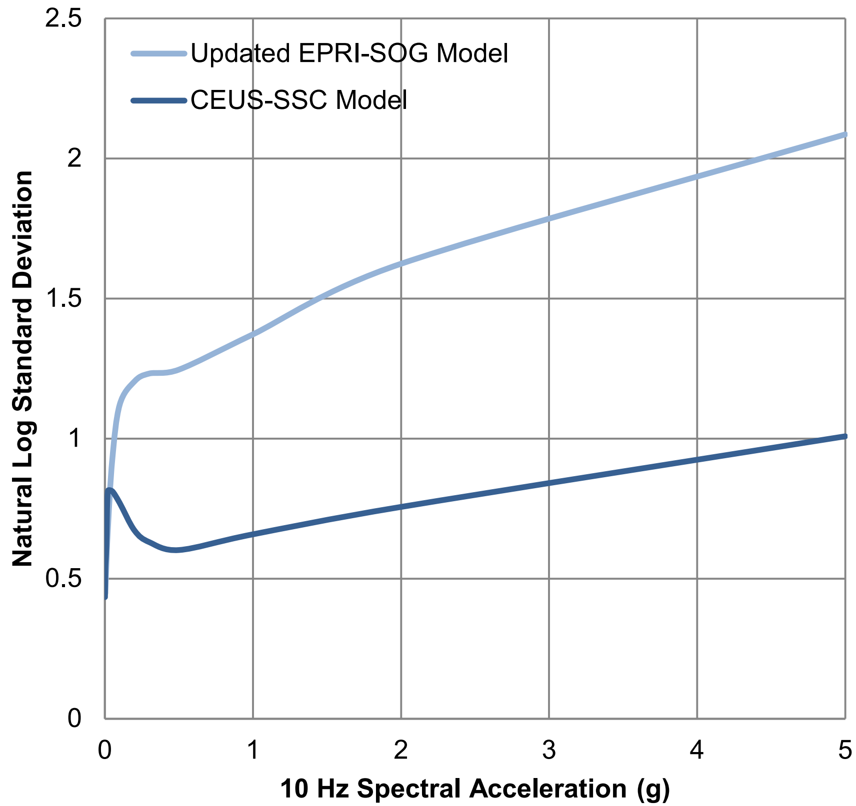


Section 2.5.2
Vibratory Ground Motion

Hazard Curve Uncertainty (Continued)

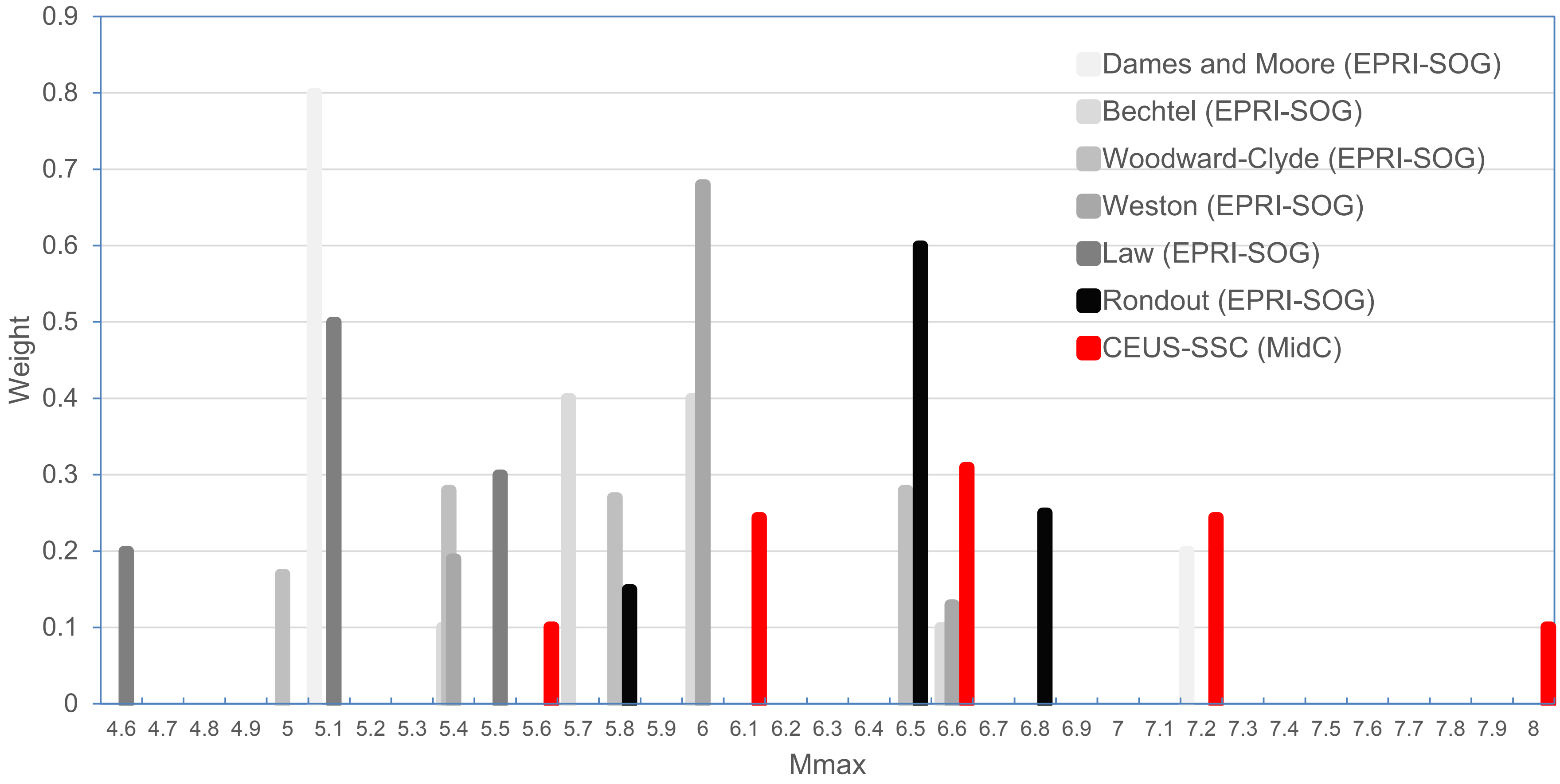
Comparison of Applicant's EPRI-SOG and CEUS-SSC Results





Hazard Curve Uncertainty (Continued)

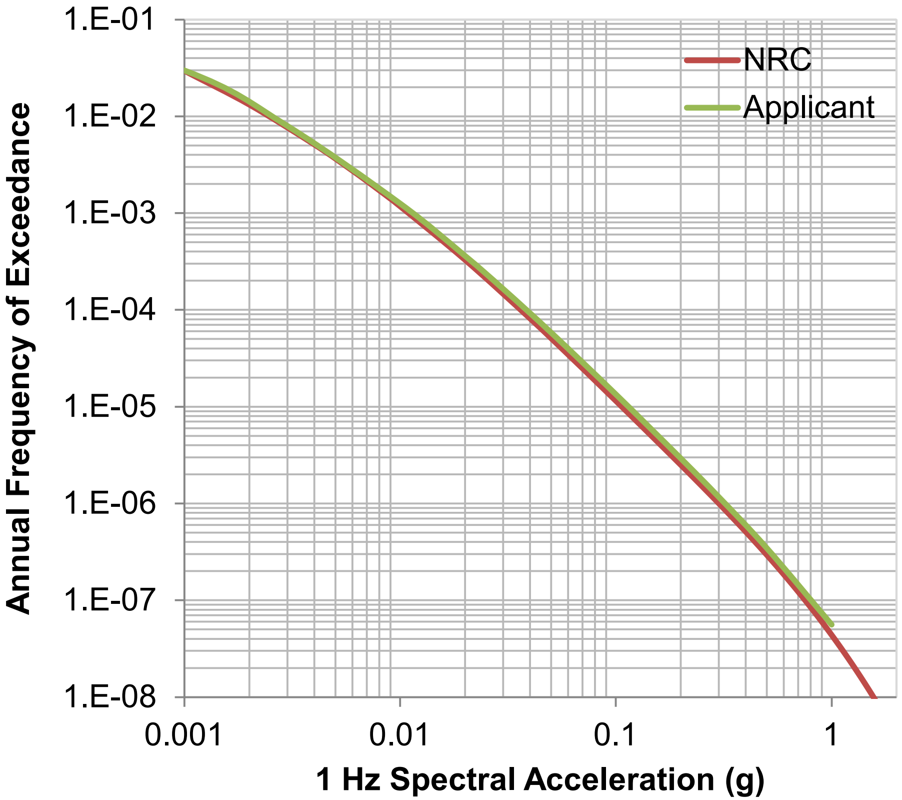
Comparison of EPRI-SOG and CEUS-SSC Mmax Distributions for Host

