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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

May 16, 2005

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

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AD HOC SUBCOMMITTEE ON EARLY SITE PERMIT

GRAND GULF APPLICATION

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MEETING

+ + + + +

MONDAY,

MAY 16, 2005

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ROCKVILLE, MARYLAND

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The Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T-2B3, 11545 Rockville Pike, at 8:30 a.m., Dana A. Powers, Chairman, presiding.

COMMITTEE MEMBERS:

DANA A. POWERS, Chairman

MARIO V. BONACA,, Member

THOMAS S. KRESS, Member

STEPHEN L. ROSEN, Member

GRAHAM B. WALLIS, Member

ACRS/ACNW STAFF:

MEDHAT EL-ZEFTAWY

WILLIAM J. HINZE, ACNW Member

NRC STAFF:

RAJ ANAND

CARL CONSTANTINO

LAURA DUDES, NRR/DRIP/RNRP

BRAD HARVEY ,NRR

JAY LEE, NRR

YONG LI, NRR

JOHN SEGALA, NRR/RNRP

BELKYS SOSA, NRR/RNRP

ALSO PRESENT:

JEFF BACHHUBER, William Lettis & Associates

GOUTAM BAGCHI, Pacific Northwest Laboratory

GUY CESARE, Enercon Services, Inc.

WILLIAM EATON, Vice President of Engineering, Entergy

JIM HENGESH, William Lettis & AssociatesMARTIN McCANN, William Lettis & Associates

AL SCHNEIDER, Enercon Services, Inc.

GEORGE ZINKE, Entergy

A-G-E-N-D-A

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

8:33 a.m.

CHAIRMAN POWERS: The meeting will now come to order. This is a meeting of the ACRS Early Site Permit Subcommittee. I'm Dana Powers, Chairman of the Subcommittee. The other ACRS members in attendance are Mario Bonaca, Tom Kress, Steve Rosen, Graham Wallis. Professor Apostolakis has chosen not to participate with us. I'm don't why he's shunning our company but Bill Hinze from the ACNW has agreed to join with us. Welcome, sir. We enjoy having you here.

For today's meeting the Subcommittee will review and discuss the NRC staff's Draft Safety Evaluation Report regarding the Grand Gulf Early Site Permit and the applicant submittals for this early site permit.

The Subcommittee will gather information, analyze relative issues and facts, and formulate proposed positions and actions as appropriate for deliberation by the full Committee. Dr. Med El-Zeftawy is the cognizant ACRS staff engineer for the meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on May 4, 2005. A transcript of the meeting is being kept and the transcript will be made available as stated in the Federal Register notice.

It is required that speakers first identify themselves and speak with sufficient clarity and volume so they can be readily heard. We have received no written comments or requests for time to make oral statements from members of the public.

First I want to clarify something on the rules. We are in the business of gathering information and this is our opportunity to plunge into some of these issues in some depth so I'm not going to try to constrain that questioning a great deal by the agenda.

If it appears that we are going to go a little long, we may break for lunch and come back as is appropriate because, otherwise, the Committee doesn't have a chance to get a full airing of the issues involved in this thing.

With that introduction I'll ask if any of the members have comments to begin the discussions? Okay. This is the second opportunity we've had to look at an Early Site Permit. We previously looked at the Anook application. The process we're following is pretty much the same.

We will get a presentation of this material at the June meeting, I think. At the end of today's meeting we are going to need to give both the staff and the applicant some guidance on what subset of information presented here that should go to the full Committee and some guidance on any issues they would like to get addressed. Some members may want to bear that in mind as we go through presentations.

With that, I think we'll go ahead and get started on the proceedings. We'll turn to George Zinke.

MR. ZINKE: Yes.

CHAIRMAN POWERS: George, welcome.

MR. ZINKE: Thank you.

CHAIRMAN POWERS: Again, I believe last time we saw you was in connection with Maine Yankee. Is that right?

MR. ZINKE: Yes, that's right.

CHAIRMAN POWERS: So you are obviously a man of flexible interest.

MR. ZINKE: Yes, sir.

CHAIRMAN POWERS: And temperatures, too. I am dying to know what it would be like at 170 degrees fahrenheit in Vicksburg, Mississippi. That must be close to death.

MR. ZINKE: I think it's endured in the shade. Well, I would like to start by introducing some of the members of our team. I'm George Zinke, project manager for the Early Site Permit Project for Entergy. Bill Eaton is Vice President of Engineering. He will give a few opening remarks in such a minute.

Kenneth Hughey is in the back and Mike Bourgeois. This is Guy Cesare in front and Al Schneider is in the back row. Then in our seismic team Jim Hengesh and Jeff Bachhuber, and Martin McCann. Various of these people may speak or answer questions throughout the presentation.

Bill, would you like to make a few opening remarks?

MR. EATON: All right. I don't know if I need to come to the front or if you can hear me from here.

CHAIRMAN POWERS: You can pull that microphone a little closer to you and it will work just fine. Introduce yourself first.

MR. EATON: All right. My name is Bill Eaton. I'm the Vice President of Engineering for Entergy Operations. I'm also Director of SERI, System Energy Resources. I represent Entergy Corporation today in this Committee meeting and it's our pleasure to be here as a part of the regulatory process reviewing the status of the staff work and other work on the Early Site --

CHAIRMAN POWERS: I hope this is the only untruism that you will tell us today.

MR. EATON: Actually, it is. I haven't been to one of these before so in a warped sort of way it is my pleasure to be here.

Entergy certainly recognizes the importance of the process that we're undergoing and we recognize that the reviews that are going to be conducted, all of the questions and the dialogue will hopefully create a very robust safety review of the project.

We also recognize that without this particular sort of review dialogue and evaluation of the technical merits of the project, that the economic benefits of new nuclear generation would not be realized by our customers and ultimately that's our goal. We anticipate a lot of dialogue today, a lot of information to be shared and we look forward to being able to answer all of the questions. Those are my brief comments.

CHAIRMAN POWERS: I want to make one

comment, Bill. That is, in some sense we are kind of piloting this Early Site Permit Process. It's kind of our first time through it. Over the course of the period that you are visiting with us if you have insights on things that you think could be made to improve it or things that were omitted and what not, I hope you will be willing to share those with us and draw our attention to those.

MR. EATON: We certainly will. Thank you.

CHAIRMAN POWERS: George.

MR. ZINKE: Page 3 identifies the agenda we plan to go through this morning. There are a lot more slides in your package than we anticipate getting to but just trying to anticipate where you may ask questions.

CHAIRMAN POWERS: I was hoping you would go through every single one of them. I wanted to see how that was going to be done.

MR. ZINKE: Well, we may get to that. Going to slide 4 just some general information. We have prepared the Early Site Permit SSAR in accordance with 10 CFR 5217, followed the format of the reg. guide. The proposed new facility is located at the site with the existing Grand Gulf Nuclear Station.

The Grand Gulf Nuclear Station was

intended to be a two unit site. We only completed one unit. The second unit initiated construction but it was abandoned during the middle of construction. The exact location of the Unit 2 was connected to the Unit 1. They were going to be mirror units.

DR. WALLIS: Where does this name Grand Gulf come from? Is there a gulf of some sort that's there?

MR. ZINKE: No.

DR. WALLIS: Is it a geological feature of the site?

MR. ZINKE: No. There is a little town called Grand Gulf and it's been that since the Civil War -- before the Civil War.

MR. CESARE: The community was called Grand Gulf, Mississippi.

DR. WALLIS: No reason that you know of?

MR. CESARE: I do not know that.

MR. ZINKE: So it co-exist with existing Grand Gulf Nuclear Station the nature of which we abandoned the Unit 2 so that the proposed location of the unit or units would not be on the exact location of where Unit 2 was going to be but it's within yards of it.

CHAIRMAN POWERS: But you are no longer

proposing a mirror unit here?

MR. ZINKE: That's correct. No longer proposing a mirror unit.

MR. ROSEN: Is the land that you will actually begin work on, was that land disturbed by the preconstruction activities at Unit 2?

MR. ZINKE: Yes, it was.

MR. ROSEN: Can you describe how much disturbance there was?

MR. ZINKE: The area where we would be putting the new unit there was a lot of lay-down areas that were used for the construction of the first unit. Initially when we were building Grand Gulf Unit 1 a lot of that was forested area so the whole area then was cleared including where we would be putting the new units.

MR. ROSEN: So to the extent that the land was disturbed, it was just deforested and there was no digging in that area?

MR. ZINKE: There was borings but --

MR. ROSEN: No deep subset?

MR. ZINKE: No deep.

MR. HINZE: There's mention of swells being filled to depths of up to 30 feet as I recall. Are those in the immediate vicinity? Where are they?

MR. ZINKE: We'll get to that when we get into the geology section and that way I'll have the people up here that can better answer that so if you can hold that, we'll get to that.

The original Unit 1 was licensed in 1982. Entergy is a company with a lot of subsidiary and affiliate companies. A number of the subsidiaries are involved with Grand Gulf. For this particular ESP system energy resources as a subsidiary of Entergy is the applicant which is different than the subsidiary we used to operate the current Grand Gulf Unit 1 which is Entergy Operations, Inc.

We used another subsidiary in preparing the application. There's over 100 subsidiaries associated with the Entergy parent company. Prior to preparing the application we had extensive preapplication activities with the NRC in order to be more consistent in the product that we are going to submit. We submitted the application October 2003.

Now on Slide 7. Our main purpose in doing an Early Site Permit was to exercise the regulatory processes. That was due to new regulations, Part 52, Part 100, Part 2; the dated guidance documents that were at various stages as far as how they would support new construction; the new mandatory hearing process which was different than the hearing process of 30 years ago.

We also wanted to establish the cost and the value of an early site permit. A major purpose was to establish some predictable and repeatable processes associated with determining suite suitability and early site permit. Many of the lessons learned would apply also to an operating license application so it's not restricted to just the ESP.

Additionally then as a secondary purpose we did want to establish the suitability of an Entergy site. We went through a site selection and chose for our first Early Site Permit application the Grand Gulf site. The nature of our Early Site Permit was to defer the reactor technology selection to the combined operating license and to determine what things that we could close with finality at an Early Site Permit Stage.

MR. ROSEN: Tell us a little bit about your thinking of what about the Grand Gulf site made it most attractive of all the sites Entergy could have chosen.

MR. ZINKE: When we went through it some of the economics were better for the Grand Gulf site than some of the others. Entergy, of course, has a southern plant and a northern plant. We looked at our plants also in New England and the New York area so we compared all of those together. The economics were not the best there but they were good and better than some of our other southern sites economics being primarily the cost of transmission, any additions that might have to be made to transmission.

We looked at that Grand Gulf appeared to be a fairly good site, easier to look at a second unit meaning that we could test the regulatory processes, get guidance in place without tackling any really unique site specific issues. Although we didn't determine any of our sites to be totally unacceptable, some would just have more difficult technical issues so it was kind of the easiness of --

DR. WALLIS: Did seismic play a role in this decision?

MR. ZINKE: Seismic looked real -- compared to a lot of other sites it looked to be in very stable regions. Again, that made it technically easier than some others.

DR. WALLIS: Floods make it better or worse.

MR. ZINKE: Yes, but we've solved a lot of the flooding problems. Like I said, we didn't determine any unacceptable. Also the community around Grand Gulf receptive to new construction so we wouldn't have to deal with some of the problems that we might have to do with other sites.

DR. BONACA: But you didn't look at any new sites?

MR. ZINKE: We only looked at sites within the Entergy fleet that had existing nuclear power plants. That was by decision to say that in first trying to test the ESP process and develop it would be better to go with a site that had a nuclear power plant.

The overall approach on slide 8, application content, we identified site characteristics. There is site safety assessment. Of course, in the application there is also an environmental report and emergency planning information.

CHAIRMAN POWERS: Quality assurance as well. Your overall approach seems like it's a little truncated there.

MR. ZINKE: I'm not sure --

CHAIRMAN POWERS: Well, I mean, it has other things. You have to deal with quality assurance measures.

MR. ZINKE: Right. This is not a full list of the application content, just some of the major portions.

DR. KRESS: Could you go back to the previous slide?

MR. ZINKE: Yes.

DR. KRESS: The accident dose consequences are you going to get into that further later on?

MR. ZINKE: We will get into some of the site characteristics of which like when we get to meteorology that play a role in the accident dose. We won't specifically have any slides on the accident dose but we can answer questions in that area.

DR. KRESS: Well, just one simple question. Did you do a Level III type analysis PRA where you calculated the full consequences of the site out to 50 miles or so?

MR. ZINKE: No. The PRA that would be associated would be done at the operating license.

DR. KRESS: Even though that might be a consideration in suitability?

MR. ZINKE: Our approach is that in setting up what the site is for the Early Site Permit and the characteristics and then reviewing to make sure that they would follow in within the limits of reactor technologies that are being certified so the assumptions that are contained within a certification so that if you meet those assumptions, then you are by definition going to be within acceptable limits in PRA space, in radiological space.

Our approach, which I'm going to get to in a little bit, really has to do with looking at how this will interface with the things at the COL so that you're basically guaranteed that you would meet all the limits at that point in time.

DR. KRESS: Pretty much that means does your side have chi over q that fits your Plant Parameter Envelope?

MR. ZINKE: Yes, so we did chi over qs and did some sample calculations with source terms to make sure.

DR. KRESS: But that's at the dose at the site boundary.

MR. ZINKE: Yes.

DR. KRESS: Mostly 10 CFR 100 type.

MR. ZINKE: Yes. Then also some normal dose. We looked at normal dose also.

Going on to page 9, we made extensive use of existing site licensing information, information that was used to license the original Grand Gulf Unit 1. A lot of that data then we looked at and we would augment and evaluate it's applicability given the passage of time.

We made use of what has been referred to as Plant Parameter Envelope which is basically characteristics of various reactor designs whether certified or in a certification process or they're anticipated. In the SSAR primary use of the PPE was one to make sure and to look at our site characteristics to make sure that they were in line with the reactor designs are being certified. On the most part they don't play a direct listing in the SSAR section because the SSAR is more of a listing of the actual site characteristics rather than those postulated in the reactor designs.

We selected for ESP duration a 20-year duration for the ESP. I'm going to talk a little bit more about the considerations we did with that. We also considered in the duration what kinds of things could be resolved early in an ESP with finality versus being revisited whenever you choose to use the ESP in a COL application.

And we looked at how the ESP is then going to fit into a COL application. We wanted to make sure that as a process we were not spending money on things that you have to duplicate and just do over again so that we could sort out those things that really have value in resolving early versus those that you really don't get a value in resolving now because you've got to resolve it later again also.

MR. ROSEN: Are you going to come back in some detail for the surrogate plant parameter approach?

MR. ZINKE: I'm trying to think. Not to any extent. If you have a question, probably now would be the --

MR. ROSEN: I guess the overall question is estimating accident dose consequences without knowing the core design or containment design. It's a bit of a mystery to me.

MR. ZINKE: On the accident dose what we did was recognizing how the Early Site Permit is going to fit with the COL. At that point in time when you select the reactor technology you'll know all the parameters, the source term. At that point in time in that application you will then do a definitive dose calc. So what we did then --

MR. ROSEN: Because that is required by the regulation.

MR. ZINKE: Right. So what we did now was we took our chi over qs which come from met information and did sample calcs with the source terms associated with technologies we know now. By definition it ought to -- it has to work out because as long as our site parameters were better than those assumed in the design when you run the numbers, they have to come out better. We did go ahead and do those sample calcs and submitted them.

MR. ROSEN: For the plants that are now certified.

MR. ZINKE: I actually think we did the AP 1000 which isn't yet certified but will be.

MR. ROSEN: Does that rule out for you designs that are further away from fruition than AP 1000?

MR. ZINKE: No.

MR. ROSEN: If you don't know, for instance, the number of kilograms of uranium.

MR. ZINKE: It doesn't rule them out but it provides more uncertainty. The early site permit basically said this is what the site parameters are. Later on if there is some new technology it may or may not work meaning that there may be some technology that when we try to match it up with the Early Site

Permit and ran the dose calcs, well, we can't build that technology.

It doesn't necessarily rule them out. You have to see whether or not at the COL stage you are required to pick a technology that fits within the parameters of the Early Site Permit. To the extent that we could look at what we think is going to happen now, we could insure that there will be reactor technologies. But it doesn't exclude using them. There is no guarantee they will fit.

MR. ROSEN: So you are essentially going to accept the limitation or set a limitation on future designs by accepting a Early Site Permit and so forth.

MR. ZINKE: Yes. In one sense you are accepting the limitations but in another sense the site is what the site is. Unless the technologies are built such that they fit on your site, you couldn't build them no matter what. There isn't anything we are essentially doing at the Early Site Permit that restricts it. It just means that you are never guaranteed -- you can only build reactors that your site will fit.

An example was the AP 1000 where the AP 1000 is designed for seismic area rock site. Grand Gulf is not a rock site so we know that to use the AP

1000 there would have to be additional design analysis work to see whether or not it would fit and then that analysis would have to be submitted to the NRC for approval at the license stage. Without that I could not use the AP 1000. Future reactors would be the same way.

DR. WALLIS: Well, you've listed a PBMR in your list of possible grantors.

MR. ZINKE: We list those --

DR. WALLIS: How did you -- did that have any influence on your application whatsoever?

MR. ZINKE: It had influence primarily in the environmental section that we tried to evaluate the environmental affects of various designs. In the safety section it has very little influence because you are just going to establish what the site has.

We list things like the PBMR, but we also know that there may be characteristics of a PBMR that has to match the site characteristic which we did not identify or analyze so that would be a hole that would have to be filled in at a COL application. There is no guarantee with Early Site Permit that we can use any of the reactors. We just use them in order to provide -- so we would know what we think --

DR. WALLIS: It just seems to me you made a list of everything that you might conceivably know about now so the next generation -- it wasn't clear that has an influence on the application. It's just a list of possible reactors.

MR. ZINKE: It had an influence in the environmental section because we took parameters there. In the safety section --

DR. WALLIS: Do you know the environmental impact of a PBMR?

MR. ZINKE: To the extent that the PBMR has identified that, but we also found that given the information known now it wasn't bounding cases. We know that in the case of like the PBMR and the gas reactor GTMHR, there's not enough known to fully analyze but we analyzed what information we had.

DR. BONACA: So the radiological -- I mean, you use the ABWR and AP 1000 as the only one that we use as far as the accidents provide the source term.

MR. ZINKE: We've looked at the ESBWR which hasn't quite entered to see how it is going to compare with the ABWR.

DR. BONACA: Okay.

MR. ZINKE: On page 10 this is a chart that shows pictorially a way that we looked at duration. We were taking a lot of the data early from around when Grand Gulf was licensed which would be pre-1980. In 2000 we reviewed that. We looked at collected new data. Then the permit would be for 20 years. But a key important place is what happens at COLA Preparation.

I'm on slide 11. The time-dependence of site characteristics. Fundamentally and in general, but not in all cases, the expectations of what is going to happen in the future are reflective of the past. We collect a lot of historical data and we in general assume that has some reflection on the future.

That's not always the case and I'm going to get into some examples but that is in general. We also did population projections. We did population projections out to 40 years after the end of the Early Site Permit so 20-year duration plus 40.

CHAIRMAN POWERS: I guess it's no secret that what this Committee is questioning is expectations of the future are reflective of the past. I mean, that's a truism.

MR. ZINKE: Well, there is some of that.

CHAIRMAN POWERS: The question is how perfect is that reflection. Are you going to discuss that issue?

MR. ZINKE: Yes.

DR. WALLIS: Now, in the long term Mississippi changes its course. Doesn't it?

MR. ZINKE: In the long term the Mississippi has changed its course.

DR. WALLIS: There is evidence at the site of that.

MR. ZINKE: Right. It changed --

DR. WALLIS: If there is a major flood, is it likely to do it in the next 20 years?

MR. ZINKE: It floods every year. Most every year. Of course, as far as changing course, a lot of the changes in the course was before the river was managed. Of course, now it is with the Corps of Engineers. But in the application it talks about what has happened to the river and, of course, then it becomes involved --

DR. WALLIS: So you have assessed changes in course.

MR. ZINKE: Yes.

CHAIRMAN POWERS: A lot of the trends, certainly in the west with rivers, is to move toward a less-managed river. Is there a similar trend ongoing with the Mississippi or is it possible to have a trend toward a less-managed river?

MR. ZINKE: For the Mississippi the trend has not been towards less management. It's because it's a major navigation route and the navigation is not decreasing. There is some increase in traffic. At least now there is no trend in that direction.

CHAIRMAN POWERS: I wonder if you had spoke -- I have a sort of curious way of asking you if you spoke to the Corps of Engineers and understand what their anticipation is for the next 70 years.

MR. ZINKE: We did consult with the Corps of Engineers. That was part of the process.

DR. WALLIS: I think the argument is that you can manage the small floods but sometimes when you manage the river too much that the undertow flood becomes much worse. Once your management system breaks down all kinds of things happen.

MR. ZINKE: That's correct.

DR. WALLIS: It can be worse than it you had no management at all.

MR. ZINKE: The way the geography is in this particular area, when floods get worse because the area of Mississippi is so flat the flood rather than getting much change in the height it spreads out so you end up flooding lots of land but not necessarily --

DR. WALLIS: It spreads out close to the site.

MR. ZINKE: It floods Louisiana.

DR. WALLIS: Well, Mississippi doesn't get flooded.

MR. ZINKE: The river does.

DR. WALLIS: No, the state.

MR. ZINKE: Oh, parts of it but it takes a lot of water to ever get --

MR. ROSEN: Up to the top of the bluff.

MR. ZINKE: Yes.

MR. ROSEN: How high is the bluff at the site?

MR. ZINKE: Sixty.

MR. ROSEN: We'll come back to it. When you show slide 18 I have some questions about the site itself.

MR. ZINKE: Okay. Major things that have happened at the COL application -- I'm back on slide 11 -- is that we select reactor technology and then some things can happen that previously could not happen with an Early Site Permit. That is the first time that you know what your site related design margins are.

Up until then all you have is site parameters and you also at the COL application process is the first time you can establish risk significance of any particular site characteristic. That is why as we looked at duration we looked at what do you really know at the COL application.

You would know a whole lot more then that information is used. You could things at an Early Site Permit stage but you would have to do them over because you don't know to what extent any small margin or big margin is worth.

At page 12, at COL we would be doing the 52.79 comparison which is where we look to make sure the design falls within the parameters. We've looked at how that would be done. In doing that we would then look at safety margins. We would look at the potential for change in variation for the Early Site Permit site characteristics because at that point then you know what the significance of any of those changes is.

Just because the parameters change doesn't mean that it's risk significant for any particular characteristic for any particular design. We would look at regulatory issues that have come up since then, operating experience and, again, the safety and risk significance of all of those.

So then at that point we can then look at the Early Site Permit and the information that we would have and make some judgments and identify what needs to be done which could result in design considerations and monitoring considerations. What I want to go through now is just some examples of how we saw this play because then that all has to do with whether these things do vary or don't vary.

In the population, which primarily affects emergency preparedness, at the point of a COL we would know the latest census and that would then factor into the emergency plan and we could confirm the validity of those things that were in the Early Site Permit to ensure that, indeed, no changes have occurred at that point in time since for our application we did not submit full and completed emergency plans and that would be part of a COL application. We would also be looking at the evacuation time estimate which would be the safety issue, or one of the safety issues directly associated with population. Not the only one but one of them.

With regard to man-made hazards, although we looked at man-made hazards in the Early Site Permit, we don't think that has a lot of finality because the future isn't reflective of the past. Anybody can come and build things so that would have to be looked at including things like air traffic. That is not something that is predictable with assurance.

And there is meteorological. Meteorological data affects chi over q and affects a number of things. Since we have right now selected a site that has an operating unit, meteorological data is gathered daily. At that point in time we would know whether or not something different is happening.

What we see looking at the past is we see variations. We don't see any relationship to those variations to what has been called global warming but we do have variations that are associated with various conditions --

DR. WALLIS: Changes in pattern in Wisconsin and Minnesota and the rivers in the west.

MR. ZINKE: Right.

DR. WALLIS: You've got a huge drainage area for your river.

MR. ZINKE: And so we know just the local area but the affects on the local area in collecting the data.

DR. WALLIS: Floods in the Mississippi are not influenced by the local area at all.

MR. ZINKE: They are reflected by what happens north and what happens south of us. Again, we have not seen changes at this point in time that are any different than the normal variations.

CHAIRMAN POWERS: But you have to project 70 years effectively

MR. ZINKE: In the guidance as it exist today we don't project in the area of the meteorology as far as what we think the temperatures will do then. We do look at the flood data and determine what we think the maximums are of that data but it's based upon past data. We don't enter it into a predictive computer program and say add this much.

CHAIRMAN POWERS: But if I look at what I see without doing a systematic survey but rather a spot check of what is available, I would be able to predict more frequent and intense El Nino affects. The consequence of that is that the rainfall in the southern parts of the United States goes up. You don't take that into account at all?

MR. ZINKE: At the stage we are in the Early Site Permit, no.

CHAIRMAN POWERS: Why not?

MR. ZINKE: At the stage of an operating

license it would be different. Whether the rain goes up or doesn't doesn't tell you whether that's important. It doesn't tell you until you pick your design and on starting to match.

CHAIRMAN POWERS: I think to any kind of extent you end of saying give a permit any place because I can't determine the significance until I choose a design. I can establish the significance. I know roughly what things are going to be. I mean, Lord knows you can do safety assessments without precision accuracy because we never have that kind of accuracy.

MR. ZINKE: Part of this is the nature of the Early Site Permit because it does not permit anything. It does not allow any construction to start. It lays out parameters that characterize the site but nothing is allowed and until then you match that with the other pieces at a COL application, that is the application then that will actually allow something to occur.

MR. ROSEN: One more quick point on your man-made hazards. You say you're going to consult with the FAA and the Air Force?

MR. ZINKE: Yes.

MR. ROSEN: Well, I would suggest there

are other services, military services, that have aircraft.

MR. ZINKE: Yes.

MR. ROSEN: You might want to check with them.

MR. ZINKE: This was not intended to be a comprehensive list but just some examples of things that we would do in these areas within the application in all of our required contexts.

MR. CESARE: The FAA would cover commercial flight traffic. What we found is the FAA in concert with the Air Force in Atlanta gave us a fairly thorough look at military training, military air training route.

That is why we listed the FAA and the Air Force seemed to be one stop shopping to interpret the aeronautical charts that are publicly available to tell us where the commercial air traffic is and allowed us to apply the staff's review guidance. Then we had to consult with the Air Force for the military training that we wouldn't know. And also it's subject to change fairly frequently.

MR. ROSEN: I think that is appropriate at this stage but at some point you might want to do a more in-depth with the particular services that are flying military aircraft in that area.

MR. ZINKE: Okay.

MR. HINZE: In terms of the man-made hazards, did you check with the economic development groups within the area that are soliciting construction of industrial sites and so forth? Is that incorporated in the man-made hazards looking forward to this 60-year period?

MR. ZINKE: We did consult with the state economic development boards to find out what they could say about what was happening in that area. That shaped our opinions about what we put in the application.

CHAIRMAN POWERS: I'm going to come back to your consultation with the FAA but I think there is a better slide to do it.

MR. ZINKE: Okay. In the area of seismic when you get to the COL stage we are required to collect more data specifically in the area where once you determine where the foundations are actually going to go.

Grand Gulf site located in Claiborne County, Mississippi, eastern bank of the Mississippi, 2,100 acres. Nearest population center is Vicksburg, Mississippi which is 25 miles north. The closest town is Port Gibson, Mississippi which is about six miles southeast.

DR. KRESS: What is the population of those two cities?

MR. ZINKE: Fort Gibson is 10,000.

DR. KRESS: It's really small.

MR. ZINKE: Yes. Vicksburg is 25,000 to 30,000, I believe. Sixteen shows a general map of where the Grand Gulf site is south of Vicksburg, southwest of Jackson. Seventeen, exclusion area boundary. The proposed was revised to encompass the proposed new facility. There are no residents in the EAB; not traversed by rail or navigable waterway. Low population zone, two-mile radius, essentially unchanged from Unit 1.

CHAIRMAN POWERS: Let me ask a question about that. I got confused. Not so much from your document but in the staff's document so maybe they are the right ones to ask but I'll ask this anyway. The low population, you have the exclusion area boundary?

MR. ZINKE: Yes.

CHAIRMAN POWERS: Okay. Is it two miles from that border or is it two miles from the center of the site?

MR. ZINKE: I've got to think through.

CHAIRMAN POWERS: As I read it initially, it was two miles from the border of the exclusion area boundary. Then subsequent reading I said maybe it's two miles from the center of the proposed site. It makes a 325-foot difference or something like that.

MR. ZINKE: Right. I'm trying to --

MR. LEE: Excuse me. This is Jay Lee. Dr. Powers, that's from the reactor?

CHAIRMAN POWERS: Say that again?

MR. LEE: From reactor itself.

CHAIRMAN POWERS: Two miles from the reactor.

MR. ZINKE: Center line of the reactor.

CHAIRMAN POWERS: The center point of the proposed site to the low population zone boundary is two miles.

MR. LEE: Right.

CHAIRMAN POWERS: The center of the reactor to the exclusion area boundary is roughly 600 feet or something like that?

MR. LEE: About 5,000 and some feet.

CHAIRMAN POWERS: I got confused on that. I mean, it's more a matter of wording. It's not your document but it's staff document.

MR. ZINKE: I know in ours since we didn't know exactly where the reactor would be, we also did some looks at -- we might measure that a little bit different place which then allows you some flexibility on where it might go.

CHAIRMAN POWERS: Yeah. That's why you -- I would have put it at two miles from the exclusion area boundary because then I can move the reactor all around the exclusion zone and not change any of the subsequent multiplications.

MR. ZINKE: Figure 18 shows the proposed facility area. You can see where it's westerly of the existing Grand Gulf buildings.

MR. ROSEN: Let's just talk about that figure for a minute. The bluff begins where on that figure?

MR. ZINKE: I'm not sure that's going to be the best figure to show the bluff.

MR. EATON: George, I can point it out. This is the flood point of the river and these lake features here are old basically drainage channels that flood very frequently. The river floods a couple of times in the spring and probably once in the fall, probably what happens on the Ohio on the upper Mississippi.

Basically as the topographic lines start concentrating this is the edge of the blood plain so the bluff starts roughly here. This is what we call the heavy haul road which goes from a barge split across the flood plain to the foot of the hill. The plant proper is up here 65 or 70 feet up the hill. It does not flood at all. Those are the topographic issues.

MR. ROSEN: Now, down on the flood plain there are no structures or equipment of any kind or than the barge split?

MR. EATON: There is quite a bit of structure and equipment. Grand Gulf utilizes what is called raining or radial wells. These circles are orange concrete caisson structures with pumps that draw water from the alluvial strata under the river itself so you get the benefit of roughly filtered water and you get the benefit of quite a bit of temperature depression so you are able to get a cooler water supply for plant surface water, plant cooling water using these radial wells.

There are five of them along the river with laterals that go radially from the caisson out into the river structure and under the flood plain as well. Then to support the electrical power supplies and the control systems for those radial wells we have a large elevated structure with transformers and switch gear associated with those particular components.

MR. ROSEN: And that structure is not submerged when the river floods?

MR. EATON: It is not submerged when the river floods. The water obviously comes up on the caissons but does not submerge the elevated transformer and switch gear structures.

MR. ROSEN: How does the power get to the pumps?

MR. EATON: They have lines and a redundant underground line that goes down the hill across the flood plain to these facilities.

MR. ROSEN: So those facilities, the pumps itself, let's just pick anyone of them. is fed power from an underground source in a cable?

MR. EATON: Cable and overhead line as well.

MR. ROSEN: But it is also is flooded. Am I correct?

MR. EATON: That's correct.

MR. ROSEN: I'm having difficulty with the flooded pump.

MR. EATON: The pumps are inside a caisson structure. The pumps are not flooded. The water comes up on the exterior of the caisson. It doesn't rise to the top level and those flood levels are established as part of the design features of the radial well system. The flood waters are accommodated by virtually the elevation of the structures that are down there.

MR. ROSEN: They are basically in a great big pipe.

MR. EATON: That's correct.

MR. ROSEN: So they don't get wet.

MR. EATON: That's correct.

MR. ROSEN: And inside the pipe is a pump motor.

MR. EATON: That's right.

MR. ROSEN: A pump and pump motor.

MR. EATON: That's correct.

MR. ROSEN: Big pump motor.

MR. EATON: Big pumps.

MR. ROSEN: Powered by at that point what voltage?

MR. EATON: 4160, I believe.

MR. ROSEN: And access for service?

MR. EATON: Access for service probably nine months out of the year would be via roadway.

Truck operators come down and do their daily round, shift and rounds. In extreme flooding conditions the operators access those radial wells by boat.

MR. ROSEN: Then they climb up over the top of the caisson and go down inside.

MR. EATON: There are structures attached to the caissons for boat docking and there are safety systems and rails and platforms that they access. Then they go up to the top works where the motors are and the switch gears for the particular radial well.

MR. ROSEN: Is any of that equipment safety related?

MR. EATON: No. This is normal cooling water for the plant totally separate from the safety related central heat --

MR. ROSEN: Which comes from the pond up on the bluff?

MR. EATON: The safety related aspects of the design are associated with some very large underground basins that are located -- we're talking Unit 1 but right here is the essential service water basins which are underground storage safety related seismic and that constitutes the heat sink for the plant.

MR. ROSEN: And they get their source

from?

MR. ZINKE: They have a 30-day supply and then makeup water to them would be from service water.

MR. EATON: All the makeup water for the plant comes from the river. These supplies are secured, recirculated, chemically treated and managed in accordance with the technical specifications.

MR. ROSEN: Well, that's my first set. Thank you very much. That's very helpful. That's my first set of questions. My second set has to do with the stability of the bluff. What can you tell me about what history has been of subsidence along that bluff? How far back is the first safety related structure from the bluff?

MR. ZINKE: Is that going to be in our --

MR. BACHHUBER: Yeah, I'll be covering some of that. I have a cross section that will really help.

MR. ROSEN: I have been watching television lately and I just remembered seeing a bluff in New York City, actually, on the Henry Hudson Parkway while I was looking at this and thought to myself, oh, my goodness. Maybe someone should tell me about that. That's what I'm interested in.

MR. ZINKE: All right. Page 19, basically the 0 to 10 miles, 10,000 people, 10 to 50, 325,000. Projections, we used Mississippi and Louisiana State for projections of growth not projecting a large increase in population in that area. The areas, on slide 20, are generally rural, remote. The primary industry forestry and agriculture. No commercial airports within 10 miles. Closest major highway is U.S. 61 which is east of the site.

No active rail lines, close gas/oil pipeline, 4.75 miles. Mississippi River is important river transportation which we did analyze as part of the safety of what goes up and down the river.

CHAIRMAN POWERS: Let me ask this question on both your commercial airport at Jackson and your air traffic corridors. We see some dynamicism in the way the commercial industry structures its aircraft transport. They have for the last 20 years been using a hub kind of concept and now we see people going away from that. Is there any indication that Jackson could become a more active airport than it is now?

MR. ZINKE: I don't know that we've seen any indication but I don't think there is anything to preclude that in the future either.

MR. CESARE: The transition away from hubs has seen the growth, therefore, of the low-cost carriers but the same routes getting from Jackson to the major cities haven't changed. New Orleans, Jackson, Memphis, Atlanta, Dallas all exist geographically in the same place.

When we looked at the aeronautical charts the major commercial airways were virtually unchanged from 1980. What we saw that we couldn't guarantee was the military stuff and that is where FAA led us to other places. The same routes have virtually been unchanged since when we put those charts in in 1980.

MR. ZINKE: Slide 22, proposed elevation for the new site located 65 feet above normal Mississippi River levels. Like I said before, we did in the application consider river-borne hazards. Climatology, meteorology, we used the sources from Vicksburg and Jackson and Unit 1 Met tower.

CHAIRMAN POWERS: There was some controversy about the Met tower that is available to you on the site. It apparently has changed from one kind of a structure to another.

CHAIRMAN POWERS: We had a problem with some of the Met tower data that we initially submitted that one of the instruments was found to be not giving true indications I guess is the best way to put it. The structure itself hasn't changed over the major life of the plant.

MR. SCHNEIDER: There have been several changes in the Met tower --

CHAIRMAN POWERS: Microphone, Al.

MR. CESARE: Initial site characterization had a temporary Met tower that provided data for the PSAR stage in the '70s. That tower was continually improved to the one that, I think, Al, the site used for a number of years. There have been a number of instrument improvements on the current tower.

MR. ZINKE: Say who you are.