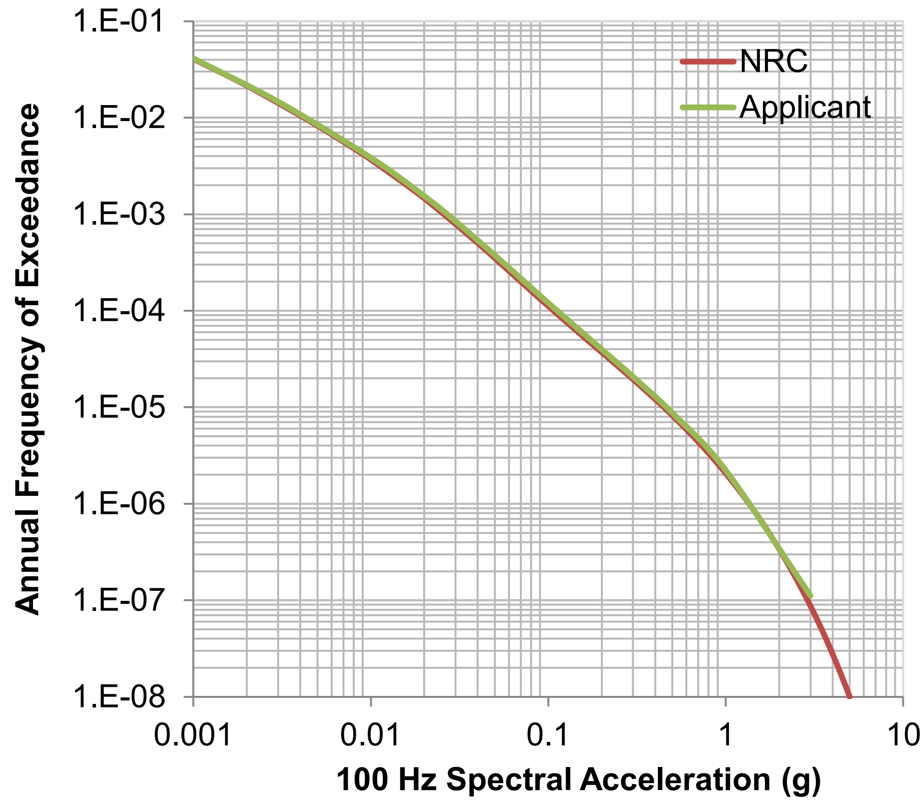


Section 2.5.2
Vibratory Ground Motion

Staff Evaluation

PSHA Confirmatory Analysis





Staff Evaluation (Continued)

Site Response Confirmatory Analysis

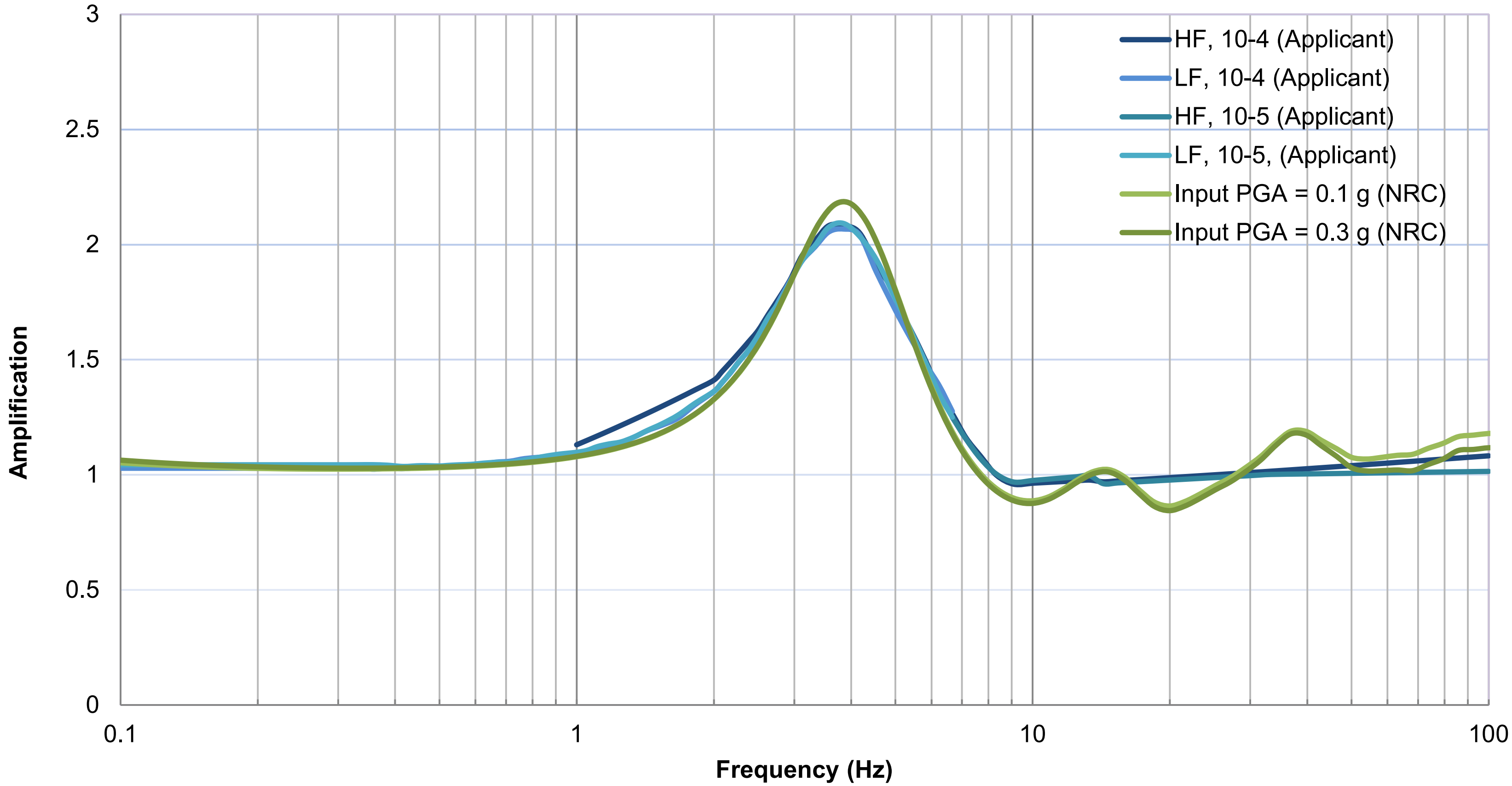
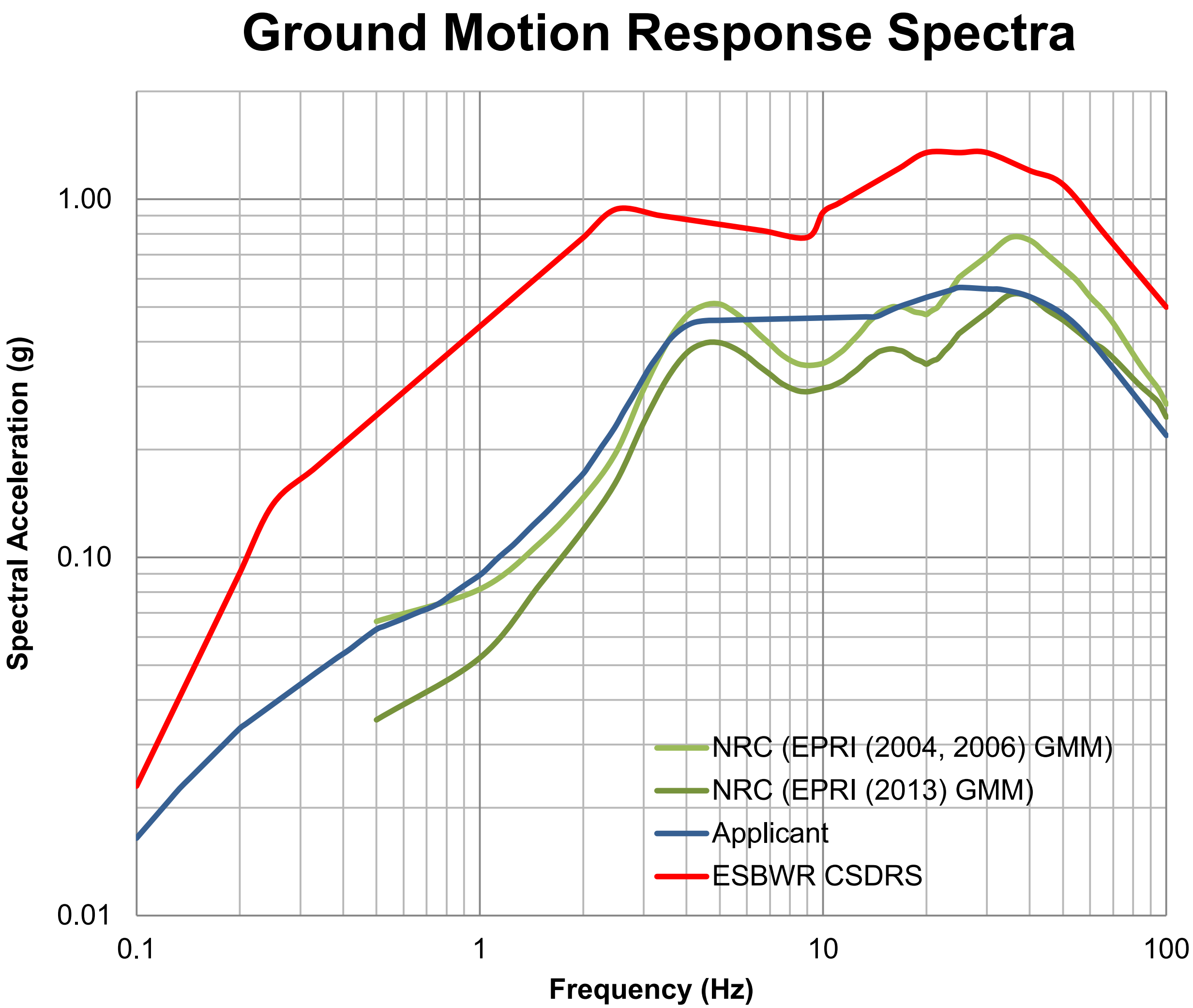


Figure developed from Applicant's results provided in SER Figure 2.5.2-12 and the Staff's results shown in SER Figure 2.5.2-13 (corresponding to a Q_s=40)

Section 2.5.2
Vibratory Ground Motion

Additional Staff Confirmation



Staff Conclusions

- NRC staff reviewed the Fermi 3 COL application and confirmed that the applicant has adequately addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section.
- In addition, the staff compared the additional information in the Fermi 3 COL application to the relevant NRC regulations, the guidance in Section 2.5.2 of NUREG–0800, and applicable NRC regulatory guides.
- The staff's review concludes that the applicant has provided sufficient information to satisfy the requirements of NRC regulations. The staff determined that the applicant has adequately addressed COL Item EF3 2.0-27-A related to vibratory ground motion.
- The staff also determined that the applicant has adequately addressed the R2.1 RAI (RAI 01.05-1)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 2.5.4, Stability of Subsurface Materials and Foundations
and
Section 2.5.5, Stability of Slopes

Presented by:
Zuhan Xi

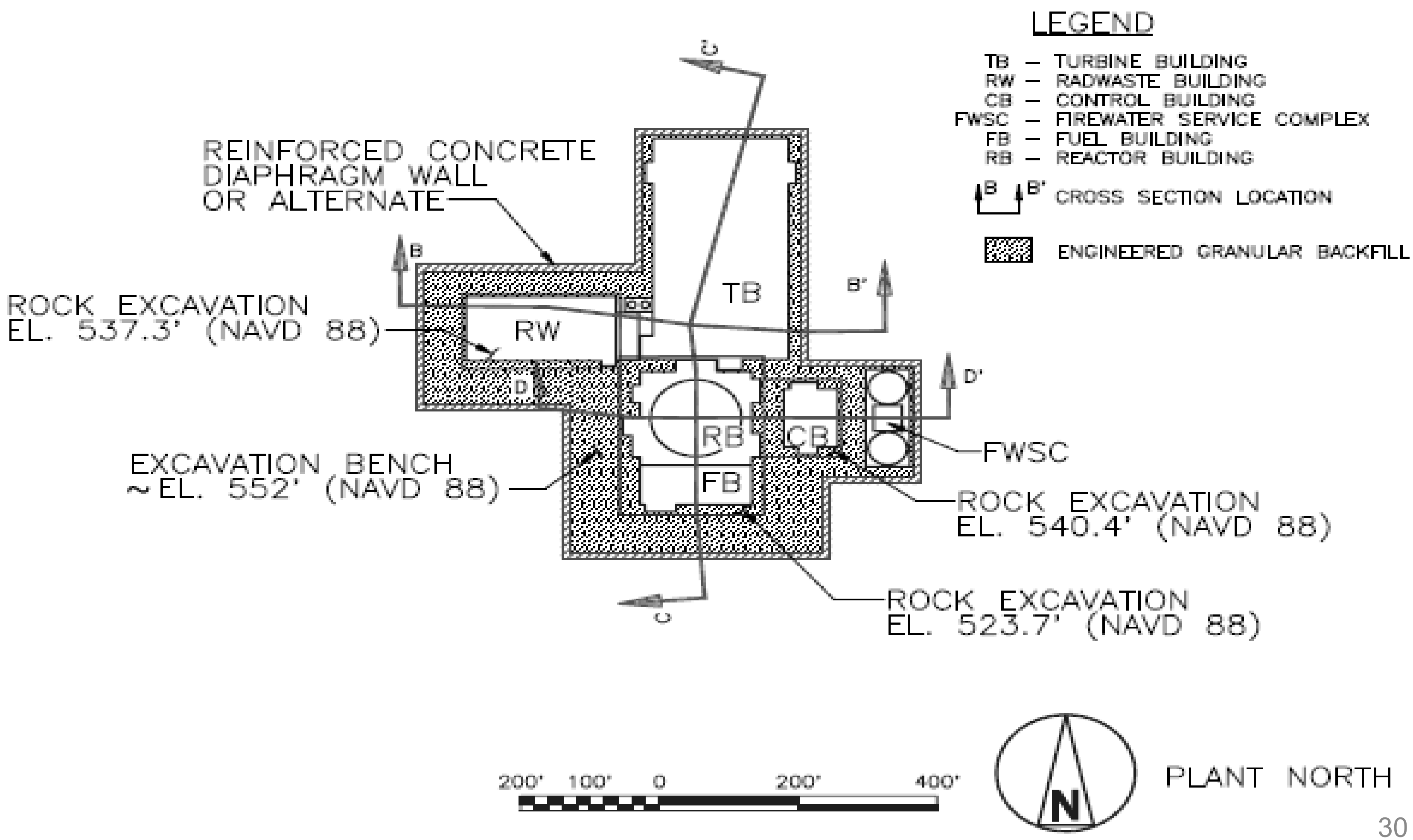
Section 2.5.4
Stability of Subsurface Materials and Foundations

- Summary of FSAR Section
  - FSAR section 2.5.4 presents the stability of subsurface materials and foundations that relate to the Fermi 3 site.

- Staff's Review included:
  - Evaluation of Engineering Properties of Subsurface Materials
  - Evaluation of Foundation Interfaces
  - Evaluation of Geophysical Surveys
  - Evaluation of Excavation and Backfill
  - Evaluation of Groundwater Conditions
  - Evaluation of Response of Soil and Rock Dynamic Loading
  - Evaluation of Liquefaction Potential
  - Evaluation of Static Stability