MR. SCHNEIDER: Al Schneider with Enercon. They have made some improvements in the Met tower recently, I think, as recent as 2000. The problem I think you're talking about is the directional wind data that was questioned for some of the period that we used in the initial submittal. That problem was corrected and we have in our AIs provided data from years 2002 to 2003 which isn't affected in the way that the previous data was. It did change a little bit, the figures and things in the submittal, but not significantly.

DR. WALLIS: Do these thunderstorms include tornados? Are they included in there are there were no tornados?

MR. ZINKE: No, we have tornados.

DR. WALLIS: I just wonder why it wasn't listed here.

MR. ZINKE: Just not shown on the slide. I mean, the application discusses tornados. It discusses the affects from hurricanes which also we receive at the Grand Gulf site, general storms. It's just not listed on the slide. It's generally a humid area, short cold season, infrequent snow and ice events. There are occasions we do get some snow and ice. A lot of thunderstorms. Slide 14 00

CHAIRMAN POWERS: Coming to your data sources that you have, you've indicated data from Vicksburg and Jackson to supplement what you have for your Met tower. Have you used data from places like Memphis? Then overall the question that I will get to eventually is why is it appropriate to use Vicksburg data and Jackson data? How do you go about assessing that's appropriate for your site? I mean, Vicksburg is 25 miles away. Jackson is 65 miles away.

MR. ZINKE: Al, you want to answer that?

MR. SCHNEIDER: I don't know if I can answer it specifically but I think in meteorological terms 25 miles isn't all that much. There was a good bit of data comparison between the Met tower data taken at the site and the data taken in Vicksburg and also in Jackson. They show very close agreement.

CHAIRMAN POWERS: I mean, that's the problem. I've not seen but maybe because I didn't identify. I mean, you could point me to the appropriate place in the document. Is there some sort of quantitative matching between the data that you have for your site and the data that you're using to supplement that? Give me some better feel for what one -- why they are appropriate to use.

MR. SCHNEIDER: I don't have anything right off the top of my head but, as I said, we did compare a number of parameters for the different locations and they did compare reasonably. Level of humidity was one, for example. Humidity conditions in Vicksburg are very close to --

CHAIRMAN POWERS: But when I look at things like wind speed I don't see a very good comparison.

DR. WALLIS: Doesn't the bluff influence this? If there's a strong west wind and it flows up over the block you get turbulence and stuff behind the bluff which you wouldn't get on a plain?

CHAIRMAN POWERS: Turbulence is good, by the way.

DR. WALLIS: It mixes things up. It may break things but it mixes up --

CHAIRMAN POWERS: Turbulence we like.

DR. WALLIS: I'm not familiar with this but you do something about the local conditions at the site and how they influence the winds and so on?

MR. ZINKE: Yeah, but that also then factors into the design justification for the location of the Met tower because the Met tower data has to be located in order to reliably predict because that's the data that is then used in your real-time accident dose calculations.

DR. WALLIS: Now, 100-year snow pack thing is still an open item, is it, or have you sorted that out?

MR. ZINKE: Well, all of our open items are still open. We won't submit our responses until June 21 so we have been in discussion.

DR. WALLIS: You've had trouble figuring out how much it's going to snow down there in 100 years?

CHAIRMAN POWERS: I would think that would be an impossible to figure out how much it's going to snow in Mississippi.

MR. ZINKE: The open item doesn't so much happen to do with figuring out how much it snows or how much it rains. It has more to do with how many numbers do you add together to get a worse case.

CHAIRMAN POWERS: It has to do with what independent and dependent probabilities. You'll love it, Professor Wallis.

DR. WALLIS: Good.

MR. ROSEN: At some point during your presentation are you going to discuss the transmission system and the effects of an additional unit on it and current grid reliability and predictions of future grid reliability?

MR. ZINKE: No. For the Early Site Permit there was some amount of -- very small amount of prediction on the environmental effects of transmission in the environmental report but we deferred in the environmental report most of the efforts on transmission.

We would do that analysis at the COL. In the safety area the transmission off-site reliability is basically divided up so that is the subject that gets addressed at the operating license application phase versus site characteristic.

MR. ROSEN: Surely you know now whether the existing transmission will carry the load.

MR. ZINKE: Yes, we do and it would for a unit. If we built the maximum units for the early site permit there might have to be some upgrades. Part of that would then have to do with where new industry might locate and where you were trying to move the electricity. Then it would also end up being dependent upon whether or not the plant is ultimately going to be regulated.

I'm talking about state regulated. Where you are going to try to move the electricity to so there's a number of uncertainties to do with the transmission that wouldn't be decided until we make a decision to build the plant and at that point decide where are we going to sell it. Relative to the safety issues associated with the reliability, even though it is a COL issue is when you actually have to address that in the application. Just because we have operating plants in the south we are aware of the reliability data.

MR. ROSEN: Grid reliability is an issue of some prominence now with the trend towards the regulation and the impacts thereof on grid reliability. I was just trying to get an early understanding of your views as to how good is the site now and how likely is that record is to continue or be improved. For instance, let's ask a specific question. What's the current frequency of loss of off-site power?

MR. ZINKE: No, we haven't lost off-site power for Grand Gulf in over 10 years.

MR. ROSEN: So it's at least not more than once in 10.

MR. ZINKE: When I checked on the data before, some of our data -- that's the data I have right now. The site people and our engineering has more data on reliability for our whole southern fleet. We are as Entergy addressing and staying current with the issues of off-site power reliability just because we are a large company with a large number of plants in the southern region so it is an issue that we are actively managing.

DR. WALLIS: While we're talking about weather and whether it snows there, what's your 100-year hailstone diameter? You've got hailstones the size of golf balls or grapefruit or baseballs or what? This would presumably affect the switch yard and loss of off-site power. Are you worried about hailstones?

MR. ZINKE: I don't have that.

DR. WALLIS: Some parts of the country it's quite prevalent large hail.

MR. ZINKE: We do get hail.

DR. WALLIS: But you don't get the large hail they get in parts of the west? You do?

MR. ZINKE: We can get large hail.

CHAIRMAN POWERS: Pea-size hail?

MR. ZINKE: I don't have that information for you today.

DR. WALLIS: I just wonder why it's not part of the list of things. If you list infrequent snow, you might as well list --

MR. ZINKE: For the slides we did not try to be comprehensive and list everything that we looked at and that's in the application. That pretty much ends where we are in moving into the seismic. I was going to move to slide 26.

CHAIRMAN POWERS: Before you jump there, staff has questioned your maximum and minimum temperatures that you have used. What is your response?

MR. ZINKE: We -- Al, you can answer that.

CHAIRMAN POWERS: Come to a microphone, please, sir.

MR. SCHNEIDER: We intend to provide the data that the staff has asked for.

CHAIRMAN POWERS: You can respond to the

particular question which is a matter of a couple of degrees here or there. But in the larger sense what they are questioning is your data collection for this historical thing.

You are dependent on historical data if you are to project what the future is going to be. They have questioned specifically the high and low temperatures. But in a larger sense they are questioning your whole collection of historical data. I mean, how do you defend yourself on that question?

MR. SCHNEIDER: I think we have taken the approach to review the data that is available for the area of concern.

CHAIRMAN POWERS: But they didn't make up their numbers.

MR. SCHNEIDER: No, they didn't.

CHAIRMAN POWERS: They went and looked and came back and said, "Gee, we find a higher temperature and a lower temperature." I mean, it can be a particular instance or just made a mistake or didn't see that particular number, or maybe the staff is mistaken, or it could be part of a larger issue and that's what I'm trying to find out. Is it part of a larger issue on the data examine issue.

MR. CESARE: I believe the -- I don't know the story on the lower temperature but the maximum temperature that the staff identified was at the Vicksburg National Military Park data collection. I believe we knew about that temperature but we discounted it based on temperatures on the same period from Vicksburg and the site.

That's the initial understanding of our position. We still have to review that. It was a higher temperature but at that time I think we also had data from Fort Gibson as well from the data collection center there. I don't know if we knew about it previously but it does look like an outlier.

DR. WALLIS: On the lower temperatures the staff seems to be worried about your ultimate heat sink water storage freezing. This is a large tank of water, Grand Gulf, Mississippi. Is it actually going to freeze?

MR. ZINKE: No. The ultimate heat sink within the application we said that we would follow the same kind of design assuming we pick a reactor that needs an ultimate heat sink, that the design would follow the same idea of the Unit 1 which would be separate basins of water. They are not real large basins as far as surface area as compared to the Mississippi River.

DR. WALLIS: Is the staff serious about the possibility of freezing of this water storage?

MR. ZINKE: That was the question and it does go below freezing.

DR. WALLIS: Yes, but not for long.

MR. ZINKE: Not for long.

MR. CESARE: And, indeed, part of our response is about looking at days below freezing over a period of time.

DR. WALLIS: So you're going to respond to that.

MR. CESARE: Oh, yeah. And the surface area of the basin. The Grand Gulf Unit 1 experience has been no freezing in these large swimming pools that are very deep.

MR. ROSEN: There would be design solutions in any event that would be rather simple. Tempering circuits or something like that.

MR. ZINKE: Yes.

MR. CESARE: Yes.

MR. ZINKE: I think the main point for the Early Site Permit is that to identify those kinds of things so that when we get to the COL stage we do the appropriate designs and don't forget what the characteristics are.

MR. CESARE: My perception also is that the staff was covering a broader scenario where the ultimate heat sink was perhaps a pond or something like that taking it in that approach. If we do mechanical basins as we have for Unit 1, then we believe there would be very little chance and that would be on design.

MR. ROSEN: You said they are very deep. Could you just tell me how deep so I get a feel for that?

MR. EATON: I think approximately 30 feet deep and a couple million gallons underground to some extent flow beyond the confines of the surface area. Basins are designed to support some bands. The basins are quite large.

MR. ROSEN: You said they go underground. They are deep and they are actually tunneled in under the ground and the overhang parts are supported in some way?

MR. EATON: The basins are primarily underground basins. The above-ground portion supports a cooling tower design so there is a substantial part of the basin that is underground.

DR. WALLIS: So it's designed to be below the frost line.

CHAIRMAN POWERS: Which isn't very deep.

MR. ZINKE: Okay. We are going to move to slide 26. We are going to move into the geological seismic geotechnical portion of the application of which I'm going to let experts discuss this.

I want to take you through that one of the major items in the application was the seismic analysis and the seismic analysis was under a new part 100 section different than our existing fleet with the primary difference was that the new analysis is a probabilistic safety hazard analysis, probabilistic based for determination of the SSE versus the current Grand Gulf and, in fact, the current fleet of nuclear plants which was deterministic seismic SSE.

DR. WALLIS: On your slide presumably EERI is EPRI?

MR. ZINKE: We missed that one but it is EPRI. The difference if you look in the blue section that is where part of the probabilistic where differences in the probabilistic is in the deterministic design like for Grand Gulf the SSE is the worse case earthquake. Under the new analysis for seismic there is weight given to all earthquakes, not just the worse earthquake. There is also a part of the process that looks at giving different weights to different models of how earthquakes act.

The left hand side was as part of this process the input into the PSHA was the EPRI update of the ground motion models went through a SSHAC process, developed a PSHA code. Then also in the green part there was an update of the geological geophysical database and all that then went into performing of the PSHA.

Through that we identified a new fault but it was a precharacterization of fault data to say that this would be described as a different fault called the Saline River Fault so that factored in. Then the site investigations which factored into borings that were for the original Grand Gulf plus some new borings.

That's basically how the seismic process and analysis plays out in a flow chart fashion as in contrast to the old seismic analysis for the current fleet which basically skips a large amount that's on there and to determine the SSE is deterministically the worse-case earthquake. We still do a lot of investigations but the bottom line is it's really something different than what we do now.

I'm going to turn it over to Jeff Bachhuber.

MR. BACHHUBER: Thank you. If it's okay, I'm going to present standing up if you can hear me okay. I have a loud voice.

CHAIRMAN POWERS: We have to get you a microphone.

MR. BACHHUBER: Okay. Thank you. I'll be pointing to a lot of the figures so it's easier for me from a standing position. Plus that way I can run out the door quicker in case it gets too hot in here.

CHAIRMAN POWERS: We have guard outside so you can't get very far.

MR. BACHHUBER: Okay. George already covered our process so kind of a flow chart of how we ultimately came up with the SSE spectrum. First I'll be presenting this branch of the tree here under site investigations which included performing the site borings, laboratory testing, developing the site geotechnical profile, and also the site response profile.

Also under this portion of the work we reviewed potential site hazards from landslides, liquefaction, any kind of seismically induced ground failure. After my presentation Jim Hengesh will be working us through this portion of the flow chart and so the source characterization looking at these sources that George has mentioned. Then Marty McCann will be wrapping it up here discussing the PSHA site response analysis in the SSE.

DR. KRESS: Can you explain to me what SSE's spectrum is? With the original deterministic SSE you design your system to withstand that thing but then have a site shutdown. Now you've got a spectrum of frequency versus strength, I presume. Do you have a slide that talks about how there is some kind of acceptance criteria built into that?

MR. HENGESH: That is the ground motion that has the 10 to the -5 median annual probability.

DR. KRESS: That's how you select the strength of the earthquake that you are going to design for safe shutdown.

MR. HENGESH: Yes.

DR. KRESS: That's basically my question.

MR. BACHHUBER: Right. Yeah, Marty will be elaborating on that showing the SSE and talking through them.

Next slide, please. Okay. The goals of the ESP site exploration were to use existing information first as much as we could. There were 275 existing borings from the FSAR. Where the ESP site is, there were about 20 borings within the ESP envelope or immediately adjacent to it.

We started out with a significant amount of subsurface information. In addition to that, we planned out our new borings specifically to target certain potential issues such as site variability, either lateral differences in geologic deposits or vertically.

Then also to use newer techniques. Since the FSAR work was done there's been quite a few advances to determine site shear wave velocity and such. Our investigation program brought in that new type of technology.

MR. HINZE: Jeff, if I might, the borings that you're talking about, how were they distributed over the area and what criteria were used in their selection originally? When I looked at your structure contour maps, for example, there's no data source indicated on them so when does it know really the validity of the contouring?

MR. BACHHUBER: Okay. In a couple slides I'll show you the layout so we'll get to that.

Let's see. Ultimately the goal was to develop the site profile that was then feed into the site response analysis. To collect sufficient information for that, first we had to be satisfied that we were capturing the site variability. Then also we had to be satisfied that we had enough laboratory test data and field data to characterize each of the stratigraphic units underneath the site.

CHAIRMAN POWERS: Are you going to explore how you determined what enough is?

MR. BACHHUBER: Yeah, we'll take a look at that also. We'll discuss that in two more slides where we have the boring location.

CHAIRMAN POWERS: I can wait.

MR. BACHHUBER: You had made a comment earlier about the heat so I was directing the field investigation during July/August right in the middle part of the heat.

CHAIRMAN POWERS: I assume you have offended your management in some undescribed way.

MR. BACHHUBER: But the heat didn't compare to the fire ants. They were actually more of an annoyance when we were out there.

Next slide, please. Okay. This map shows the ESP site which is outlined right here. Then the geologic conditions around the ESP site. The existing power plant is shown right here and so the distance from the plant to the ESP is on the order of 500 to 1,000 feet. As George mentioned previously the ESP site occupies an area that was use for a lay-down area for construction of the existing plant site.

DR. WALLIS: So going back to my colleagues question, it goes right out to the bluff.

MR. BACHHUBER: Yes. And so the edge of the bluff is right here. You can see by the contrast between the green formation and --

DR. WALLIS: You'll show us how stable the bluff is.

MR. BACHHUBER: We'll take a look here. There are a couple of failures that we have mapped in the bluff and we will explain how we characterized those.

MR. HINZE: As I recall, though, you said you had a setback distance of 100 feet. How did you arrive at that distance?

MR. BACHHUBER: I'll show you that also. I think I have all that.

CHAIRMAN POWERS: We're just playing your straight man. We got your instructions before you presented.

MR. BACHHUBER: If I don't get to that but that will be in a couple slides. The site here is within the Loess Hills geomorphic province. That is all the area here in the tan shading. From the bluff to the east are the Loess Hills. They rise on the order of 60 to maybe 100 meet above the Mississippi River flood plain. They are underlain by old alluvial deposits in the Mississippi River when it had a former different course further to the east.

DR. WALLIS: A hundred foot is a hill?

MR. BACHHUBER: Yeah, this is Mississippi. A hundred feet is a good hill.

CHAIRMAN POWERS: In Texas it's a mountain. They would probably put a ski resort on it.

MR. ROSEN: If they had any snow.

CHAIRMAN POWERS: They make snow.

MR. BACHHUBER: The Loess Hills are underlain by these old alluvial deposits. They are Pleistocene age and older. It was before the end of the last glaciation. To the west of the bluff here so all this material here are recent alluvial deposits in the active Mississippi River Valley. These include a variety of channel deposits out here more towards river itself, interbedded sands, gravel, silt.

Then in green here over-bank flood deposits so during flood stage finer sands and silts are carried further onto the flood plain. However, ESP site here, the edge is coincident with the top of the bluff so it does not extend onto the river plain.

I'll be showing you a cross section somewhere in this region right here so you can look at a section like an elevation between flood plain and the site here.

We compiled existing information as a start and then we did some independent mapping by site recognizance looking at road cuts, aerial photographs to update the existing maps. We also evaluated these deposits here in the Loess Hills specifically to look for evidence of any kind of deformation indicating that there's been past instability at the site from either faults or folding or subsidence.

MR. ROSEN: Could you show me again which ones you are now referring to?

MR. BACHHUBER: Yes. I'm referring to all the deposits that are from the bluff to the east so from here east so it's all these materials in here.

MR. ROSEN: All of them?

MR. BACHHUBER: Yes. The materials are relatively horizontal and they are embedded. They extend away from the river so you can track the same units from the bluff eastward. We'll show that in the borings how we were able to define how the stratigraphic layers are oriented.

MR. HINZE: Jeff, let me play your straight man once again. In your work for the existing power plant was there any shallow or deep seismic work to look at the possible presents of faults or other structures?

MR. BACHHUBER: Yes, there was quite an extensive program of refraction surveys. I don't recall the exact footage but they had a whole network of lines that were typically hundreds of feet long so they canvassed pretty much the entire area including the ESP site with those.

MR. HINZE: This was refraction and not reflection?

MR. BACHHUBER: Refraction. The depth of penetration was limited maybe to 50 to 100 feet, somewhere in that range. The existing site borings, the deepest extent, I think, we had some borings about 400 feet deep during the FSAR stage.

MR. HINZE: Did that get through the Catahoula?