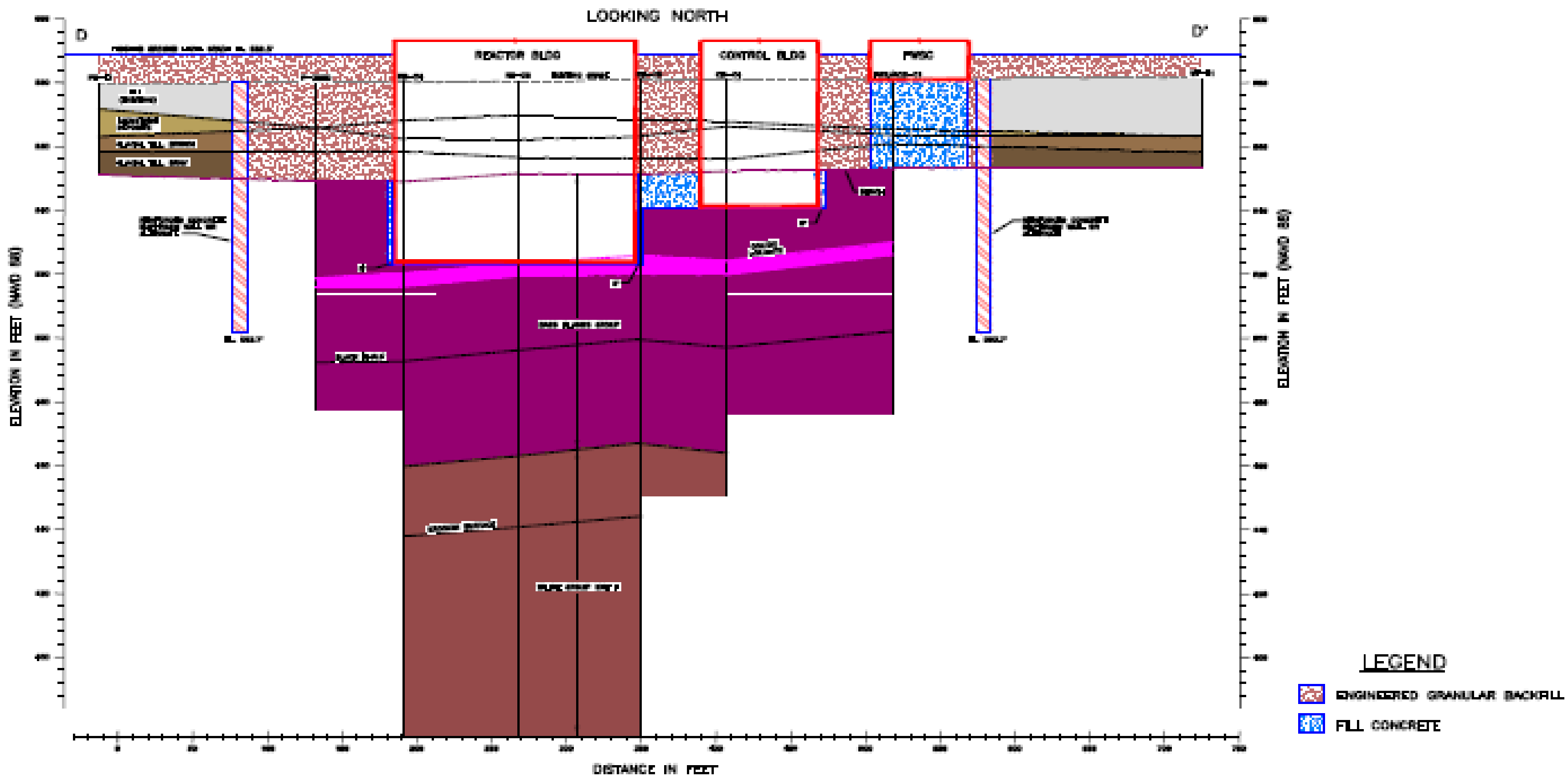
Section 2.5.4
Stability of Subsurface Materials and Foundations

Fermi 3 Site Plan View



Section 2.5.4
Stability of Subsurface Materials and Foundations

Fermi 3 Cross Section D-D'



Section 2.5.4
Stability of Subsurface Materials and Foundations

Issue: Shear Wave Velocity for Backfill

- The design for the backfill surrounding the Category I structures would not meet the DCD soil property requirements to maintain the 300 m/s (1,000 ft/s) shear wave velocity for backfill surrounding Seismic Category I structures.

Resolution:

- The applicant decided to use granular backfill to surround the Category I structures and to perform a site-specific SSI analysis in accordance with Note Number 16 of the Referenced ESBWR DCD, Tier 2 Table 2.0-1, to demonstrate the adequacy of the site and adherence to the standard plant design.

Conclusion:

- The staff finds that the alternative of using site-specific SSI analysis to demonstrate the adequacy of the standard plant design is acceptable in accordance with ESBWR DCD. The staff concludes that the 300 m/s (1000 ft/s) shear wave velocity requirement for backfill surrounding Seismic Category I structures may not be maintained based on the findings for the site-specific SSI analyses documented in FSER Sections 3.7 and 3.8.

Section 2.5.4
Stability of Subsurface Materials and Foundations

Issue: Potential Aging Effects on Concrete Exposed to Sulfate-Containing Solutions

- The foundation and/or sub-foundation concrete may be exposed to the groundwater. Chemical test results for groundwater indicated, based on ACI 349, that all sample results for sulfate concentrations from the monitoring wells fell into the categories of “moderate” and “severe” sulfate exposure for concrete.

Resolution:

- The applicant will implement ACI 349 requirements for concrete exposed to solutions containing sulfate. The applicant will use fill concrete instead of lean concrete to address the staff’s concern about the chemical composition requirements for sulfate exposure conditions.

Conclusion:

- The staff confirms that ACI 349 requirements for concrete exposed to solutions containing sulfate (Low water-to-cement ratio, an adequate cement content, a plasticizer or super plasticizer, a silica fume (fly ash), and an air entrainment) address the potential aging effects.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 2.5.4 Stability of Subsurface Materials and Foundations

Site Specific ITAACs

- ITAAC for Fill Concrete Under Seismic Category I Structures
  - The foundation grade for the FWSC will be established using fill concrete. Fill concrete placed under Seismic Category I Structures to a thickness greater than 5 feet will be designed and tested to meet ACI standards.

- ITAAC for Backfill Surrounding Seismic Category I Structures
  - The engineering properties of backfill material surrounding Seismic Category I structures are equal to or exceed the FSAR requirements as follows:
    - Angle of Internal Friction: ≥ 35 degrees
    - Product of peak ground acceleration, α, (in g), Poisson's ratio, v, and density, γ: α(0.95v+0.65)γ: 1220 kg/m^3 (76 lbf/ft^3) maximum
    - Soil Density, γ: 2000 kg/m3 (125 lbf/ft^3) minimum

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 2.5.4
Stability of Subsurface Materials and Foundations

Staff's Conclusion:

NRC staff reviewed Section 2.5.4 of the Fermi 3 COL FSAR, related to the stability of subsurface materials and foundations. Based on the review of the applicant provided information, responses to the RAIs, staff evaluations and staff's independent confirmatory analyses, the staff found that the applicant:

- conducted its investigations at an appropriate level of detail
- provided the design analyses containing adequate margins of safety for the construction and operation of the nuclear power plant
- and met the requirements of 10 CFR Part 50, 10 CFR Part 52, and 10 CFR 100.23.

Section 2.5.5
Stability of Slopes

- Summary of FSAR Section:
  - FSAR section 2.5.5 addresses the stability of all earth and rock slopes, both natural and manmade (cuts, fill, embankments, dams, etc.) whose failure, under any of the conditions to which they could be exposed during the life of the plant, could adversely affect the safety of the plant.

- Staff's Review included:
  - Evaluation of Slope Characteristics
  - Evaluation of Design Criteria and Design Analyses

Section 2.5.5
Stability of Slopes

Staff's Conclusion:

No slope failure at the site will adversely affect the safety of the nuclear power plant structures.

- No natural or manmade slopes, dams, embankments, or channels on or in the proximity of the Fermi 3 site. The existing water channels located west of the Fermi 3 site will be backfilled as part of site development.
- The finished grade for the Fermi 3 site will be relatively flat, with an 8 percent slope angle down from the periphery of the power block fill area without cut slopes.

The staff concludes that the applicant has provided sufficient information to meet the requirements of 10 CFR Part 50, Appendix A; GDC 2; 10 CFR Part 50, Appendix S; and 10 CFR 100.23.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Backup Slides

Section 2.5.1 Basic Geologic and Seismic Information

Glacial isostatic adjustment (GIA)

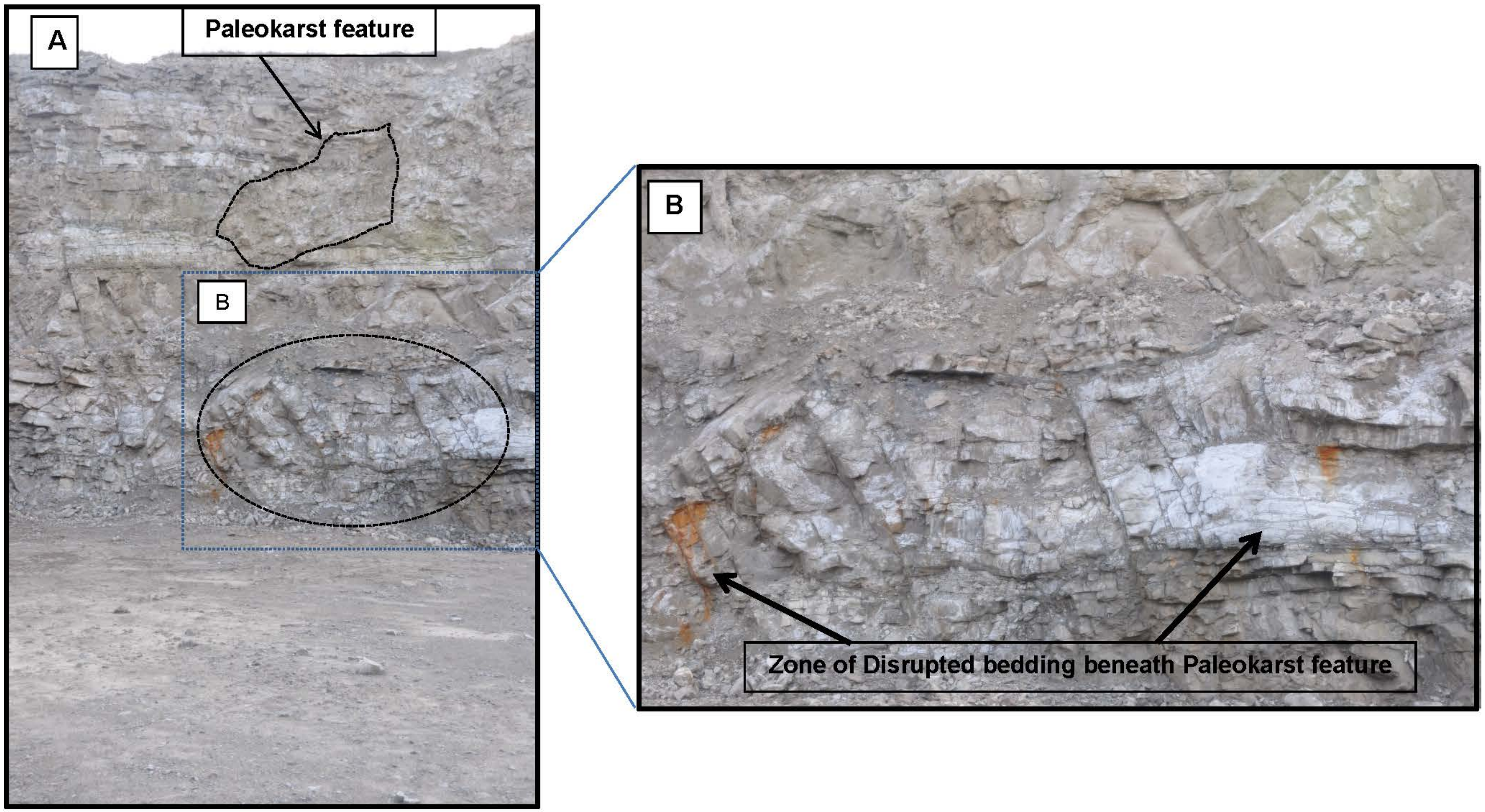
- The applicant defined GIA as the response of the solid earth to changing surface loads brought on by the waxing and waning of large-scale ice sheets and glaciers.
- The applicant explained that GIA is believed to be the basis of deformation within continental plates and perhaps is a trigger of seismicity in eastern North America and in previously glaciated regions.
- The applicant stated that seismicity rates in the site region are not expected to vary significantly in the future due to the GIA. The applicant based this assertion on research conducted by Mazzotti and Adams (2005) and on modeling of the strain and the resulting changes in seismic stress caused by the GIA in other areas.

Backup Slide

Section 2.5.1
Basic Geologic and Seismic Information

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Localized deformation features within the Bass Islands Group at Nearby Denniston Quarry

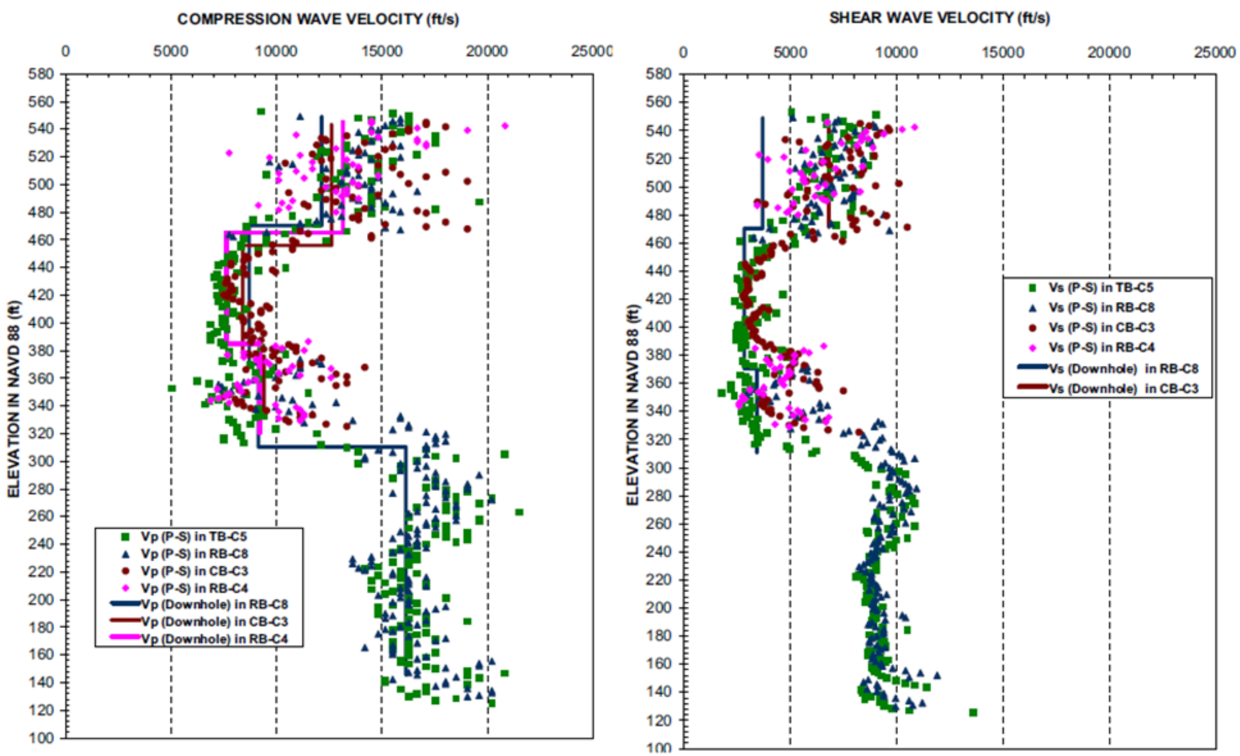


Backup Slide

Section 2.5.4
Stability of Subsurface Materials and Foundations

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Vp and Vs measurements (P-S and Downhole Methods)



Backup Slide

Section 2.5.4
Stability of Subsurface Materials and Foundations

Table 2.5.4-227 Results of Bearing Capacity Analysis [EF3 COL 2.0-29-A]

	Terzaghi Approach			Uniform Building Code	Required Maximum Bearing Demand		
	Bearing Capacity				From Referenced DCD		From Fermi 3 Site-Specific SSI
	Ultimate	Allowable Under Static Loading Condition(1)	Allowable Under Dynamic Loading Condition(2)	Allowable Loading Condition(3)	Static Loading Condition(4)	Dynamic Loading Condition(5)	Dynamic Loading Condition(6)
Structure	(ksf)	(ksf)	(ksf)	(ksf)	(ksf)	(ksf)	(ksf)
Reactor/Fuel Building	281	94	125	259	14.6	23.0	42.9
Control Building	879	293	391	374	6.1	8.8	17.8
Firewater Service Complex	96	32	43	43	3.45	25.1	N/A

Note:

1. Allowable static bearing capacity using factor of safety of 3.
2. Allowable dynamic bearing capacity using factor of safety of 2.25.
3. Method 2 only allowed determination of allowable bearing capacity under static loading condition.
4. Criterion from Referenced DCD; (1) and (3) were used to check against (4); (1) and (3) are greater than (4), therefore satisfy the Referenced DCD criterion.
5. Criterion from Referenced DCD; (2) was used to check against (5); (2) is greater than (5), therefore satisfies the Referenced DCD criterion.
6. Fermi 3 site-specific SSI; (2) was used to check against (6); (2) is greater than (6), therefore satisfies Fermi 3 site-specific SSI dynamic loading condition.

ksf = kips per square foot

Backup Slide

Section 2.5.4 Stability of Subsurface Materials and Foundations

Table 2.5.4-232 Comparing Acceptance Criteria in Referenced DCD

[EF3 COL 2.0-29-A]