MR. BACHHUBER: Yes, it did. We'll show some cross sections of that.

MR. HINZE: Has there been any thought in order to validate this concern of the structural stability of the immediate site? Has there been any thought given to reflection studies that might be more discerning in higher resolution than the refraction, the old refraction work?

MR. BACHHUBER: That is something that could be entertained during a COL phase. At this point we felt very satisfied with the boring information along with the existing refraction surveys. We had a real solid characterization of the site.

Once a specific location and plant type is selected, then it would be typical to integrate some additional geophysical lines and whether we would use refraction or reflection surveys kind of would depend on exactly the layout that we have in the depths. But it could be typically reflection surveys. You could penetrate a lot deeper. However, the resolution often in the upper materials isn't as good as in a refraction survey. What we are real concerned about is probably the upper most --

MR. HINZE: People would take exception to that but so be it.

MR. BACHHUBER: But we would look at all possible techniques and we did for this program also just to make sure we're capturing the best way to image and get the information we need.

These deposits here were laid down by the former Mississippi River. They are relatively horizontal. They don't show evidence of faulting at the site or in the immediate vicinity. We don't see evidence of past subsidence holes from cause type development, large scale landsliding that involves large tracks of land around the ESP site. We will look at a couple of those shallow bluff failures that occurred about right here in the bluff in this area here.

Next slide.

DR. WALLIS: Are you going to talk about salt domes later on?

MR. BACHHUBER: We don't have that worked into the slides but we did look at that.

DR. WALLIS: There are some that are pretty close there.

MR. BACHHUBER: We compiled the information regarding the location of those salt domes. We looked for evidence of possible deformation from other salt dome structures, either the existing ones or possibly some deeper that haven't been identified. We didn't see a deformation in the substantial thickness of deposits that go back to the Pleistocene episode.

MR. HINZE: How did you accomplish that, Jeff? How did you look at, for example, the possibility of a deep salt dome underneath the structure?

MR. BACHHUBER: That was by compilation of existing information so we relied on those data sources. Plus looking for deformation in the deposits so by our surface map, or subsurface investigation down several hundred, maybe down to 400 feet at the site, we could say confidently that upper 400 feet of material doesn't show deformation. That extends back to the Pleistocene so we have a long record of no disruption from salt dome formation at the site.

Okay. The investigation, the scope, of course, included the initial data review which I've covered. We drilled three new borings at the site. Actually, we had four but two of the borings were immediately adjacent to each other. We had to terminate one of the holes early due to some problems with drilling and then continued the hole immediately adjacent to it. They combined it really to three holes. They extended 140 to 200 feet deep. We also performed four cone penetrometer soundings.

DR. WALLIS: How did you choose that depth? What is magic about 140? That seems a little shallow really. Why did you choose that?

MR. BACHHUBER: The depth ranges were

selected to cover any anticipated maximum foundation depths plus an additional depth of the foundation influence zone which would be around 140 feet for any reasonable very deep embedded foundation.

We extended them either deeper to 200 feet mainly for the site profile to look at velocities deeper. We didn't extend our borings deeper than that. It was a balance of the information that we thought was adequate to characterize the site.

DR. WALLIS: The borings you just spoke about that went to 400 feet, unless I misheard, and you were looking for deformation, that's something different?

MR. BACHHUBER: Those are from the previous investigation.

DR. WALLIS: Previous investigation.

MR. BACHHUBER: Yeah, for the existing plant site.

We performed down hole suspension velocity surveys in three borings. These were using the most modern techniques. We subcontracted this out and it obtains a discrete shear wave and compressive wave velocity profile. I'll have examples of those profiles of the site.

We performed both standard index testing of the materials and we looked at foundation properties and also compare our site materials to those of the existing power plant site. Plus we performed six dynamic soil tests using special techniques, resident column and torsional shear testing. That was performed at the University of Texas. That was to look at the dynamic properties of the soils. Then also we made some considerations for what type of work would be performed.

DR. WALLIS: Dynamic properties means liquefaction and that sort of thing?

MR. BACHHUBER: It's shear modules.

DR. WALLIS: Shear modules.

MR. BACHHUBER: Yeah, reduction and the damping properties. So looking at the nonlinear behavior of the soils to the seismic shaking and those were fundamental parameters that were plugged into the site response analysis.

DR. WALLIS: There's no liquefaction issue at this site?

MR. BACHHUBER: No. We'll take a look at that. We used standard penetration blow count data and shear wave velocity data to look at liquefaction potential.

MR. HINZE: Those were on cores? Those

dynamic tests were on cores?

MR. BACHHUBER: Yes, they were.

MR. HINZE: And how frequently did you down the hole did you make the test?

MR. BACHHUBER: Some portions of the hole were continuously sampled so we just stacked samplers on top of each other. The widest space we had between sample intervals was about five feet.

MR. HINZE: Was that predicated on lithology? What controlled where --

MR. BACHHUBER: That was based on lithology, review of the existing borings in the area where we knew specific strata that we wanted to target. Then also as we drilled successive borings we used the information from the previous boring and also the cone penatrometer soundings to help determine exactly where we wanted to sample. We had kind of a default sample interval, let's say, at five feet and then we would add samples between those to target specific horizons.

MR. HINZE: Thank you.

MR. BACHHUBER: Next slide, please. Okay. Here's a map of the ESP site. You see this gray circle here. The inner circle is a proposed power block area so this is the envelope, the extent of the

ESP site where we would be putting a reactor, a new plant. Then the out --

DR. WALLIS: Can you orient me? This cafeteria looks as if it's suspended out over the bluff somewhere.

MR. BACHHUBER: Okay. The edge of the bluff extends something like this. It curves around.

DR. WALLIS: So there are more contours than are shown here.

MR. BACHHUBER: Yes, so you don't see the contours in here. The edge of the bluff is right at about the back of the cafeteria building. Here is north. Here's the scale. This is 200 feet right here to give you an idea. This distance across I think is about 1,200 feet, the diameter of the circle. We have also identified an outer circle and we called this the area of influence. This is 150 feet.

DR. WALLIS: Zone of influence.

MR. BACHHUBER: And we calculated that by looking at the likely deepest depth of a foundation looking at all the different types of configurations that would be entertaining here. It's about 150 feet deep below existing grade. We took that depth and projected it upwards at a one-to-one slope. If you just take this circle if you could project it 150 feet down and then take a one-to-one slope coming up from that, that would meet this line here.

That's the zone where any kind of foundation, excavation activities, any construction or any influences from the plant foundation we believe would be conservatively within that zone. That is kind of a standard distance or relationship using a one-to-one projection from a foundation so we came up with that.

There's a couple features here to point out. Here is the existing plant site. In yellow here this feature right here and this feature right here, these are previously swales that existed at the site so even before grading for the existing plant site there were some drainage swales and they were about in size about 30, 40 feet deep below the ground surface.

During site grading they in-filled these swales so now the outline of these swales also defines the outline of filled ground. We will be looked at this cross section B-B prime. Right here the cross is a couple of these arms of these swales so we can look at cross section what that fill ground looks like.

MR. HINZE: Excuse me, Jeff. Let me catch up here. Is the site of the proposed or potential plant anywhere within that innercircle?

MR. BACHHUBER: Yes. It could float anywhere within the circle.

MR. HINZE: Okay. So it can go through the filled areas.

MR. BACHHUBER: Yes.

MR. HINZE: Thank you.

MR. BACHHUBER: Now, the depth of the foundations will be considerably below the depth of the fill in those areas so will be much greater than the depth of the fill.

MR. HINZE: And that's 80 feet or something like that?

MR. BACHHUBER: Yeah. And we'll see that in this section. I think it's my next slide.

DR. BONACA: Before that, on slide 28 I'm just curious to know what is the intake structure for the existing plant?

MR. BACHHUBER: I'm sorry? Again?

DR. BONACA: What is the intake structure for the existing plant?

MR. BACHHUBER: The existing plant's Unit 1, which is right here. Unit 2, which was not built out, is adjacent.

DR. BONACA: I understand that. I'm asking for the intake structure.

MR. BACHHUBER: In fact, there is no intake.

MR. ZINKE: That was a discussion over the swales on the river.

DR. BONACA: So, okay.

MR. BACHHUBER: I'm sorry. They said intact.

MR. ROSEN: I think, Mario, you weren't here when we talked about this.

DR. BONACA: All right. Sorry.

MR. BACHHUBER: All right. This slide also shows the location of the borings. The ESP borings are in black here so this is boring 1, 2, and 3. Then our four cone penatrometer tests are the black triangles here. You can see they are distributed across the ESP site. We also specifically targeted these in-filled swales here. We wanted to get some tests on those.

In blue are the existing FSAR borings. So before we cited our borings we took a look at the layout, the distribution of the existing borings. We wanted to fill in gaps plus also target specific areas where we thought there may be different site conditions so we're capturing the site variability.

MR. HINZE: How did you determine that

site variability, from the preexisting drill hole information?

MR. BACHHUBER: Yeah. Yes. By compiling the existing bore hole data. Then after a site investigation we prepared a series of cross sections shown here, A-A prime, B-B prime which we'll look at and C-C prime to look in sections how those deposits in the different strata varied across the site.

MR. ROSEN: And what is that feature, that north/south feature? That looks like a rectangular feature. It says "cut slope" on it.

MR. BACHHUBER: Oh, this one right here.

MR. ROSEN: Yeah.

MR. BACHHUBER: Okay. This is a cut slope and so the ESP site spans two flat existing pads. There is a lower pad right here which is on the east side of this cut slope so here is a cut slope. East over here this is graded flat equivalent to the existing plant grade, 132, 134 feet. Then this cut slope rises, I think, about 20, 25 feet to an upper pad right here. This upper pad is at about 154, 156 feet.

MR. ROSEN: So it's actually higher on the west than it is on the east?

MR. BACHHUBER: Yeah, it is. So it rises

to the west and then here is the top of the bluff right here. It's actually a higher pad right where the bluff is at. The plan is to make the new plan at ESP site at the same plant grade as the existing power plant so that would involve grading out this material here. All this portion from the cut slope to the west would be excavated down up to about 25 feet or so.

Okay. Here is the two slumps I had referred to before. Here is one right here. There is another right here. These slumps have developed in the bluff. They involve the superficial soil. They show up on looking at topography pre-plant excavation and post-plant development. It looks like these formed possibly before the site was graded. In any case, we don't see evidence of recent movement of these, any post-plant construction movement.

MR. HINZE: Are they associated with springs?

MR. BACHHUBER: We didn't see any springs but we didn't have a chance to really clear all the vegetation. It was very vegetated where these occur so it is possible that there are some water zones, some springs that are causing these failures. This is a typical type of mechanism that's eroding the bluffs regionally.

MR. HINZE: But that gives you a mechanism for this and one where you can look at the possibility of future slides.

MR. BACHHUBER: Yes, that's true. For the COL phase investigations once the location is figured out, let's say right here for an ESP for the new plant site, additional investigations would be specifically targeted to look at the influence of bluff stability. As I'll show in the cross section, next slide, here is cross section B-B prime and the extent of the ESP site, these gray zones right here. I'm outlining what we showed on the map as the outer perimeter circle which includes the area of influence and this zone right here --

MR. HINZE: Excuse me. Tell us what those colors represent, please.

MR. BACHHUBER: Okay. So, anyhow, the proposed ESP site spans right here. Here is the bluff, here is the Mississippi River plain. Now, the different colors that are shown here are the major stratigraphic units underlying the site. We have four primary units. The upper unit right here is in yellow.

This is loess soils. They are Pleistocene loess deposits that were deposited at the end of the glacial period so as the continental glaciers receded you have a lot of ground-up material that was then blown down the Mississippi River Valley and deposited within the Loess Hills province. They extend on the order of about 40 feet thick up to maybe 60 to 80 feet thick.

MR. HINZE: But you are characterizing that as a single lithologic unit and it really isn't. Is it? I mean, there are variations within the loess.

MR. BACHHUBER: Yeah. Within every one of these units there is actually discreet little smaller beds that are possibly on the order of inches to feet thick. But each of these units has a distinct range of properties either from a distinct geologic process that deposited them or a distinct age or a distinct geotechnical property.

Even though this Unit 2, for example, is actually comprised of a whole series of loess separate different layers, in total they behave very similar. They are all related to wind deposition of the same type of material so the material type is the same, the consistency is the same and the geologic --

MR. HINZE: We know there are perched water tables within the unit so there must be a difference in the permeability. That gives us a signal that there are variations. Right?

MR. BACHHUBER: Yeah, there can be. It varies locally. For instance, at our site in all three of our borings the loess looked remarkably similar. We had a hard time even picking out different strata. In other areas it's very obvious. You can see real nice layering. But even though it was very subtle there are some strata within the loess but they don't appear to be significantly different either permeability wise or geotechnical foundation property wise.

Now, a bigger contrast is between the loess materials here and the underlying alluvium.

DR. WALLIS: What is 2a?

MR. BACHHUBER: 2a is the slump deposits so this is in the Mississippi River bluff so this is a portrayal of the land slide materials.

DR. WALLIS: This is 2 which has moved.

MR. BACHHUBER: Correct. Yes. It's derived from 2 but it's been translated by the slumping movements.

DR. WALLIS: This map is derived from --

MR. BACHHUBER: This cross section?

DR. WALLIS: -- soundings or something?

MR. BACHHUBER: Yes. We developed this

cross section on the basis primarily of bore hole data so these vertical lines here --

DR. WALLIS: You have very few bore holes and you've got a lot of detail.

MR. BACHHUBER: Well, each of these is a boring. This is a series of CPT soundings.

DR. WALLIS: And then you fill in between them?

MR. BACHHUBER: Yes. Then we extrapolate between.

DR. WALLIS: Oh, okay.

MR. BACHHUBER: And what we also do -- could you go back one slide, please? So we are just looking at cross section B-B prime and the control for that cross section are the borings that are nearby the cross section line.

We also have all these other borings and by constructing a series of cross section lines we also look where the cross sections intercept to give us more control. We actually have brought in a lot more bore hole data than you see immediately on that cross section to control them.

Forward, please. Other units. So we discussed the upper loess. Underneath it the orange Unit 3 are old alluvial deposits of the Mississippi

River. They are Pleistocene in age.

DR. WALLIS: So if there were a salt dome at 200 feet or something somewhere off the map, would you know it was there or not?

MR. BACHHUBER: You would tend to see deformation but the salt domes are much deeper.

Jim do you recall?

MR. HENGESH: Like 400 feet.

CHAIRMAN POWERS: Microphone.

MR. HENGESH: This is Jim Hengesh. The salt domes, I believe, are around 400, 480 feet deep and the closest one is 8.5 miles from the site. It does not even fall in the five-mile site area.

MR. HINZE: Jim, have there been gravity surveys of the site which might help to elucidate the presence of salt domes and their structure?

MR. HENGESH: I'm not aware of any gravity surveys. There were geophysical surveys conducted for the --

MR. HINZE: The density of salt is 2.152150 and your surrounding materials are 2,500, something like that. This makes a good density distribution for gravity surveys. I know there's gravity data there. I have not seen it.

MR. BACHHUBER: Yeah, I think that is how a lot of the existing salt domes were mapped and then with control from borings and such.

MR. HENGESH: Right. And there have been a lot of regional investigations of these salt deposits. Obviously the petroleum industry is very interested in the distribution of the salt.

MR. HINZE: Really if you picked up some gravity data from the National Geophysical Data Center which would be almost of sufficient detail, you could tell very quickly where the nearest salt dome is.

MR. HENGESH: We do know that the nearest salt dome is 8.5 miles away.

MR. HINZE: That you know about.

MR. HENGESH: Yes. And that there is evidence for no salt domes closer than that.

DR. WALLIS: Are these gravity surveys routinely required by the NRC since they are a tool for figuring out what's there? Are they used or not?

MR. HINZE: I can't believe that one would not use a gravity survey both on a regional and a detailed basis in looking at the geotechnical aspects.

DR. WALLIS: Can we ask the staff if they know about this? There seems to be a lot of consultation among the staff.

MR. BACHHUBER: Yeah, it's typical to have regional gravity maps. As part of our initial data compilation we compiled all the existing information. I know for the existing salt dome maps they relied heavily on the current higher resolution type gravity surveys. We didn't have any specifically performed for the site so we relied on what was existing.

DR. WALLIS: Does the staff look at gravity surveys?

MR. LI: We did not look at any -- acquire any gravity data in this particular ESP process here, review process.

CHAIRMAN POWERS: That begs the question. The question is why didn't you ask for the gravity surveys?

MR. LI: Sorry. My name is Yong Li. I'm from the Division of Engineering. The reason why we did not acquire the gravity data because the applicant did a lot of the boring data and also included some refraction data. We have a good understanding of the subsurface condition.

DR. WALLIS: Down to a certain depth.

MR. HENGESH: This is Jim Hengesh. They are in the process of reviewing the geophysical, the geological, and the seismological data for the site. We went through a screening process that involved the detailed review of the existing information. As we moved closer and closer to the site, we looked in greater detail at that information.

In this area we're in the northern salt basin and there are extensive publications on the salt deposits in this area. The locations of the salt domes are well known on a regional basis. Again, the closest one that is mapped and included in the published literature is the Galloway Dome which is 8.5 miles from the site.

MR. ROSEN: I'd like to come back to what we know about it. This map, Section B-B, does not really give me a lot of confidence. That western edge of this triangle that would be left after the full maximum foundation excavation had been completed would be stable. Now, it seems like you've pushed this site all the way as far west as you possibly could leaving almost a sliver of ground left. Why would you do that? What gives you confidence that's enough to restrain the foundation and not cause -- because of the pressure of the foundation cause more pressure on the bluff?

MR. BACHHUBER: Well, the foundation elevations in order to achieve the bearing capacity and the shear rate of velocity required for stability of the foundation, they will be at least this deep and possibly this deep. Even at the shallowest depth if you project it, it's below the toe of the bluff.

Even if we completely lost this bluff, it wouldn't influence the stability of the foundation. It would have some potential implications for soil structure interaction and that has been discussed previous in some of our responses to RAIs. That would need to be specifically looked at.

If the plant is pushed to this outer edge, then for site response SSI type analysis, additional borings and characterization is required here. But for plant stability we were comfortable pushing it to this point because we are well below any influence from future slumping with respect to potentially destablizing the foundation.

MR. ROSEN: That's if the bluff stays where it is now but over the next 60, 70 years it's hard to predict what the bluff will do.