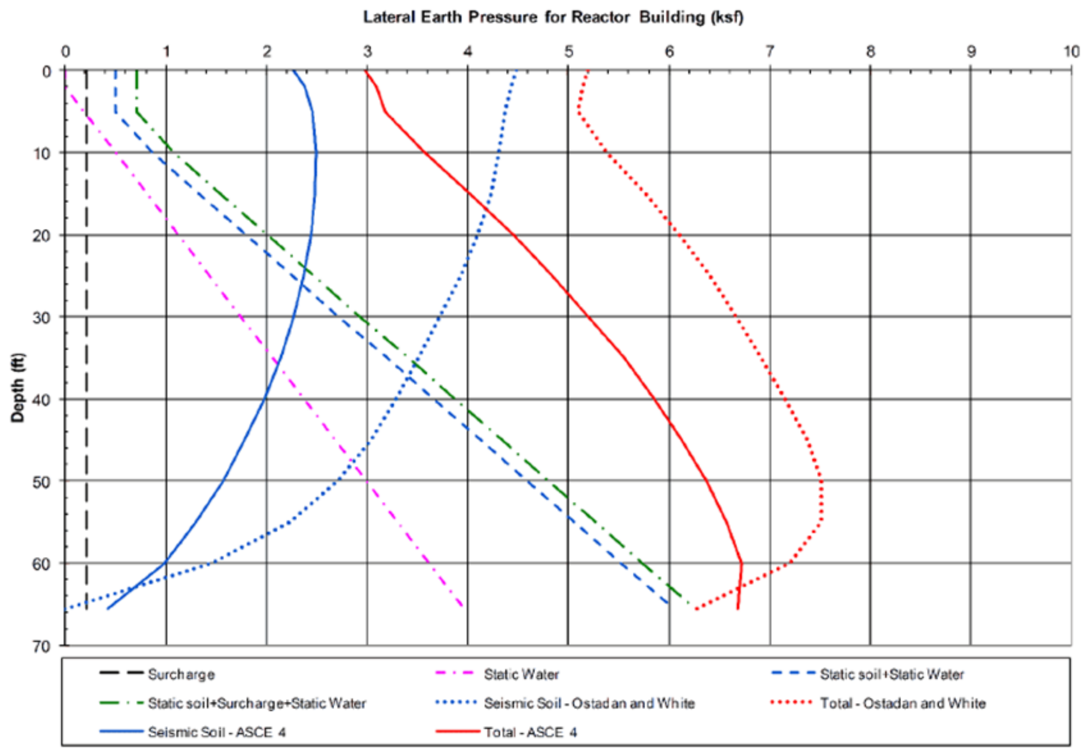
	Finite Element Model (FEM)		Acceptance Settlement in Referenced DCD / Calculated Settlement from FEM			
	Maximum Settlement at any point in Basemat	Minimum Settlement at any point in Basemat	Maximum Settlement at any Corner of Basemat	Average Settlement at Four Corners of Basemat	Maximum Differential Settlement along Longest Mat Foundation Dimension	Maximum Differential Displacement between Reactor and Control Building
Building	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)
Reactor Building/Fuel Building	0.76	0.42	4.0 / 0.52(1)	2.6 / 0.48(1)	3.0 / 0.34(2)	3.3 / 0.37(3)
Control Building	0.56	0.39	0.7 / 0.56(1)	0.5 / 0.47(1)	0.6 / 0.17(2)	
Firewater Service Complex	0.18	0.11	0.7 / 0.18(1)	0.4 / 0.14(1)	0.5 / 0.07(2)	NA

Notes: All values listed above are rounded to the nearest 0.01 inch.

1. The calculated FEM settlements are obtained from Table 2.5.4-231.
2. The FEM differential settlement is obtained from (column 2 – column 1) in this Table. This is conservative since it is the maximum differential settlement at the basemat.
3. The value is based on the column 1 in the Reactor Building/Fuel Building row – column 2 in the Control Building row. This is conservative since it is the maximum differential settlement between these buildings.

Section 2.5.4
Stability of Subsurface Materials and Foundations

- **Lateral Earth Pressures on Reactor Building Walls**



Notes:

1. Lateral load of 500 psf due to compaction is included in the static soil pressure.
2. Total = Static Soil + Static Water + Surcharge + Seismic Soil.

Backup Slide

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Presentation to the ACRS Subcommittee

Fermi Unit 3
COL Application Review

Advanced Final Safety Evaluation
Section 3.7, “Seismic Design,” and
Section 3.8, “Seismic Category I Structures”

August 20, 2014

Staff Review Team

- Project Manager
  – Tekia Govan

- Technical Staff
  – Jim Xu, Chief, NRO/DE/SEB
  – Manas Chakravorty, Technical Reviewer, SEB
  – Carl Costantino, Contractor, Brookhaven National Laboratory
  – Manuel Miranda, Contractor, Brookhaven National Laboratory

Outline of Presentation

- Background and Review Scope
- Applicable Regulations
- Topics of Interest
- Conclusions
- Subcommittee Questions

Background and Review Scope

- Fermi 3 site condition and Backfill
- FSAR incorporates ESBWR DCD Sections 3.7 and 3.8 by reference
- FSAR provided Supplemental Information to DCD backfill requirements and partial embedment of RB/FB and CB
- Staff reviewed and evaluated Supplementary Information

Section 3.7, “Seismic Design,” and
Section 3.8, “Seismic Category I Structures”

Applicable Regulations/Guides

- 10 CFR Part 50, Appendix A, GDC 1, GDC 2
- 10 CFR Part 50, Appendix B
- 10 CFR Part 50, Appendix S
- 10 CFR 52.80(a)
- Standard Review Plan, Sections 3.7 and 3.8
- DC/COL-ISG-01, 017

Topics of Interest

Address staff’s review of Supplementary Information

- Site-specific seismic input
- Site-specific SSI and SSSI analyses
- SASSI2010 program verification and validation (V&V)
- Site-specific seismic lateral soil pressures
- Foundation stability and bearing pressure

Site-Specific Seismic Input

- Site-specific seismic input parameters developed by the applicant
- Uncertainty in characterization of range of properties for granular backfill
- Effects of 2-D geometry on results of 1-D site-response analysis for FWSC

Site-Specific SSI and SSSI Analyses

- Site-specific SSI analyses of RB/FB and CB
- Site-specific SSI analyses not required for FWSC
- Applicant followed frequency domain complex response approach, consistent with methodology of DCD App. A
- SSI sensitivity analysis cases performed for RB/FB and CB
- Additional SSSI analyses performed to capture interactions between structures

SASSI2010 Program Verification and Validation (V&V)

- V&V of SASSI2010 for use in Fermi 3 site-specific SSI analyses
- V&V included SSI test problems representative of the Fermi 3 site
- Use of SASSI 2010 is consistent with SRP Rev. 4 Section 3.7.2
- Staff's concluded that V&V for SASSI2010 is acceptable for Fermi 3 site-specific SSI and SSSI analyses

Site-Specific Seismic Lateral Soil Pressures

- Lateral soil pressures obtained directly from site-specific SSI and SSSI analyses
- Site-specific soil pressure exceeded DCD soil pressure
- Applicant performed additional evaluations to determine impact of exceedances on design of embedded walls
- Member forces induced in the walls by the site-specific pressures are bounded by the corresponding DCD

Foundation Stability and Bearing Pressures

- Site-specific evaluations of foundation stability
- Staff's review focused on sliding stability evaluations
- Maximum toe bearing pressure evaluation

Section 3.7, "Seismic Design," and Section 3.8, "Seismic Category I Structures"

Conclusions

- Applicant incorporated ESBWR DCD seismic design of Category I structures by reference
- Applicant provided Supplemental Information to address partial embedment of the RB/FB and CB in the rock and DCD backfill requirement
- Staff reviewed and determined that Supplemental Information for site-specific SSI is adequate
- Staff concludes that the applicant has provided sufficient information to meet relevant ESBWR DCD requirements and applicable NRC regulations

Section 3.7, “Seismic Design,” and Section 3.8, “Seismic Category I Structures”

Discussions/Subcommittee Questions

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 3.7, "Seismic Design," and Section 3.8, "Seismic Category I Structures"

Acronyms:

DCD	Design Control Document
RB/FB	Reactor/Fuel Building
CB	Control Building
FWSC	Fire Water Service Complex
CSDRS	Certified Seismic Design Response Spectra
FIRS	Foundation Input Response Spectra
PBSRS	Performance Based Surface Response Spectra
SSI	Soil Structure Interaction
SSSI	Structure-Soil-Structure Interaction
LB/UB/BE	Lower Bound/Upper Bound/Best Estimate
LR/IR/UR	Lower Range/Intermediate Range/Upper Range
SASSI	Computer Code for SSI Analysis
MSM	Modified Subtraction Method
DM	Direct Method

United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 3.7, "Seismic Design," and Section 3.8, "Seismic Category I Structures"

Background Slide

Confirmatory Item 3.7.2-1

- COLA includes site-specific ITAAC to ensure that site-specific SSI and SSSI analyses of Seismic Category II and Seismic Category NS structures (Turbine Bldg., Service Bldg., Ancillary Diesel Bldg., and Radwaste Bldg.) are performed if necessary to demonstrate that the standard plant design for these structures is applicable to the EF3 site
- Staff review concluded that language in FSAR Section 3.7.2.8 and Part 10 of COLA was not clear
- Applicant submitted proposed modifications to ITAAC for better clarity with respect to the expectations of the site-specific SSI and SSSI analyses
- The proposed modification is acceptable and it is being tracked as Confirmatory Item 3.7.2-1 pending next COLA revision

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Presentation to the ACRS Subcommittee

Fermi Unit 3
COL Application Review

Closure of ACRS Action Items

August 20, 2014

Staff Review Team

- Technical Staff
  - Thomas Scarbrough, NRO, Acting Branch Chief
  - Yiu Law, NRO, Technical Reviewer
  - Dan Barss, NSIR, Team Leader
  - Eric Schrader, NSIR, Technical Reviewer

- Project Manager
  - David Misenhimer

ACRS Action Items

	Request	Context	Disposition
1.	Provide information in SER related to the technical qualification review.	Chapter 1	Item closed - the staff finds that DTE is technically qualified to hold a 10 CFR Part 52 license because DTE holds a 10 CFR Part 50 license for a nuclear power plant and has demonstrated its ability to build and operate a nuclear plant.
2.	Discuss any uncertainties related to the GMRS hazard curves.	Section 2.5	Discussed in this morning's presentation of Section 2.5.
3.	Fukushima Recommendation 2.1 – Discuss the flooding analysis that was reviewed for Fermi 2 when making the determination that flooding was not a factor for Fermi 3.	Chapter 20/ Section 2.4	Item closed based on a meeting with Member Stetkar on 7/28.

ACRS Action Items

	Request	Context	Disposition
4.	Fukushima Recommendation 4.2 – Discuss the evaluation of coping time for a beyond design basis external event and the inspection criteria that determines license condition has been met.	Chapter 20	Item closed based on a meeting with Members Corradini and Stetkar on 7/16 and proposed revisions to the staff's SER.
5.	Fukushima Recommendation 7.1 – Discuss the environmental qualification conditions for electronics for a beyond design basis event.	Chapter 20	Item closed based on a meeting with Members Corradini and Stetkar on 7/16.
6.	Explain the close-out of North Anna's Open Item 03.02.01-3 in Fermi 3 SER.	Section 3.2	To be discussed in this presentation.
7.	Multi-Unit Emergency Planning	Chapters 1 and 13	To be discussed in this presentation.

Fermi Open Item 03.02.01-3

Committee Member Stetkar requested that the NRC staff explain the close-out of North Anna's Open Item 03.02.01-3 in Fermi 3 SER. Member Stetkar said that the SER was not clear how the RAI response, which discussed RTNSS equipment, resolved the request for the SSC list.

Fermi Open Item 03.02.01-3 (cont'd)

- Closure of referenced North Anna Open Item 03.02.01-3 in Fermi Safety Evaluation Report
- Regulatory Requirements
  - 10 CFR Part 50, Appendix S, Section IV(a)(2)(i)(B)(I)
    - If Operating Basis Earthquake (OBE) Ground Motion set to 1/3 of Safe Shutdown Earthquake (SSE) Ground Motion, no explicit response or design analyses required.
- Applicant incorporated by reference the ESBWR DCD
  - ESBWR DCD sets the OBE Ground Motion to 1/3 of SSE Ground Motion.
  - Therefore, the ESBWR DCD SSC list does not need to be modified.

Multi-Unit Emergency Planning

Committee Member Schultz requested that the staff address the topic raised in the public comments regarding multi-unit emergency planning. In short:

- Assess the failure of mission critical systems at Fermi involving multi-unit issues, including ways in which emergent scenarios would require evacuation of major metropolitan areas located within a 50 mile radius of the facility.

Multi-Unit Emergency Planning (cont'd)

- Fermi Unit 2 has an approved Emergency Response plan
- Fermi Unit 3 has submitted an Emergency Response Plan the NRC staff has found acceptable
  - The Emergency Response Plan contains a description of two emergency planning zones (EPZ):
    - a plume exposure pathway EPZ consisting of an area about 10 miles (16 km) in radius and
    - An ingestion pathway EPZ consisting of an area about 50 miles

Multi-Unit Emergency Planning (cont'd)

- There is currently no regulation requiring licensees or applicants to address multi-unit events
  - The Fermi 3 Plan has two license conditions addressing the Fukushima 9.3 recommendation
    - Licensee will perform an assessment of on-site and off-site communications systems and equipment required to ensure communications capabilities can be maintained during prolonged station blackout condition an affect needed changes.
    - Licensee will perform an assessment of the on-site and augmented staffing capability to satisfy the response to a multi-unit event an affect needed changes.

Multi-Unit Emergency Planning (cont'd)

- Rulemaking described in SRM 14-0046 addresses multi-unit events
  - The Fermi 3 Emergency response plan describes:
    - An Emergency Operations Facility (EOF) and an Alternate Emergency Operations Facility sized to accommodate both Fermi Unit 2 & 3 emergency response organizations (ERO)
    - A required drill, at least once every 8-years, to test the EOF staff's capability to handle an event affecting both units.

Questions

U.S. NRC ACRS Subcommittee on ESBWR
Fermi, Unit 3 COLA
Applicant: DTE Electric Co.

August 20, 2014
Public Meeting

To: Christopher Brown
Designated Federal Official (DFO)
Christopher.Brown@nrc.gov

From: David Schonberger, Member of the Public
Ann Arbor, Michigan U.S.A.
dahvidi@hotmail.com

<u>Public Comment</u>:

As a concerned Member of the Public, I respectfully appeal to the U.S. NRC ACRS Subcommittee on ESBWR to conduct a thoughtful deliberation of the following safety-related issues (briefly outlined below) pertaining to the **Fermi, Unit 3 COLA** and within the scope of discussion for today's meeting agenda:

1) Fermi: Section 2.5 and Fukushima Recommendation 2.1 (Chapter 20)

All parties agree that the seismic risks at the Fermi, Unit 3 site will ultimately need to be assessed using the **NGA-East** ground motion characterization model (ongoing project; scheduled completion 2014/2015). It is agreed that: (a) the state-of-practice for addressing seismic hazards is evolving; and, (b) the CEUS SSC model (NUREG-2115) does not include any demonstration sites applicable to the Fermi site, and, therefore, the impact of the CEUS SSC model on the Fermi 3 seismic hazard is not known.

The Applicant proposes to resolve this problem by completing the NGA-East site-specific assessment "post-COL prior to completion of the 52.103(g) finding." The Applicant concludes that: "Implementation of applicable Fukushima Near-Term Task Force recommendations to address the evolving state-of-the-practice for assessing seismic risk at Fermi 3 can be effectively regulated via **License Condition or ITAAC** [for the purpose of] confirmation that the GMRS and FIRS used for the Fermi 3 FSAR remain valid after issuance of the NGA-East ground motion characterization model." (emphasis added).

As a concerned Member of the Public, I oppose the Applicant's response approach. The GMRS and FIRS developed using the CEUS SSC model and revised CAV filter cannot be used as a valid comparison to show that the Fermi, Unit 3 FSAR is adequate. I believe that confirmation of seismic qualification must be a **prerequisite** for ACRS-endorsement of this COLA. It is ironic that even as the Applicant uses a post-Fukushima CAV filter, the more basic and fundamental confirmation of seismic design qualification is subordinated.