MR. BACHHUBER: One thing also you have to keep in mind is this is exaggerated four times so the actual one-to-one cross section, this is much less steep than it looks here. It would actually be more flat something like this here. Do we have those loaded up, George?

MR. ROSEN: That might be helpful because just looking at this you get the impression that I have. I must admit I haven't done the calculations and wouldn't know how to do them but it looks like just from a layman's point of view a rather --

MR. BACHHUBER: We also looked -- we do have some boring control here, right here, where we looked at the strength of these materials. Also our foundation requirements forced us to go a certain depth. Once we got into those deposits they are dense and stable.

Even if you had a retreat of this bluff in the future, let's say something like this, again, our foundation bearing zone is down here so it's not affected. What you may have is some cracking coming up towards the wall of the structure on the ground surface but it wouldn't, again, affect the stability of the foundation.

MR. ROSEN: You would know about it because you would lose your cafeteria and you wouldn't be able to eat lunch.

MR. BACHHUBER: You would have a warning, yeah. Also, another thing that factored in here is looking at the amount of retreat that has occurred during the past slumping event. A typical single event retreat would be on the order of 20 feet, 30 feet or so just based on how far they work back into the existing bluff.

This zone of 150 feet provides a very substantial warning period. It would take a number of slumps or a real significant retrogressive type failure to work back to the facility which would give you time to address it, to take a look at the situation and do any kind of measures you may need to. Again, that would just be influencing superficial nonsafety related type structures.

Other units, I haven't completed my profile yet. So we have the upper loess. We have No. 3, or the old alluvial deposits from the former extent of the Mississippi River. Below those here in 4 these are very old alluvial deposits. Again, likely from the Mississippi River but these are Pliocene to Pleistocene in age so very old type deposits.

Even deeper yet, which we don't have on this cross section because their borings didn't extend to it, but on other cross sections with deeper borings we had what we called the Catahoula claystone which is a semi-indurated material, a very weak soft rock type material. That's our basic section underneath the site. To the west we also have the Mississippi Valley alluvium but that doesn't come into play because they don't extend underneath the site.

MR. ZINKE: I know timing wise there is a lot that can be talked about in the seismic area. I'm not sure how best you want to use the time.

CHAIRMAN POWERS: What I'm going to do we are going to get -- we are going to struggle through this. Once we've gotten to slide 36 we are going to take a break and then we'll map out strategies after that. The difficulty is this. If we don't ask these questions now, they get asked in the full Committee and our time constraints there are much, much worse.

DR. WALLIS: It looks to me as if the applicant is going to take the whole morning for this presentation.

CHAIRMAN POWERS: We'll develop a strategy on that.

DR. WALLIS: There's no problem with going into the afternoon.

CHAIRMAN POWERS: No, there is no constraint on us.

DR. WALLIS: I don't quite understand why the schedule says we are going to finish this morning.

CHAIRMAN POWERS: Because we had no further information. You see, we did what the applicant is doing. We took our annual -- our previous exercise and developed the schedule from this. You can see how bad of an idea that is projecting the future from the past. We'll let you go ahead. The problem, of course, you face is the USGS is unconstrained by the past.

MR. BACHHUBER: Okay. I have two more slides, I think, in my eight-minute allotment. Okay. This is, again, a summary of the site stratigraphy, the upper loess, upper complex alluvium. This is Pleistocene Mississippi River old alluvium. The older bold alluvium, which is the Pleistocene. Here is a Catahoula claystone.

On the left here I'm showing the profile of shear wave velocity so this is from our bore hole velocity surveys and they extended comparable to the deepest boring about 240 feet deep. I have overlaid the data from the three borings together here so we can look at the variability of shear wave velocity from the three points that we explored across the site.

The left hand series you can see a blue line, red line, and black line. These are all the shear wave velocity profiles laid on top of each other. What we have here on this scale here is velocity in thousands -- yeah, thousand feet per second so here is thousand, 2,000, 3,000, 4,000, 5,000, 6,000, 7,000, 8,000 feet per second.

On this ornate I have on the left depth zero feet to 240 feet. You can see how the velocity is changing with depth. The surveys we use give you almost a continuous profile of velocity. Actually, it's sampled about every three feet through the bore hole so you get a nice continuous survey of the velocity.

Looking at the left hand column which is shear wave velocity, and then on the right hand side these are compressive wave velocities. They have a kick-out right here. By superimposing them you can see they all cluster pretty close together. There is some variability, for instance, right here. You can see one of the surveys has given you a much higher velocity than over here.

On average they are lining up pretty well. This is actually astounding. I have never had such good replication between bore holes at a site. The stratigraphy in the uniformity of materials within each of the main stratigraphic units is pretty good, pretty uniform under the site. This kick-out here, compressive wave velocity, is caused by the groundwater table.

As soon as we hit the groundwater table our compressive wave velocities are increasing but not the shear wave velocities. It's almost transparent the water to the shear waves. So we use this information here then to compile our site velocity survey for the ground motion analysis.

A couple of other things we did here is we looked at these profiles to select where we wanted to submit samples. Here is an example of how we selected samples, at what depths and why. Here we are showing where the samples were taken that we had processed for the dynamic properties analysis at the University of Texas. We have some here corresponding to the deeper old alluvium, some up here in the alluvium, and some up here in the loess. We have properties from each of these materials.

Next slide. Could you hit it again. Okay. Then to develop our final velocity profile we combine the data from the lab testing with our velocity survey prints, velocity profiles, and took an average. This was picked by a couple of different processes. We had two different groups do this independently to come up with their referred average velocity profiles. Then we combined the two to select the final one that was carried forth in the analysis.

What I'm showing here is the portion of the velocity profile in the loess deposit so from zero to about 75 feet deep. Then the corresponding test results. What I'm showing here I know is too small to red but it's just an example. The upper plot is shear modules reduction and lower plot is a plot of damping. These are standardized curves that have been developed by EPRI for stand type materials.

We took our actual test data overprinted them on the EPRI curves to select the final curve that we used for the analysis. What we found is at the site the materials are very consolidated. They are all Pleistocene or older and because of their geologic age they have had time to consolidate. Because of that they actually are quite dense.

For instance, for the loess what we found from our test data is that it would actually correspond to the EPRI curve for soils that are between 125 and 250 feet deep even though they extend from zero to 75 feet. We are seeing that aging effect. In order to appropriately model these materials in the response analysis, we have selected this EPRI curve.

Could you hit the next button? We did the same process -- we skipped one. Okay. For the alluvium we took our velocity survey for the interval that we encountered the alluvium and matched it to the lab test results. Again, for the depth range of the alluvium 75 to about 150 feet we actually were corresponding to the EPRI curves 250 to 500 feet deep.

The last button. Here is where the old alluvium and Catahoula formation. This was a fundamental input that was put into the site response analysis that Marty will be presenting. That's my last slide. Let's check. The conclusion slide. I can't forget this.

Okay. So in conclusion from our site geologic and geotechnical characterization we found positive evidence for no significant geologic hazards. We say that because the geologic deposits of strata we were able to trace continuously and undisrupted underneath the site.

We didn't see any geomorphic evidence of past subsidence, vaulting, other type liquefaction. We looked at the bore hole data and looked at the standard penetration test data, the shear wave velocities, plus the age of the deposits with respect to the potential for liquefaction. Really even just because of the age of the deposits of Pleistocene and older we believe that the liquefaction hazard is low. Over 90 percent of historic liquefaction has occurred in Pliocene deposits or artificial fill placed over Pliocene deposits. Ours are old consolidated sediments.

In order to achieve foundation capacity, bearing capacity and velocity that will be required for plant design, we will have to extend foundations below the upper loess which is less dense material and into at least the Pleistocene alluvium, possibly into the Pliocene Pleistocene deeper alluvium.

Now, the deeper alluvium is coincident with what was used for the existing plant site so that would be an equivalent type of -- an equivalent strata to the existing plant which has had very good performance. The existing plant site in similar materials here has shown no evidence of settlement or any kind of adverse performance.

Groundwater. The foundations to get the depths we need for the capacity they will extend below the groundwater table. Groundwater dewatering/control procedures will be required during excavation. They will be similar to what was used for the existing plant site that also was extended below the groundwater table so typical construction procedures with subpumps, maybe some predrains would be expected to develop the ESP site.

With that, I am going to turn the pointer over to Jim Hengesh who will take us through the source characterization.

CHAIRMAN POWERS: No, we're going to stop and we are going to take a break until 5 minutes until 11:00.

(Whereupon, at 10:41 a.m. off the record until 10:57 a.m.)

CHAIRMAN POWERS: Let's come back into session. What I would like to do is devote no more than the next 35 or 40 minutes to the applicant's presentation. I would like to get quickly through the seismic analyses and get onto the issues where there are additional information being requested by the staff and contentions.

I have assured the speakers that the Committee as a whole is very aware of the probabilistic seismic hazard assessment. Individual members have questions about that. We do have an expert on the Committee who would be glad to instruct you in the details of that methodology. Were he here, he would undoubtedly want to interrogate the speakers in some depth with that so they can appreciate his absence. With that, I'll turn it back to you, George.

MR. ZINKE: Jim.

MR. HENGESH: Great. My name is Jim Hengesh. I'll be talking about the green part of the flow chart where we develop the information about the seismic source characterization which is used as input to the probabilistic seismic hazard assessment.

Next slide, please. Developing the seismic source characterization we followed the guidance provided in NRC Regulatory Guide 1.165. In accordance with that guidance we adopted the EPRI 1986 methodology to develop the safe shutdown earthquake ground motion for the ESP site.

Next slide. In this process we went through a thorough review compilation and reviewed the geological, seismological and geophysical data for the area within about 200 miles of the Grand Gulf site. We then also evaluated an area to the north that includes New Madrid Seismic Zone. That actually extends up close to 400 miles from this site.

In the course of updating this information on the seismic characteristics and ground motion characteristics, we identified three changes that we would have to make to the EPRI source model and the EPRI methodology. Those included adding new characteristic earthquakes for the New Madrid Seismic Zone.

We identified a new seismic source referred to as the Saline River seismic source. We added that to the model. We added new ground motion continuation models that were developed during the EPRI 2003 ground motion study.

Next slide. Just quickly, the Grand Gulf site is located here in west central Mississippi. This is the 200-mile radius around the site and a blow-up of the site over here with a 25-mile radius and a five-mile radius. Again, we are on left edge of the Loess Hills province here and the Mississippi alluvial valley.

Next slide. This is a geologic map of the site region in the Mississippi alluvial valley. What it shows is that this area has had a tremendously long history of stability and geologic development. These deposits you see around the edges of the valley southward toward the Gulf at very low dips of like a half a degree to one degree. The extend back to Cretaceous and Jurassic time period, a 100 million years, 200 million years. The Grand Gulf site is right here and I'll show you this north/south cross section through the site vicinity.

This is the north/south cross section going down past the site here. This is exaggerated, nearly vertically exaggeration 20 times. It looks like there is a fairly good dip here that has been exaggerated to be able to depict this stratigraphy.

What we see and what is really important here is that we have a lot of data going across this part of the Gulf Coastal Plain and the information from all of these borings show that for the Grand Gulf side, which is located about here on the section, we have upwards of 10,000 feet of undisturbed sediments so we have a long history of geologic stability in this area and a lot of information that provides positive evidence for no faulting and no deformation in the site vicinity. Next slide.

MR. HINZE: Jim, I noticed that your cross section, I assume is controlled by your well level control. You are about 30 miles away from the Grand Gulf site. How would that profile change if that were drawn north/south through the Grand Gulf site?

MR. HENGESH: It would change very little actually because we are very close to the center -- let me back up two slides. We are very close to the center of the Mississippi alluvial valley here. In fact, this line coming down through here shows that the axis of this syncline.

We are over here fairly close to the axis of that syncline and our site is there almost on the axis. I suppose there might be some subtle changes in the dip. But in terms of the gross stratigraphy and the continuity of the deposits I would say would be very, very similar.

MR. HINZE: So the structures would be much the same for localized things like the Jackson Dome and the salt domes?

MR. HENGESH: That's correct. As you mention the salt domes, I would just like to correct one comment I made during the previous session. The closest salt dome to the site is referred to as the Bruinsburg Dome and it is actually 6.5 miles, not 8.5 miles.

So if we could go back then. This is a compilation map that shows the major structures in the site region. The area outlined here is the edge of the Gulf Coastal Plain. This is divided into two main structural areas, in the north the Mississippi Embayment and then in the south the Gulf Coast Basin.

The main structural tectonic features include the Realfoot Rift up here in the Mississippi Embayment and the New Madrid Seismic Zone, the

Ouachita Orogenic Belt which goes up into the Appalachian Mountains over here. Two inactive fault zones, the Southern Arkansas Fault Zone and the Pickens Gilbertown Fault Zone.

And then the area of active growth faults are the Gulf margin normal faults down along the Gulf Coast. Again, this is the axis of the Mississippi Embayment syncline structure. It's not a tectonic structure. Just say a growth structure. Next slide, please.

MR. ROSEN: Excuse me. What did you just refer to was not a tectonic structure?

MR. HENGESH: The actual syncline. Within the Gulf Coastal Plain and the Mississippi Embayment the deposits here on the west side dip very gently about a half a degree to a degree towards this axis here. On the east side they did dip very gently in this direction.

This is a crustal down-warping that is due to sediment loading within the Gulf Coast area, within the Mississippi area. There is so much sediment that's been dumped in here over such a long period of time that it has actually depressed the crust.

MR. ROSEN: Is that what's been causing the Gulf Margin Normal Faults as well?

MR. HENGESH: This would be in terms of sediment loading, yes, it is. These faults are forming because they are right on the active delta front so there's nothing holding those sediments back. They are pushing very young loose sediments out in to the Gulf. As the front of that delta collapses you get gravitational almost like mega landslides. That's really what these structures are.

This map shows the distribution of those same major tectonic features, Reelfoot Rift. We have lots of those in the Gulf Margin Normal Fault. Here's our site, 100-mile, 200-mile radius circles, and the historical seismicity that has occurred within this part of the United States. The blue at the centers are events recorded between 1627, obviously historical reports, and 1984, and then the reddish color epicenters are 1985 to 2004 seismicity.

We compared those two different seismicity data sets to see if there had been a change in the seismicity rates or locations of our plates from the original EPRI study to the current situation. We see really no noticeable change. One of the really important things to point out here is that within 100 miles radius of the Grand Gulf site there have only been three earthquakes recorded in the fire circle so it's a very, very quiet, seismically quiet region.

MR. ROSEN: The closest one being?

MR. HENGESH: Vicksburg, I guess, 25, 30 miles away. One near Jackson and one out here in the western edge of the 100-mile radius.

Next slide. So based on our review of all that data, we updated the seismic source model for the site. We evaluated the geometry of seismic sources, faults and aerial sources in the region. We evaluated the maximum earthquake magnitudes and earthquake recurrence intervals and developed or updated the EPRI seismic source model to -- I'm sorry. We developed the seismic source model for our site that included the 200-mile radius circle plus the New Madrid Seismic Zone so standing up over 350 miles to the north.

Next slide. What we found in the review of all of this information is that the EPRI source model is acceptable for most of the region that we considered with a couple of exceptions. We added a characteristic earthquake model for the New Madrid seismic zone. We added the New Saline River and we've replaced the ground motion continuation model.

Next slide. This map shows the Grand Gulf site and the location of the New Madrid Seismic sources. This is the area affected by the 1811, 1812 earthquake sequence. We've named our three main fault segments up here, Blytheville Arch, Reelfoot Rift, and the East Prairie Fault. To pick our distances we took the closest approach for each of these fault segments and included those closest approaches in our source model.

These lineaments here represent the locations of the Saline River source that we included in the model. In characterizing these sources we used the logic tree type of approach. Next slide, please.

MR. ROSEN: Can I ask a question?

MR. HENGESH: Sure.

MR. ROSEN: When you said you identified the closest approach of the New Madrid Zone, how do you know that was the closest approach?

MR. HENGESH: There has been a lot of detailed geological and geophysical work done up in this area to constrain the locations of possible structures that produce those earthquakes in the subsurface. The Blytheville Arch is a recognizable structure based on geophysical data in the subsurface. This would be the southern most extent and a conservative interpretation of the extent of that.

So by taking the closest approaches as the distance measured to the site, it actually is a conservative approach. An alternative would be to let that earthquake float anywhere along that line which means it could also occur and we could have taken the point up here. To be conservative we put that earthquake at the closest possible approach.

MR. HINZE: Jim, a couple of questions. Some of the things that have happened since the EPRI study are kind of interesting and one is certainly the much greater acceptance of far-field triggering as a result of landers earthquake, etc. In your evaluation did you consider at all far-field triggering?

MR. HENGESH: We didn't because the type of model that we included. By developing a characteristic earthquake, it means we are saying that an event on that southern part on any one of those three points will occur within a certain time period. There are a lot of data now.

There is a lot of Paleoseismic data that have been developed that show a repeat of 1811, 1812 type earthquakes going back several cycles. When we look at that record of earthquakes, we see that there is a range between 300 and 900 years roughly.

MR. HINZE: I understand but the 1811, 1812 earthquakes, my understanding is that they have -- that the most recent evidence indicates that they may have triggered earthquakes elsewhere in the midcontinent region. Is that correct? The evidence is just starting to come in but is there any evidence that bears on that?

MR. HENGESH: No. I'm sorry, I don't have any information on that.

MR. HINZE: Let me ask another question then. I know when we did the EPRI study I wish we would have had the Saline River Seismic Zone as part of our bag of tools. But I'm curious, that's a strange lineament. That's a strange strike to the lineament.

It doesn't seem to be unless we're totally off in what the Quachita looks like underneath the Mississippi Embayment, the strength direction of the lineaments do not correlate with preexisting faults in the area. In your analysis of this is there any control upon that strike of the lineaments and the occurrence of earthquakes, for example, along the Saline River up there at the northern end?

MR. HENGESH: Right.

MR. HINZE: You know where I'm going.

MR. HENGESH: Yes, I do. I think the first point I would make is that these are quite generalized lineaments so they are generalized locations where those features are. But they do --

MR. HINZE: Excuse me but you can't move those very far. You can move those lineaments very far. Right?

MR. HENGESH: Right. They coincide with the Arkansas River, the Saline River, and the Quachita River. They generally follow those trends.

MR. HINZE: Right.

MR. HENGESH: That is the orientation that they have. I speculate that they may be actually related to extensions of Reelfoot Rift beneath the Quachita and they could be analogous to Reelfoot Fault type of trending structures.

MR. HINZE: That's a cross fault in the Reelfoot.

MR. HENGESH: But we don't know what is driving this and the research is still ongoing and probably will be for some time.

MR. HINZE: So those could be much longer than actually indicated there because we don't have any control on them. Is that right?

MR. HENGESH: No. I don't believe that the geomorphic evidence would support extending them beyond where they go. We believe that this is a conservative interpretation of the extent of where those features could go.

MR. HINZE: It's kind of interesting that the liquefaction areas are at the extreme ends. How do you place any credence on that?

MR. HENGESH: That is where they are and the work is ongoing to look elsewhere. I suspect that researchers will continue to work out here in this area between the 1811, 1812 liquefaction field and this area down here will -- my guess is that there probably are more liquefaction fields up there.

MR. ROSEN: I'm not sure I understood the discussion between you two gentleman that just concluded. But what I took away from it was that this Quachita River lineament does not extend any further southeast than is shown on this map because if you just extend it, it goes apparently right through the Grand Gulf site.

MR. HENGESH: I think another constraint that we have is actually the edge of the rifted North American continental margin. We would have to go back 200 million years when South America and North America had collided and were intact and formed the belt here.

Then those continents drifted apart and as they drifted apart they basically removed what I think is the driving mechanism for these structures which is the extension of the Reelfoot Rift down to this point. I think the transition of the crust from the North American trade to this transitional area would serve as a termination point to those structures.

Next slide. So in developing our source model, we used the logic tree approach to try to capture the epistemic uncertainty in the parameters that we used for input to the probabilistic seismic hazard assessment. This figure is a graphical illustration of how we look at a range of magnitudes and alternative scenarios for occurrence earthquakes and a range of earthquake recurrence intervals for this site so in developing our source characterization we did look at the epistemic uncertainty and treated that in the development of the ground motion for the site.

MR. HINZE: While you have the logic tree on there, I note that you've given a 50 percent probability to the Saline River features whatever they are. Who gave it that number and what is the background for it not being smaller or larger?

MR. HENGESH: We talked to a number of researchers who were working in that area. We looked at the data that had been developed. In particular the paleo liquefaction data. When you compare the dates of paleo liquefaction events for Saline River they overlap in every event with possible 1811, 1812 type of earthquakes so there is a chance that all of those liquefaction features are related to New Madrid earthquakes.

MR. HINZE: So the deformation that we also see includes extended of the quaternary. Then those two are caused by liquefaction or are they caused by something else? You understand where I'm going?

MR. HENGESH: Yes, I do. There is a 50 percent probability that these features are tectonic and a 50 percent probability that they are related to the Madrid. The tectonic features are permissive of quaternary deformation but really are not conclusive. There are alternative interpretations that can be made for those features out there.

MR. HINZE: Is there any thrusting, Jim? Is there any thrusting? Any indication of thrusting? That's the kind of movement we see on the rift with a similar direction and stress field.

MR. HENGESH: There is one fold that has been identified. Cox and Van Arsdale also identified normal faults and what they think may be strike slip faults. Again, there's not a lot of certainty in the type of mechanism that is occurring out there. We need some more studies.

MR. HINZE: Excuse me. One more question. Has anyone done any shallow seismic reflection across any of those?

MR. HENGESH: Yes, they have.

MR. HINZE: And that's available to you?

MR. HENGESH: Yes, it is. We involved both Dr. Van Arsdale and Dr. Cox in our assessment of this feature.

With that I'll hand it over to Marty.

MR. McCANN: Okay. I'm Marty McCann and I'm going to talk about the last few steps in the process in taking the input from the seismic source characterization and the site geologic investigation and basically the computational activities in ultimately generating the SSE ground motion.

As Jim mentioned, the ground motion models were updated by means of a SSHAC Level III process. The EPRI software was updated to incorporate these new models and to incorporate the capability to model characteristic recurrence models which the code did not originally have when it was developed in the mid '80s.

Next slide. This little diagram shows you the basic steps in performing a probabilistic seismic hazard analysis. I won't go through those in detail. They are fairly standard and we have been using the basic steps for decades, in cartoon form, anyway. I really hasn't changed over the last few decades.

This is one example of the results for the site. The probabilistic hazard calculations were performed for seven ground motion frequencies spanning the frequency range of interest. This happens to be the results for spectral acceleration at 5 hertz. All of the results were computed for rock site conditions. At the Grand Gulf site because it is not a rock site, we needed to translate that motion to account for the local side effects in the soil response.

The results incorporate all of the epistemic uncertainties in the process and, thus, we have a family of hazard curves the red being the earth medic mean and the various fractile curves giving us a sense of the aggregate epistemic uncertainty in all of the parts of the process source characterization and ground motion in particular.

Next slide. As part of the process for developing the SSE ground motion, the regulatory guide recommends that the seismic hazard be deaggregated such that we can see the contribution of earthquakes of varying magnitude and of varying distance to the hazard. The SSE ground motion is developed using the median fractile hazard curve in each magnitude distance bin so you see the bins that were used listed here for distance and over here for magnitude.

Grand Gulf is somewhat unique in that we have a substantial contribution from the New Madrid sources despite their distance from the site. For other sites in the east where we do not have a Charleston or a New Madrid type source, we typically see the contribution in this corner of somewhat lower magnitudes and shorter distances but Grand Gulf is unique in that we get a contribution from the very distance New Madrid earthquakes.

There is a number of reasons for this. One is the rate of seismicity in New Madrid is substantially higher than it is in the local vicinity of the Grand Gulf site and the earthquakes are significantly larger that can occur there. That combination gives us a much higher contribution from these events.

Next slide. As part of the process and one of the uses of the deaggregated hazard results, we want to compute what the average size earthquake at what average distance of those events are contributing to the ground motions at a median 10 to the -5 annual probability of exceedence level. The procedures suggest that you do it in two frequencies bands, one to 2.5 hertz and 5 to 10 hertz. You calculate what is called the controlling earthquake, thus the subsea.

Because it was known that distance earthquakes may contribute substantially and, thus, give you this bimodal distribution look, we do the 1 to 2.5 hertz contribution at two distances considering all the distances in the hazard, and then secondly for distances greater than 100 kilometers to see if there is any difference in what the controlling earthquakes would be.

We have fairly large events over 6.5, nearly 7 or greater in terms of the average earthquake that is causing ground motions at the median 10 to the -5 level. And the distances are somewhat substantial contributing substantially from the very distant New Madrid events. Again, that's not quite the normal pattern. We would just tend to see distances being somewhat closer to the spike than we see here.

We use this information to then develop response spectra for earthquakes of these representative magnitudes. We use those as inputs to the site response analysis.

Next slide. The solid line here is the median 10 to the -5 response vector of the uniform hazard response spectra with an annual median probability of 10 to the -5 per year. We then develop for the controlling earthquakes in the various frequency bands representative earthquakes for those size events at those distances.

One is anchored at the average spectra acceleration between 1 and 2.5 hertz and the other is anchored at the average spectral acceleration between 5 and 10 hertz. These spectra are then used to drive the soil column to evaluate the site response to ultimately get the surface site motion.

Next slide. This is a schematic of what we're doing on the right hand side. We have rock motion coming from the probabilistic seismic hazard analysis. We have from the site geotechnical investigation a soil profile and we perform a site response analysis to determine the motion at the top of the soil.

What you see on the left hand side is the calculated mean amplification. The solid line here gives you the envelope. The two dashed and dotted lines give you the mean amplification that is calculated for the two different driving earthquakes, one average to the 1 to 2.5 spectral acceleration, the other to the average spectral acceleration between 5 and 10 hertz.

You can see right here being no amplification. For the most part over the frequency range there is considerable amplification of ground motions that occurs at the site. Over here at 100 hertz this being 1 and that being a factor of 2 we have considerable amplification of the p crown acceleration which is often quoted as an SSE number.

Next slide, please. This gives us the result with some comparisons. The red solid line here is the result of the probabilistic seismic hazard rock calculations incorporating now the site soil response. That would be the 10 to the -5 SSE ground motion referred to here as the probabilistic ESP SSE.

The solid blue line is the deterministically determined SSE ground motion for the existing unit. Then the solid black line just for reference is a regulatory guide 1.60 response spectrum anchored to the standard plant SSE PGA of .3(g) just to give you a sense of where this site falls relative to a standard plant design. That's the final slide.

MR. ZINKE: Moving on back to nonseismic things, emergency planning. The regulation was that we had to show no major impediments. Additionally we chose an option in the regulation of major features that in implementation turned out to be something different than what we expected.

Since Grand Gulf is supported by an existing operational emergency plan we took advantage of that to the extent that we could or felt it was reasonable to do at the early site permit stage. Same way as far as various on-site and off-site plans, we took advantage to the amount that we felt was appropriate for us at the Early Site Permit stage and that was incorporated into the application.

We have 23 open items in the DSER. Responses are due June 21st. I have attached the matrix of what the items are. The status of them right now is that we have had conference calls with the staff and discussed general approach of how we are intending to respond to them. Within our organization those responses are still being prepared and have not been technically reviewed. Even though we can probably talk to some of them, we haven't made final decisions on the actual responses.

CHAIRMAN POWERS: Just looking at them, you have either said, "We're going to do it," or, "We are going to ship it to COL."

MR. ZINKE: Right.

CHAIRMAN POWERS: Since it comes up a lot, let's talk just a little bit about the snow loading and the maximum weather precipitation issue. Basically you say you're going to do this. I don't think you believe it.

MR. ZINKE: On the maximum precipitation some of the things that we discussed internally and discussed with the staff was that the local PMP is dependent upon final grades and a lot of design specific things that we feel gets done at the COL and that although we could do some things and make some guesses now, that relative to local PMP it's work that has to be done anyway. That's basically the issue we struggled with on the PMP.

The snow load, Al, do you want to talk kind of what the issue has been on the snow load?

MR. SCHNEIDER: Well, I guess, as staff pointed out, we had to provide the maximum winter precipitation added to the 100-year snowpack. We had provided some similar type information in the SSAR. We went back and looked at the data and using HMR 53, I guess, determined that the PMWD for the Grand Gulf area is like 35 inches but it's rainfall so it's not reflective of snow.

We looked at data from the weather stations around the site regarding snow. The conclusion is that what we have in the SSAR is representative. I think the maximum snowfall event in the area was recorded in Jackson about 10.5 inches of snow.

We also looked at ice events in the area. In Vicksburg there was an event. I forget the year, '99 or '98, where there was an inch and a quarter of ice recorded in Vicksburg. We took that number as providing the most conservative estimate of the 48-hour PMWP and decided that we would report that in the SSAR to be used with the 100-year snow pack.

CHAIRMAN POWERS: So you're going to go ahead and treat these as two independent events. That is, you've got a snow event and then you've got this ice storm which you receive on top of that.

MR. SCHNEIDER: The 100-year snow pack, I guess, is defined for this site by the AESCE 7-02 rounded to 5 pounds per square foot roof loading and that's a 50-year recurrence interval number so we use the multipliers to make it 100-year recurrence. We use that number in addition to the ice event which provided the most boating for the site that seemed credible for roof loading to add to the 100-year snow pack. We intend to revise the SSAR to reflect that type of data.

MR. ZINKE: That's the end of our presentation.

CHAIRMAN POWERS: Members have any questions? Seeing none, thank you, George. Do I turn to Raj?

MS. DUDES: We're going to transition right in. While they are setting up and doing their slides I guess I can make some opening comments. That was quite comprehensive with respect to seismic.

I'm Laura Dudes, the Section Chief for New Reactors. Raj Anand is the project manager for Grand Gulf and he will be making the presentation to you today with help from various staff members who are sitting here.

We presented our North Anna DSER to you, the Subcommittee and the full Committee, in March 2005. Just by way of information, we have drafted a response to the interim letter, your interim letter of March 16 which had some generic issues and concerns, that probably will be applicable to all ESP applications. Expect that response, I believe, May 31st, 2005. Staff has drafted the technical response and are now working it through management. I guess after the seismic discussion we had --

CHAIRMAN POWERS: Is that a threat?

MS. DUDES: Pardon me?

CHAIRMAN POWERS: Is that a treat or something?

MS. DUDES: What, getting the response?

CHAIRMAN POWERS: Yes.

MS. DUDES: Well, I don't know. You'll have to read it and tell me what you think. I know you'll tell me what you think.

CHAIRMAN POWERS: I'm sure they are wonderful comments and we will go along pleasantly with the advice from the Advisory Committee.

MS. DUDES: Yeah. And I think when you see the response, it is applicable to all the ESPs. I just wanted to make a note. I know we just went through an extensive discussion on the seismic issues associated with Grand Gulf. We received all three Early Site Permit applications in 2003.

We issued all three Draft Safety Evaluation Reports with the exception of the staff is still working on the review of a performance based seismic methodology for the Clinton site. It's just important to note that the performance based seismic methodology is not applicable to Grand Gulf and today's presentation.

With that, before Raj begins, let me just introduce to you our two other project mangers, turning slides Belkys Sosa for North Anna and --

CHAIRMAN POWERS: We hardly know her.

MS. DUDES: Yeah, I know. And our Senior Early Site Permit project manager and also the project manager for the Clinton site, John Segala, who is sitting here at the table. With that, Raj.

MR. ANAND: Thank you, Laura, very much. I am Raj Anand, the project manager for Grand Gulf Early Site Permit application. Let me get started. We are on slide 2. Our purpose here today is to brief the Subcommittee on the Grand Gulf Early Site Permit application and the staff review of that application and to support the Subcommittee review and subsequent Committee's interim letter that we are going to request that you sent it to the Commission. We do have technical staff reviewers here.

CHAIRMAN POWERS: Are we going to send an interim letter to the Commission? I mean, usually we send interim letters, I think, to the EDO.

MR. EL-ZEFTAWY: Yeah, that's what we did for North Anna.

CHAIRMAN POWERS: I mean, I'm sure the

Commission takes a look at it but ordinarily interim letters go to the EDO.

MR. ANAND: Thank you. We do have technical staff members here who can answer your questions. Slide 3, please. This is today's agenda. After hearing applicant's presentation, we have got a little bit smarter in the last couple of hours. I will spend less time on the issues that have been discussed by the applicant and more time on the issues that the Subcommittee would like to hear.

Slide 4, please. This slide discusses the regulatory framework which, or course, is Subpart A to 10 CFR Part 52 which governs ESP and Part 52 references Subpart B to 10 CFR Part 100 which contains the applicable citing criteria. 10 CFR 52.23 requires ACRS to report to the Commission on portions of the application that pertains to safety and that's the reason we are here today, sir. Grand Gulf is the third of the three ESP applications NRC is currently reviewing.

CHAIRMAN POWERS: Do I have Clinton?

MR. EL-ZEFTAWY: We have a portion of the draft DSER which is not complete yet. There's going to be another supplement to the DSER.

MR. ROSEN: I think the answer is no, you have not been given Clinton.

MS. DUDES: Well, Med, this is Laura Dudes. I mean, there is only one section missing from Clinton. I don't know if John wants to --

MR. SEGALA: We provided the ACRS copy of our Draft Safety Evaluation Report which includes everything but the supplemental on the performance based seismic approach. I think the intent was to wait until you received the supplemental before we have a Subcommittee meeting.

CHAIRMAN POWERS: I mean, I don't want to wait until the supplement comes out to look at it. I find that your documents are voluminous enough that additional time to read them doesn't hurt.

MR. SEGALA: Well, you have them, or Med has them.

MR. ANAND: North Anna and Clinton applications were submitted to NRC in September 2003 and the Grand Gulf application was submitted in October 2003.

Slide 5, please. System Energy Resources submitted ESP application by letter dated October 16, 2003. The NRC staff docketed the SERI application in November 2003. The NRC staff issued Draft Safety Evaluation Report with open items on April 7, 2005.

The staff also issued the draft environmental impact statement on April 21, 2005.

Slide 6, please. The purpose of the ESP process itself is to resolve issues separated from the design related issues at an early stage before a large expenditure of resources are invested. ESP holder can "bank" the site for 20 years for future use.

Slide 7, please. After the full Committee meeting which is scheduled on Thursday, June 2, 2005, we will be requesting ACRS interim letter to the EDO on the Draft Safety Evaluation Report by the end of June, 2005. The NRC staff plans to issue the final safety evaluation on Grand Gulf Early Site Permit on October 21, 2005. The staff will provide final Safety Evaluation Report to ACRS also in October 2005.

As the current schedule indicates, ACRS Subcommittee meeting for the final Safety Evaluation Report is scheduled on November 22, 2005 and full Committee meeting on December 8, 2005. Again, we will request NRC letter to EDO on the final Safety Evaluation Report sometime in December 2005.

The staff will incorporate ACRS letter and issue a final Safety Evaluation Report as a NUREG on January 28, 2006. There are mandatory hearings for the Early Site Permit applications. These hearings begin in 2006. There are --

CHAIRMAN POWERS: Are those hearings in the vicinity of -- to be held in the vicinity of the various --

MR. ANAND: The various sites. There are no contentions admitted in the SERI application. The uncontested hearing will begin upon the completion of the safety and environmental reviews.

Slide 8, please. Just to give you a few details of the Grand Gulf site and the applicant. The Grand Gulf ESP application was submitted for a site which is basically within the existing operating Grand Gulf Nuclear Station Unit 1. As the Committee heard from the applicant, SERI is the owner of the ESP site and SERI is also subsidiary of Entergy Corporation.

After the early site permit is received by SERI from the Commission, SERI has no plan to perform any activity on the ESP site. Therefore, the applicant has not submitted the redress plan.

Slide 9, please. SERI has requested their ESP site be approved for total nuclear generating capacity of up to 8600 MWt, with a max 4300 MWt per unit. SERI has declined to submit a specific design at this stage but the applicant has submitted a plan designed parameters that are representative that they intend to be bounding for these reactor designs such as advanced boiling water reactor, Westinghouse AP1000, or economic and simplified boiling water reactor.

DR. WALLIS: It's rather a small site if they are going to put a lot of pebble bed modules on it.

MR. ANAND: They haven't decided yet. They haven't come back to us. They might do it at the COL stage.

MR. ROSEN: Now, is it true that if they did decide on the multi-module site, as Dr. Wallis suggest, that all of those would have to be within the circle they showed us?

MR. ANAND: Right. That's my understanding. The staff is reviewing the applicant's planned parameter from the standpoint of whether they are reasonable or not.

DR. KRESS: What's your criteria for reasonable? Never mind. Go ahead.

CHAIRMAN POWERS: No. It's a legitimate question.

MR. ANAND: It is then applicant's burden to make sure that the plant's parameter site when they come in for a combined license application for the actual design that it fits within those parameters.