Citation:

http://pbadupws.nrc.gov/docs/ML1216/ML12166A349.pdf

2) Closure of ACRS Action Items related to Chapter 20

Fukushima Near-Term Task Force Tier 1 Recommendations Applicable to the ESBWR:

- Mitigating Strategies for BDBEE (4.2) - License Condition 3.8.2
- Reliable Spent Fuel Pool Instrumentation (7.1) - License Condition 3.8.3
- Emergency Preparedness Staffing and Communications (9.3) - License Condition 3.8.1

Fermi 3 COLA Part 10 License Condition 3.8.2

The strategies for mitigating prolonged station blackout conditions "must be capable of: [in part] Maintaining core cooling, containment, and spent fuel pool cooling capabilities for Fermi 3 during and after an event affecting both Fermi Units 2 and 3." In other words, the Applicant must be prepared to handle a multi-unit event.

As a Member of the Public, I suggest that such plans are necessary and desirable goals but mere fantasy and delusion. The ACRS must not endorse locating a new reactor and spent fuel pool immediately adjacent to an aging, Fukushima-style GE Mark 1 BWR with all of its well-known inherent design flaws.

Fermi 3 COLA Part 10 License Condition 3.8.3

The Fermi 3 FSAR indicates that water levels can be monitored both locally and remotely. The remote location is the Main Control Room. There does not appear to be a backup remote location available for monitoring the Fermi 3 spent fuel pool. On the other hand, the Applicant/Licensee has proposed to develop a backup remote display location for monitoring the Fermi, Unit 2 spent fuel pool.

As a Member of the Public, I do not understand the rationale for that inconsistency. Perhaps the explanation is to be found within the substantial list of Staff RAI's issued to the Applicant/Licensee pertaining to implementation of Order EA-12-051 at Fermi, Unit 2. Apparently, the Applicant/Licensee has provoked serious concerns pertaining to nearly every aspect of the implementation plan, including design qualification and reliability for BDB conditions, particularly in regards to the proposed backup remote monitoring location. The backup instrument channel remote display location must be accessible and habitable without unreasonable delay following a BDB event.

I am suggesting that the Applicant/Licensee would prefer to avoid provoking a similar quality assurance response from the NRC Staff for Fermi, Unit 3. As a concerned Member of the Public, I appeal to the ACRS to independently assess my allegations and ultimately enforce a consistent safety standard for monitoring all spent fuel pools.

Fermi 3 COLA Part 10 License Condition 3.8.1

Significantly prior to initial fuel load, the Fermi 3 Licensee "shall: [in part] have performed an assessment of the on-site and augmented staffing [and communications] capabilities to satisfy the regulatory requirements for response to a multi-unit event . . . [and] prolonged station blackout conditions . . . ".

As a Member of the Public, I believe that the Fermi 3 Applicant's Emergency Plan is inadequate, and, therefore, the ACRS must not endorse the Fermi, Unit 3 COLA as it stands. The Applicant's analyses rely on an arbitrary and scientifically inappropriate probabilistic model and evacuation plan for the Fermi site --- a 10-mile EPZ and minimal "shadow evacuation zone" --- even after the Fukushima Dai-ichi disaster proved that the 10-mile EPZ should be significantly expanded. The Applicant's evacuation time estimates (ETE) input parameters failed to consider instances of severe Michigan snow conditions (beyond 20% impairment) as well as highly-

questionable local preparedness response capabilities required by 10 CFR 50.47(b)(1). The Applicant assumes that a radiological release will affect only a relatively small area; however, proper inputs specific to the Fermi site indicate a far larger affected area ---- potentially including the densely populated centers of Metro Detroit (MI), Ann Arbor (MI), Monroe (MI), Toledo (OH) and Windsor (ON). Such realistic scenarios would result in longer evacuation times and greater costs and consequences than the Applicant has assumed. Ironically, while the Raddose-V software program's plume simulation model is capable of calculating deposition at receptors in the 50-mile ingestion pathway, which appears to include, in the U.S., about 8 counties in Michigan and 8 counties in Ohio, the Applicant's Emergency Plan executes arrangements in support of emergency preparedness with only two county governments -- Monroe Co. and Wayne Co., Michigan.

A proper Severe Accident Assessment significantly affects whether local communities will receive commensurate safety enhancements. Thus, as a concerned Member of the Public, I appeal to the ACRS for an independent and rigorous review of the Fermi, Unit 3 Emergency Plan; further analysis is called for.

3) Fermi: Sections 3.7 and 3.8

3(a)

". . . the site-specific maximum dynamic soil-bearing pressures for the RB/FB and the CB exceed the values reported in the ESBWR DCD for the **'hard'** site condition, which is the DCD condition that **most resembles** the underlying rock at the Fermi 3 site. The staff finds this acceptable . . . " (emphasis added).

http://pbadupws.nrc.gov/docs/ML1416/ML14162A375.pdf

Section 3.8.5.4 "*Seismic Category 1 Structures: Foundations: Technical Evaluation: Structural Acceptance Criteria: Soil Bearing Pressures,*" page 49.

As a Member of the Public, I dispute the above analysis and conclusion for the following reasons:

Arnie Gundersen, Chief Engineer at Fairewinds Associates, Inc., testified as an expert witness for the Fermi 3 Intervenor at an ASLB public hearing in October 2013. Gundersen voiced his concerns about the trustworthiness of geotechnical data gathered by the Applicant and its subcontractors during the initial phase of planning. The Applicant has argued that it was not required to have Quality Assurance in place, as it was not yet technically a COL "Applicant" at that time. Gundersen pointed out that the Applicant's loose definition of the legal term "Applicant" presents dangers not only at Fermi 3, but would also set a dangerous precedent for the entire industry. Gundersen contended and maintains that the Applicant's "**geological borings and soil samples are suspect**. . . . If Detroit Edison [(DTE Electric Co.)] was not an applicant, then it was not subject to NRC rules guarding against deliberate misconduct, the bearing of materially false witness, and requirements of completeness and accuracy of information, employee whistleblower protections, oaths of affirmation, and reporting of defects and noncompliance. Without quality assurance in place from the get-go, the very fabric of nuclear safety regulation has been torn asunder at Fermi 3." (emphasis added) (Beyond Nuclear, October 31, 2013).

Furthermore, NRC Staff's George A. Lipscomb, overseeing Quality Assurance (QA), was subjected to withering cross-examination by the ASLB Panel during the October 31, 2013 evidentiary hearing. Lipscomb maintained his position that DTE Electric Co. was not responsible for QA before it filed its Fermi 3 COLA in September 2008. One of the three ASLB Judges took issue with Lipscomb's testimony: "I really find your position to be very troubling," declared ASLB Administrative Law Judge Anthony J. Baratta. Judge Baratta described the NRC Staff's logic as "circular," "confusing," "appalling," and even "somewhat misleading." As well, ASLB Chief Administrative Law Judge Ronald M. Spritzer stated that the NRC Staff's position was "completely irrational" and a "totally incoherent version of this regulation."

Therefore, for the above reasons, I appeal to the ACRS to conduct an independent and thoughtful deliberation and reconsideration of the issues outlined here, prior to issuing any recommendation to the Commission for approval of the Fermi, Unit 3 COLA.

Given that Mr. Adrian Muniz's NRC Staff Team was unequivocally rebuked and repudiated by the ASLB Judge Panel as described above, I also appeal to the ACRS to issue a recommendation for an immediate restructuring of the organizational hierarchy of the NRC Staff in order to remove Mr. Muniz from his current position as the Lead Project Manager overseeing the Safety Review of the Fermi, Unit 3 COLA.

3(b)

Citation:
Section 3.7.2.4 "*Seismic Design: Seismic System Analysis: Technical Evaluation: Soil-Structure Interaction: Site-Specific SSI Analysis: SSI Analysis Method,*" pages 18-20.

As a Member of the Public, I oppose and appeal the NRC Staff's decision to allow the Fermi 3 Applicant to use a substandard methodology to perform some of the required site-specific SSI analyses at the Fermi 3 site. Contrary to a gold-standard, best-practices approach, the Applicant strayed from the costly SSI methodology specified in the ESBWR DCD. Instead, the Applicant performed SSI analyses of embedded structures using the Modified Subtraction Method (MSM) rather than the conventional Direct Method (DM). "The DM is the most accurate but also the most computationally intensive method. . . . Current staff guidance [(acceptance criteria)] regarding the use of the DM versus the MSM . . . states that the DM should be used to the extent practical . . . ". Nevertheless, after the Applicant performed validation and verification analyses, the "NRC Staff review confirmed the acceptability of the Applicant's implementation of the MSM and thus resolved the issue." Hardly.

Respectfully, today, I appeal the NRC Staff's decision and ask the ACRS to conduct an independent review of (a) the significant consequences of compromising NRC safety standards for the sake of an Applicant's proprietary interests and (b) the potentially dangerous legal precedent which would result from the Commission's endorsement of such practices.

____