DR. WALLIS: It seems to me you could be very reasonable and wrong. I mean, my colleagues on the Committee are often like that.

CHAIRMAN POWERS: I can think of no occasion of where we have been reasonable and wrong.

MR. ANAND: Slide 10, please.

CHAIRMAN POWERS: Except in the area of thermal hydraulics.

MR. ANAND: The original Grand Gulf Site was designed for two units. The Unit 1 was licensed in June 1982. Construction of the second unit was halted prior to the completion. However, the switch yard for both the units was completed.

The ESP applicant plans to use the existing switchyard for the proposed ESP sites. The normal heat sink for the ESP unit is comprised of closed loop circulating water system, pumps, water basin and cooling towers. ESP application is considering use of the Mississippi River for intake and discharge structures. Applicant has requested an Early Site Permit for 20 years.

Slide 11, please.

DR. WALLIS: This normal heat sink is the ultimate heat sink?

MR. ANAND: No, it's different. I'll get back to that.

MR. ROSEN: See, that last statement you made confused me because we had quite a good discussion of the existing structure for normal water intake from the river.

MR. ANAND: Right.

MR. ROSEN: So what is the next to the last bullet mean, that they are considering use? That is the plan. Is it not?

MR. ANAND: That is the plan. I believe the applicant is considering the use --

MR. ROSEN: I wouldn't use considering. I would have used -- you mean they are planning to.

MR. ANAND: Yes, planning to. That's the right word, sir.

DR. WALLIS: Why else would you build a plant next to a major road?

MR. ANAND: Slide 11, please. This slide --

MR. ROSEN: And actually the river provides water to a subsurface lateral acquisition system. It's not a typical intake structure. We had a good discussion of that and that is what you mean.

MR. ANAND: Right. Slide 11. This slide is just a list of the review areas and the staff reviewers. Most of those staff reviewers are here to answer your questions in their areas of review. Before we leave the list of the areas and the reviewers here, I just wanted to mention that staff was benefitted a large number of expert input.

In hydrology we have had the support from the Pacific Northwest Lab and, in some cases, the lab did the independent evaluation of applicant's evaluation and conclusion. In geology and seismology the staff has benefitted from the support from the United States Geologic Survey and Brookhaven National Lab.

DR. WALLIS: Are you going to just mention that this was done or are we going to have any presentation about any of these items?

MR. ANAND: Yes. We are going to talk.

DR. WALLIS: Are you going to justify the open items, for instance?

MR. ANAND: Well, for the open items we are still talking with the applicants and providing clarification. If time permits, we can talk. In the emergency planning the staff consulted extensively with the Federal Emergency Management Agency, FEMA.

We had a large team involved in reviewing the ESP application.

Slide 12, please. This slide indicates the Grand Gulf site and environments. The small orange circle in the middle is the footprint of the proposed ESP site. The yellow circle is the proposed ESP exclusion area boundary. Dotted line shows the property boundary. I request Jay Lee to add something on the slide.

MR. LEE: Yeah. This is Jay Lee from the NRR. I just want to point out that the exclusion area boundary and the low population zones are typically measured from reactor or are in the center of a containment. That's true for the North Anna as well as Clinton site.

But in the case of the Grand Gulf Dr. Powers raised the question this morning earlier. I don't think I answered it correctly but actually the distance for the Grand Gulf case for the exclusion area boundary and the LPG is measured from that particular circumference of ESP facility footprint area that is 630 feet circular.

CHAIRMAN POWERS: So it's measured from the innercircle boundary to the edge of the low population zone and is two miles.

MR. LEE: Right. That's unique.

CHAIRMAN POWERS: Okay. You may want to look at the wording in the DSER because it confused me. That's why I raised the question. Ah, now I understand.

MR. LEE: So really in a case LPG distance is two miles plus 630 feet. In the case of exclusion area boundary that's the 2760 feet plus 630 feet.

CHAIRMAN POWERS: That makes the particular phrases if they were causing my conclusion make sense but you might want to look at that phraseology and see if you can help the poor reader a little bit. But it makes sense now.

MR. LEE: Okay. Thank you.

MR. ANAND: Thank you, Jay.

DR. WALLIS: Is someone going to address my colleague's question, Steve Rosen, about why it's okay to put this thing so close to the edge of a bluff?

MR. ANAND: May I request Goutam to come over?

MR. BAGCHI: That's a geotechnical issue but I did not -- the staff did not see any problem with the foundation load transfer causing any potential problem with slumping of the slope. We have

Dr. Carl Constantino who will probably respond to it better when it comes to open items. We can do it now.

MR. CONSTANTINO: I'm Carl Constantino. I'm a professor emeritus from City College of New York working with Brookhaven for more decades than I would like to say. That question came up as part of our review. Actually, the impetus for the setback came from our discussion of that topic.

The criteria that was mentioned here was based on the static criteria. Since the foundations are so low with respect to the bluff, materials so stiff as you would expect in the bluff, the issue of static characteristics is not a major player.

However, there is an issue still remaining and that has to do with the seismic response, the SSI response because now we have potentially a building located with a foundation at some depth with the difference in elevation of the site soils. None of the available plants have ever looked at that issue so that's a major -- what I consider a major problem because if you do look at that, then you have to go back and relook at all the detail design, the structural response.

That, if guess, is being put off to the COL stage so the whole issue of the bluff was evaluated and looked at and this issue is really the outstanding issue still remaining.

DR. WALLIS: So this is put off until you know more details about the actual buildings.

MR. CONSTANTINO: Where it's going to be located, the type of building, what was done for the design of that building.

MR. ROSEN: Now, it helps me a little bit to have seen the proper picture of the site. What we saw was exaggerated vertical scale. I was shown during the break a normal scale one to one. I think the one we're showing is four to one. The profile is actually quite a bit less severe. The issue as I understand what you're saying is that the New Madrid quake occurs and then you have slumping because you have some distance.

MR. CONSTANTINO: There are really two aspects. If you look at seismic response during the event I have a seismic design ground motion applied to the site and now the site has a discontinuity from one side to the other.

MR. ROSEN: What is that discontinuity?

MR. CONSTANTINO: It's on the Mississippi River side you have a low elevation and there is a 70-foot discontinuity.

MR. ROSEN: Okay, yes.

MR. CONSTANTINO: The 140-foot depth even though it's very deep there still is a significant difference on the dynamic response of the building so seismic loads are impacted by that. No reactor that I know of has ever looked at that problem so the standoff distance required for that may be significantly larger than 150 feet for long periods associated with the seismic response of the building.

That's one issue. The second issue is that if there is post-event slumping, then I have lateral additional loads which I don't normally account for in standard designs so that's another issue that has to be looked at. All of those, I think, have been put off until the COL stage so there are really two components, long-term and dynamic during the event.

MR. HINZE: There's even a more deterministic approach to this earlier in the game and that is to see if we can see if there is some origin for the slumps that have occurred and to see whether those geological, hydrological conditions are repeated or replicated in the site.

MR. ROSEN: Do we know when the slumps occurred? Were they in temporal context with the New

Madrid quakes in 1811 or was it well before that or after? When did they occur? Are they recent?

MR. HINZE: I think Jeff made a casual remark regarding those if I recall correctly.

MR. BACHHUBER: Actually, if I could make a couple statements.

CHAIRMAN POWERS: Come to a microphone and tell us who you are. Join the ACRS. Welcome.

MR. BACHHUBER: It feels good.

CHAIRMAN POWERS: It won't after a while.

MR. BACHHUBER: This is Jeff Bachhuber. With regards to the stability of the bluff, first off to prepare the site for the ESP foundations would require cutting down about 25 feet on the upper pad so the portion that encroaches near the top of the bluff is currently at an elevation of about 155 feet. It will be cut down to about 132 feet to form the plant grade so the elevation differential between the base of the bluff and the site now is reduced so we are looking at less of an elevation difference through that grading.

Another item is that at the end if the site is pushed towards that far end closest to the bluff and it does become an issue during our evaluation of the SSI, the site response, there are practical measures to stabilize the bluff so it's not an unusual condition that would require any kind of extra or unusual engineering approaches. Such type of bluff stabilization could be easily accounted for in the design. For instance, slope reinforcement, regrading. There are some measures that could be used to treat that.

MR. ROSEN: Well, my question about the bluff, when did those bluffs slump, has not been answered.

MR. BACHHUBER: Oh, I'm sorry. The bluffs we can't tell exactly the timing. We do see them on the topography so it looks like they were there prior to site construction. We definitely see them in the early topography maps used to prepare the grading plan for the site.

MR. ROSEN: Which was what year?

MR. BACHHUBER: That was -- I don't know, George. Could you help me on that?

MR. ZINKE: Early '70s.

MR. BACHHUBER: So the early '70s. We don't see evidence of continued movement so since grading and site development in the early '70s there's no indication of renewed cracking or enlargement of the head area of the landslides onto the pad.

Especially where the ESP is planned.

MR. ROSEN: The bluff is presumably there because it was eroded by the Mississippi. Is that why it's there?

MR. BACHHUBER: Yes. That's an erosional bluff from the river and slope.

MR. ROSEN: What we're seeing is a continuation of millions of years of history?

MR. BACHHUBER: Yeah. The age of the bluff, the deposits are Pleistocene so they are carved into the loess so it's on the order of maybe at least 10,000 years. Maybe back a million years old. Somewhere in that time frame.

MR. HINZE: One should be able to date those slides with any organic material that is caught up in them.

MR. BACHHUBER: It could be possible. We have done that using materials recovered from borings or trenches dating material underneath the failure plain that has been overrun by a slide to date it. That is something that could be done. If during COL it looks like that is something that would need to be resolved further, we could look at some ways to date.

MR. ROSEN: It seems to me we're talking about time frames of interest which are so short in the way we're thinking about things that one would have to anticipate slumping during the life of the facility. One couldn't make an argument, I don't think, out of hand that they won't slump during the life of the facility even without an earthquake event.

MR. BACHHUBER: That was the conservative assumption we used to establish the setback and also to look at the potential influence on the foundation stability is that it would occur in the future.

MR. ROSEN: It would occur during the life of the facility and the facility will be designed to withstand that without safety-related effects, effects on safety-related structures? Is that what I'm being told?

MR. BACHHUBER: Yes. And with the setback that has been shown on the plans of 150-foot setback, that provides an adequate buffer to account for even what we believe is a worse-case future slump type event.

MR. ROSEN: As big as the ones you see now?

MR. BACHHUBER: Even greater. The current slumps it looks like they have encroached into the bluff on the order of maybe 10 to 50 feet so we would assume in future events that would be a good guide for how far back it would retreat. Our 150-foot setback would account for several episodes of similar bluff retreat.

MR. HINZE: Has anyone made an investigation up and down the Loess Hills of slumps as a function of time? It would seem to me someone would want to be interested in that.

MR. BACHHUBER: I'm not aware of that. We didn't perform that work but it is possible.

MR. HINZE: That may be in the literature.

MR. LI: Can I add a little bit about this? My name is Yong Li from NRR. I think the University of Memphis and the staff member or graduate student did some research to try to correlate the issue between landslides from the bluff and the earthquakes. Also a USGS person, I think Randy Jipson, he did the correlation study between the landslides and on the bluff and the 1811 earthquake.

MR. ANAND: Okay. Now, I would like to talk about some of the ESP site features related to hydrology. The Grand Gulf ESP site is located on the east bank of the Mississippi River near River Mile 406 and approximately 25 miles south of the Vicksburg and six miles northwest of the Port Gibson, Mississippi.

The existing Grand Gulf Unit 1 is located

700 feet from the proposed ESP site. The ESP site had a grade elevation of 132 feet mean sea level. The makeup and the normal service water for the ESP facility would be supplied from the Mississippi River. The ultimate heat sink for the ESP facility will use a closed cooling water system, possibly mechanical draft cooling towers. The ESP ultimate heat sink will not rely on water intake from the Mississippi River.

The ESP facility will have a dedicated water storage basin to hold 30-day emergency cooling water. The staff independently verified that flood in the Mississippi River is not a threat to the site. The nearest bank of the Mississippi River is about 1.1 mile from the ESP site.

This location is on the top of the bluff which is about 65 feet above the normal river level. Therefore, the distance and the river bluff provides the protective feature for the ESP site. The staff consulted with Corps of Engineers and the staff independently verified that the ESP site is safe from flooding.

The NRC staff also concluded that low water elevation resulting from ice jam or other causes would not adversely affect safety of the ESP facility. In addition the application proposed at they will install several wells at the ESP site to meet the down-water demand.

Slide 14, please.

DR. WALLIS: Ice jams? You said ice jams?

MR. ANAND: Right.

DR. WALLIS: This is way up in Minnesota somewhere? You don't get ice jams in Mississippi.

MR. HINZE: I think you can get them down in Illinois. Can't you?

DR. WALLIS: You go down into Illinois?

MR. HINZE: Yes.

DR. WALLIS: That dries up the river? It must be pretty dramatic when the ice jam breaks.

MR. ANAND: Goutam, you want to say something?

MR. BAGCHI: Nothing is needed.

MR. ANAND: Slide 14, please. The proposed --

MR. HINZE: Before you move on, can you help me with this flood water elevation of 133.25 feet being sea level versus the 132.5 proposed grade level? Where did this 133.25 come from?

MR. ANAND: The ESP site has a grade elevation of 132.5 feet mean sea level.

MR. HINZE: Right. What is the maximum

flood level?

MR. CESARE: This is Guy Cesare. The flooding at the site is driven -- or when you consider it, you look for flooding of local rivers and streams and the staff has concluded as we did that flooding from the Mississippi river which is constrained by the highest levy structure is 103. Unit 1 site is at 132.5.

We are proposing that at this point that most likely the ESP site will be graded down formally to 132.5 roughly as well. But at 132.5 that is some 29 feet above the maximum Mississippi River flood level at 103 because that would top the levi. Virtually any reason that can cause the river to flood would not approach the 132.5.

The other driver for flood water levels and the need for flood protection is that of local intense participation which is PMP driven. The 133.25 foot elevation is a Unit 1 licensing basis calculation based on the early '80s calculation of the intense local PMP.

It is the result of pooling of water around the Unit 1 structures at that time and reaches an elevation of 133.25 and flooding protection was then required for all safety related structures that were exposed to that which was primarily the ultimate heat sink pump house, standby service water pump house.

MR. HINZE: Thank you. I appreciate it.

MR. ANAND: Slide 14, please. The proposed Grand Gulf ESP site is located in a relative low seismic region. Applicant has identified no active seismic fault within 90-mile radius from the location of the ESP site and no earthquake recorded within 25-miles radius. The Grand Gulf site is a deep soil site.

DR. WALLIS: No earthshaking at all? You must get some effects from earthquakes that are a long way away. Do you mean by no earthquake center or no seismograph ever recorded anything?

MR. LI: That has a time frame I think missing there. It's since 1777.

MR. HINZE: I think what it really means is no epicenter.

DR. WALLIS: No epicenter is what it should really be. The ground has shaken.

MR. ANAND: The applicant has used the regulatory guide 1.165 for identification and characterization of seismic sources and determination of the safe shutdown earthquake ground motion. The

Regulatory Guide 1.165 described matters acceptable to NRC staff for determination of SSE.

Slide 15. The applicant has extensively dwelled on the next slide and I will skip that slide. Slide 16.

DR. WALLIS: So there is a blue circle somewhere near the site. Vicksburg. There's been a quake at Vicksburg. What's this magnitude Mb? How does that compare with a Richter Scale.

MR. HINZE: That's a body wave.

DR. WALLIS: Body weight?

MR. HINZE: Body wave.

MR. LI: What's the question again?

MR. ROSEN: How does that compare to the Richter Scale?

MR. LI: The body wave? It's similar, yeah. Another scale we use currently is moment magnitude. It's very popular now and it's very accepted. I mean, used extensively in the hazard research of seismic status.

MR. ROSEN: So an NB of 5 to 7 is equivalent to a Richter of 5 to 7?

MR. LI: Yes. There's another scale called subsway manager. I think it's a different scale. There's many, many scales in terms of magnitude measure.

DR. WALLIS: I find it difficult to believe there are so many earthquakes in the 5 to 8 Richter Scale since '85 in Tennessee.

CHAIRMAN POWERS: It happens all the time.

DR. WALLIS: Not at that magnitude.

CHAIRMAN POWERS: You hardly even notice them.

DR. WALLIS: I know. When you get up to 8 you notice them.

CHAIRMAN POWERS: Well, 8 is three orders of magnitude larger roughly.

DR. WALLIS: Or 60 times or something per unit of Richter Scale.

DR. KRESS: That seems like a long, big range, 5 to 8.

DR. WALLIS: It doesn't tell you very much.

DR. KRESS: No. That's three orders of magnitude if it's equivalent to the Richter Scale.

MR. McCANN: This is Marty McCann. Maybe I'll add a little clarification. The Richter Scale that you're referring to is sort of the popular name, if you will, developed by Professor Richter in California. It's also referred to as a local body wave. It refers to the measurements that are taken of the seismic waves on a seismograph and there are various waves that are recorded.

MR. HINZE: And a very particular seismograph.

MR. McCANN: Exactly. Very particular seismograph in California at 100 kilometers. What we have found over time as we have gotten wiser seismologically, have more instruments, understand more about wave propagation, etc., that in the east we tend to record the body waves and Lg body waves in the east so you typically see mb or mbLg being recorded.

As time as gone on, what we have found is that all of those magnitude scales to varying degrees don't accurately represent, if you will, the energy that's in the earthquake. We have evolved to seismic moment and derived from that the moment in magnitude.

If you were to look at a plot comparing magnitude scales, what you would find is that the moment in magnitude scale gives you an unbiased measure over the magnitude scale of range, if you will. And the other magnitude scales, depending upon the part of the scale you're looking at, has some degree of bias.

In particular, with the larger magnitudes what you'll find is the local magnitude, the body wave magnitude will begin to saturate meaning while the earthquake is truly getting larger, the scale is not telling you that and it's saturating and just not going up. But the body wave mb and mbLg are typical of what we record in the east. But all of the work that's being done now is attempting to report earthquakes in catalogues in magnitude scale.

MR. ROSEN: Just to understand this a little better myself, we heard various reports about the quake that triggered the tsunami recently was a 9 or 9.1 or 2 or 3.

MR. McCANN: Right.

MR. ROSEN: Were there body wave measurements made of that?

MR. McCANN: There certainly were in the seismographs all around the world but that was a moment magnitude. I don't know what the body wave magnitude would have been for that but it certainly would have saturated and you wouldn't have got an accurate measurement so it would have been useless to report it.

MR. HINZE: Generally when you get above those magnitudes 5, 6 you start using the surface waves.

MR. McCANN: You get the surface wave and even that will begin to saturate as well, particularly at a 9 so they become noninformative in terms of the real size, the real energy that has been released.

DR. WALLIS: New Madrid is in Missouri?

MR. McCANN: Yes.

DR. WALLIS: Is it on this map?

MR. McCANN: Yes.

DR. WALLIS: Why isn't it a great big blue blob.

CHAIRMAN POWERS: It is a great big blob of dots.

DR. WALLIS: It doesn't seem to be distinguished from any of the other blue blobs.

MR. McCANN: Probably because there are so many.

DR. WALLIS: Can you measure more than just a great cataclysmic event compared to these other ones?

DR. KRESS: New Madrid is a fault.

CHAIRMAN POWERS: Professor Wallis, can I ask you where you're going with this?

DR. WALLIS: Well, I was trying to figure out what this tells me since we've jumped over this map.

CHAIRMAN POWERS: No, we went through it in some detail earlier while you were away.

DR. WALLIS: I wasn't here?

CHAIRMAN POWERS: That's right.

DR. WALLIS: I'm sorry.

MR. ANAND: Slide 16, please. After applicant's investigation and their seismic hazard analysis, the applicant presented their SSE as shown in the red curve which is based upon Regulatory Guide 1.165 approach. If a future reactor design or ESP site follows the Regulatory Guide 1.160 and anchors at peak ground acceleration at .3g, then the design response spectrum of the future reactor will look like as shown in the blue line curve.

CHAIRMAN POWERS: And you find what the applicant has done to be totally acceptable?

MR. ANAND: Yes, sir.

CHAIRMAN POWERS: Good.

MR. ANAND: I will skip the slide 17. We'll have --

CHAIRMAN POWERS: We understand that extremely well.

MR. ANAND: Thank you. Slide 19, please. Slide 18. First of all, regarding the emergency planning, SERI like other two Early Site Permit applicants elected to seek acceptance of "major features" of emergency plans as provided in 10 CFR 52.17.

The concept major feature is not defined in detail in the regulation so we have ended up having to deal with exactly what is a major feature and what finality does it provide to the applicant. The review guidance that we have used for review of the major features is in Supplement 2 to NUREG-0654. This is a NRC and FEMA joint document.

There has been some concern in the industry regarding the degree of the finality associated with the major feature because the applicant objective of the Early Site Permit is to achieve finality on as many features as it can. The staff can at the Early Site Permit stage review that information against the planning standards provided in Supplement 2 to NUREG-0654 and if the staff finds the description to be acceptable and conclude that major feature is acceptable, then the conclusion is final subject to the requirement of 10 CFR 52.

However, the staff can grant finality as to the overall description but the applicant need to address implementation details of the combined license application. We see that applicant can obtain limited finality with the major feature option. For example, notification is a major feature. However, at the COL stage the applicant needs to provide implementation as, for example, number and placement, power supplies, etc.

Slide 19, please. The NRC staff has identified 23 open items in the Draft Safety Evaluation Report. These open items are listed in your handouts as backup slides 25 through 33. Staff needs additional information from the applicant prior to developing the final Safety Evaluation Report.

The staff has started conference calls with the applicant to provide clarification on these open items. The responses to all the open items are due to staff by June 21, 2005. I respectfully submit to the Committee that we will discuss with you the open items and their resolution when we brief you on the final Safety Evaluation Report.

Slide 20, please. The Safety Evaluation Report that we published on April 7, 2005, contains open items. In those sections that contain open items we have not reached a conclusion regarding the accuracy of the information provided therein.

A number of other sections, however, there were no open items and we have reached some conclusions. For example, the applicant we believe has provided appropriate quality assurance measure equivalent to those in 10 CFR Part 50 Appendix B.

Site characteristics are such that adequate security plans and measures can be developed which is largely a function of both the topography and the amount of the land they have available. We believe the SERI has adequate site to support security measures.

Slide 21. Additional conclusions from individual sections. The applicant has established appropriate atmospheric dispersion characteristics to support design basis radiological calculations. Based on the applicant's use of the plant parameter and site characteristics, the staff concludes that the site meets the radiological dose consequences criteria in 10 CFR 50.34(a)(1).

Of course, when the actual design comes in at the combined license application, then we will need to compare these release characteristics to those that are assumed at the ESP stage.

CHAIRMAN POWERS: I mean, what the applicant has submitted, I think, any plan -- I look at this cross section of plans and I picked one that

I think is the worse and put it here on the site and I do my 50.34 analysis. The presumption that is being made by all is that when somebody comes in and decides to exercise this site permit that they are going to pick a plant that is no worse than those that have been considered at this point.

MR. ANAND: Right.

CHAIRMAN POWERS: Okay. So you really look at only if, in fact, what gets selected is worse than what was assumed. Right?

MR. ANAND: Yes.

CHAIRMAN POWERS: Okay. So presumably if somebody picks a plan that has the release characteristics that are bounded by the DSP there is no additional analysis done.

MR. ANAND: Yes, sir. Another conclusion is that the potential hazards associated with nearby transportation routes, industrial and military facilities pose no undue risk to the facility or nuclear power plants that might be considered at the ESP site.

CHAIRMAN POWERS: In the discussion of potential hazards near the site, there is some discussion of a pipeline at a distance of just short of five miles. It's a natural gas pipeline. In the discussion it goes on and you discuss on-site hazards due to hydrogen being delivered to the site, both gaseous and liquid hydrogen.

MR. ANAND: Yes.

CHAIRMAN POWERS: And in there there is a statement that says the applicant concluded that the probability of the detonation from that hydrogen was 4. something times 10 to the -7th. Later in the document it seems like the staff is referring to a higher probability of that. Can you clarify that discussion?

MR. ANAND: Yes, I do remember that discussion but I think I would like to take some help from the staff if anybody can answer that question. I think I'll take that question with me and come back with the answer later.

CHAIRMAN POWERS: Okay. I mean, I did not go back and look at the applicant's analysis for an explosion of being 4.7 times 10 to the -7th which seems improbably low to me. I don't know. How about you, Dr. Kress? Does that strike you as a low probability for a hydrogen detonation?

DR. KRESS: It does, yes.

CHAIRMAN POWERS: I mean, just off hand without looking at the details. On the other hand, the corresponding calculation for the staff seemed a bit high to me. If you could clarify that just a little bit, I would appreciate that.

MR. ANAND: Thank you.

CHAIRMAN POWERS: It's not a terribly important point but --

MR. ANAND: I'll take it with me. This is a wrap-up slide, slide No. 23. The NRC staff issued the Draft Safety Evaluation Report for SERI's application on April 7, 2005. Open item responses on the Draft Safety Evaluation Report is expected by June 21, 2005. We are looking forward to seeing interim ACRS letter after we have briefed full Committee on June 2, 2005. I would like to emphasize again that we are on the right track and we will keep doing a good job.

This concludes my presentation and thank you very much for listening to me.

CHAIRMAN POWERS: Let me ask you a couple of questions. Your report clearly is very much in a draft status right now. I assume things like the population of Vicksburg, which is reported over a range from 20,457 to 26,407. Those kinds of things will get corrected.

MR. ANAND: Right.

CHAIRMAN POWERS: Now, your intention is this concludes the staff's presentation?

MR. ANAND: Yes, sir.

CHAIRMAN POWERS: Okay. We can now turn to this list of people you have available and ask questions. Is that correct?

MR. ANAND: If you wish.

CHAIRMAN POWERS: Okay. In the applicant's presentation he presented a variety of prognostication information. For instance, he said, "Gee, I've got an airport at Jackson. It's 65 miles away and it's not an especially busy airport. I checked with the FAA and they said the role of that airport may change but the flight routes are going to be about the same so I think I'm okay on that."

MR. ANAND: Right.

CHAIRMAN POWERS: How do you feel about that?

MR. ANAND: I'm think I'm comfortable.

CHAIRMAN POWERS: Did you check with the FAA and decide that the routes aren't going to change and the role of Jackson's airport is going to be about the same for the next 75 years?

MR. ANAND: We haven't checked with the FFA. That will happen after 65 years or so.

CHAIRMAN POWERS: The last three generations.

MR. ANAND: Right.

CHAIRMAN POWERS: If we looked at the flight routes three generations ago and compared them with today, I don't think we would find a great deal of similarity.

MR. ANAND: At any stage we have a process. When we find something which is beyond the site capability, we have a right to visit that issue and take appropriate action.

CHAIRMAN POWERS: The application takes a -- presents some weather data, meteorological data, and the staff took issue with particularly the high and low temperatures. They said they had found some data points that were a little higher and a little lower. They asked the applicant, "Gee, how come?"

MR. ANAND: Right. We had asked SERI.

CHAIRMAN POWERS: Okay. The larger issue, of course, is, okay, you find these other data points and it's very likely that the applicant will come back and, for instance, he indicated that the higher point he had thrown that out because he thought maybe it was an outlier compared to closer-in data that he had found and maybe he can explain that.

But it does raise the question on how comprehensive the review of this historical weather information was. Are you asking that question or are you going further here to try to understand how comprehensive the applicant's search for the weather or doing your own search of the weather data?

MR. ANAND: May I take help from Brad Harvey, please?

CHAIRMAN POWERS: I was going to get Brad up here one way or another. You were doing too good by yourself.

MR. ANAND: Brad is our expert on the meteorology.

MR. HARVEY: Yes. I'm Brad Harvey with NRR. One of the intents of that question was the applicant had relied basically exclusively on Jacksonville data to come up with historical climatological data for the site region. Jacksonville being 60 plus miles away from the site there were other climatic data sources nearby that I thought they should have looked at as well.

Based on the phone call we had with the applicant last week, they are doing that in anticipation of answering that open item. They are also doing a statistical analysis of the data closer in to project the 100-year return period, the maximum and minimum temperatures for this site.

CHAIRMAN POWERS: That raises the question of everybody is going to have to do this for an Early Site Permit. They simply don't have data for that particular plot of line they are going to look at. They are going to have to look for other weather stations that are located some distance further away. The question comes about what is the criteria for acceptability of a weather station? Is it just the nearest one you can get or is there some other way that we should codify looking at weather stations?

MR. HARVEY: There's a couple of things you can do. Proximity is certainly an important criteria, but also elevation of the site. Basically higher site elevations are going to have cooler temperature than those that are lower. Also you may want to look at what the surrounding area is in terms of whether it's an urban area versus a rural area.

In the particular case of Grand Gulf, the applicant has opposed using meteorological data from Port Gibson whose site is about five miles from the Early Site Permit site. I think based on that and similar elevation to the site, the ESP site, that is probably not a bad choice.

CHAIRMAN POWERS: I like that answer, by the way. That was a good answer. I think that might be one thing that when we talk about lessons learned that we need to provide guidance. It's not just distance but location and other similarities to help these guys when they choose weather stations around things. Just pencil that in the margin.

MR. HARVEY: Point noted.

CHAIRMAN POWERS: Now let me ask you about in the discussion -- I mean, maybe you're not the right guy. If that's the case, I've got other questions for you. In the discussion of tornadoes and the tornadoes return frequencies --

MR. HARVEY: Correct.

CHAIRMAN POWERS: -- and things like that, it says the staff looked at data over a period of 52 years during which there were 108 tornadoes and they decided based on that that the recurrence interval was 2,860 years. The staff went through and did it and they came up with a recurrence frequency of 1,350 years. But a tornado has hit this site.

MR. HARVEY: That's correct.

CHAIRMAN POWERS: Okay. I mean, do any of these things have the Bayesian update based on that?

MR. HARVEY: The characteristic tornado is based on basically a 10 to the -7th year probability tornado. The tornado that hit the site was actually a bit smaller than that in terms of its wind speed. When that hit the site or hit five or 10 miles away, I'm not sure the mathematical computations are going to pretty much give you the same results. Basically I think the staff looked at a one-by-one degree latitude/longitude area and came up with statistics for the Grand Gulf site.

CHAIRMAN POWERS: I guess it's a mystery to me. I can understand doing that as the prior distribution but as soon as something hits the site, then don't you have to do a Bayesian update somehow?

MR. HARVEY: Again, I think it's statistically what has happened within a large area around the site and the proximity to the site is not part of the algorithms that go into predicting the wind speeds. Again, when that happened at the site or five miles from the site, the methodology does not differentiate.

CHAIRMAN POWERS: I know, Dr. Kress, to your relief, or maybe disturbance, there is nothing in the SER that precludes this fault near the trailer park. Correct?

DR. KRESS: That will change the frequency in tornadoes.

CHAIRMAN POWERS: I'm sure it will. For the weather, for the meteorology the thesis throughout the meteorological discussion is that we will infer what will happen in the next 65 years from what has happened in the previous roughly 100 years. Sometimes it's less than that and sometimes it's more than that. Why do we believe that's true?

MR. HARVEY: Well, I think looking at the history is probably a good precedent as any looking forward.

CHAIRMAN POWERS: Why do you believe that?

MR. HARVEY: Why do I believe that? Because of whatever features there are of the site. Where it's located climatologically determines pretty much past history is what you are going to project in the future.

CHAIRMAN POWERS: When I look in the popular press, and by that I include both newspapers and Scientific American, I would say with respect to meteorology the only thing I see are people predicting the weather is going to get worse in some sense. Either they predict it's going to get hotter, drier, colder, wetter.

I mean, whatever happens to be the flavor of the day but never did they say the previous 150 years is just going to be like the next 150 years. They never said that. I have never seen an article that says what the weather has been like in the past is exactly what it's going to be like in the future. It's always going in some way worse. Usually warmer and warmer at this site probably translate into wetter.

MR. HARVEY: Okay.

CHAIRMAN POWERS: I mean --

MR. HARVEY: There are predictions of global warming but I'm not sure we're at the state of the art right now that we can predict for a specific location what the impact of climate change would be, whether or not the temperature would go up or down, get wet or dry. I think on average the temperature predictions are going up around the globe but for specific locations I'm not sure we're at the state of the art that we can specifically predict what's going to happen.

CHAIRMAN POWERS: In the time frame around the multiple hurricane strikes that occurred in Florida, certainly we saw numerous people saying, "Yeah, hurricane frequency is going to go up over the next 20 years." Okay. I presume those people had some basis for saying that. Do you know what that basis was?

MR. HARVEY: Probably the warming trend of the oceans in the vicinity of that site since the warm waters tend to be predicative of hurricane formation.

CHAIRMAN POWERS: Okay. Now, does that impact what you estimate for this site?

MR. HARVEY: For this site, no, because the site is fairly far inland over 150 miles from the Gulf coast. Typically at least in high winds they pretty much peter out when they get that far inland, although you could see potentially maybe a little more rainfall from those storms but I don't think they are controlling rainfall events for that area.

CHAIRMAN POWERS: If the rainfall goes up, presumably the snowfall goes up and then don't those things have some impact?

MR. HARVEY: Yes.

CHAIRMAN POWERS: I'm talking about 65 years. In some cases that longer than the data we have available. For instance, your tornado base apparently is only 53 years and we're talking about 65.

MR. HARVEY: Yes.

CHAIRMAN POWERS: I mean, it seems to me

it's difficult to use historical data to infer future data.

MR. HARVEY: Well, we are talking about 65 years out into the future here. These are long-term trends that the global warming is talking about that is going to be significantly longer than that. The one point I do want to make is that a lot of our review of what the applicant has given us is reviewed against some industry standards for snow loads, wind loads, extreme temperatures, and so forth and so on.

Basically we are using these societies, ASHREI being one of them as an example. What they are predicting basically is 50-year projections of what these climatic variables will be. We asked the applicant to actually extrapolate that to 100-year return period so there is some margin put in there.

Also we would expect that the state of the art evolves to a point where in the future they revise these type of studies to predict more extreme values before the COL applicant comes in. Then 52.39 allows the ESP application to be reopened to address the fact that now the site has migrated beyond what the original description of the site was in the ESP permit.

I think the applicant already has

mentioned in their presentation that they are looking at advances in climatology before they come in with the COL and the staff will be doing the same to see if what we predicted at the site at this point in time is still appropriate at the time they come in for the COL.

CHAIRMAN POWERS: Professor Wallis, did you want to better understand the freezing of the ultimate heat sink?

DR. WALLIS: I'm a bit surprised the temperatures get so low there.

MR. HARVEY: I think, as the applicant pointed out, not for a very long duration. The one site characteristic that we ask them to provide which is potential for freezing in the water storage facility for the ultimate heat sink, I think, over the phone are suggesting using cumulative degree days below freezing for a criteria to design against the formation of ice. They are talking about less than 100 degrees for that.

DR. WALLIS: This is a well-established way of determining whether or not things freeze?

MR. HARVEY: I believe --

DR. WALLIS: An ad hoc thing developed for this site.

MR. HARVEY: Come again? I'm sorry.

DR. WALLIS: Is this a well established way of making this prediction about whether or not a body of water will freeze or how much and so on?

MR. HARVEY: Yes.

DR. WALLIS: It's well established technology. Okay. How snow are you predicting as a worse case here?

MR. HARVEY: The applicant had mentioned worse case storm, 24-hour storm, like 10.5 inches.

DR. WALLIS: 10.5 of wet snow?

MR. HARVEY: Yes.

MR. ROSEN: I had that in my backyard this winter.

CHAIRMAN POWERS: Yeah. Tennessee gets that quite often. Usually I hear about these storms in Tennessee when we need it up in the northeast.

CHAIRMAN POWERS: Ten and a half inches would destroy Tennessee. What I don't understand is the argument that they are saying, okay, presume you have the snowpack. It's the 100-year so it's 11.14 inches or something like that. Now tell me what your maximum 48-hour snow is going to be.

MR. HARVEY: Maximum winter precipitation.

CHAIRMAN POWERS: It seems to me that is

quite a conservative approach. It might be useful if you were locating a plant where Dr. Wallis lives because that could occur, but here I can't imagine an event that you would have an 11-inch snowpack and another 48 hours adding to that.

MR. HARVEY: Staff doesn't necessarily disagree with you on that. Their approach is based on a branch technical position that was published back about 30 years ago now where we are defining a normal snow load and extreme environmental snow load. A normal snow load is based on a 100-year return period snowpack and extreme environmental load takes the 100-year return period snow pack plus the 48 hour probable maximum winter precipitation. Now, we are just asking the applicant to present these as site characteristics.

They can choose up to COL stage when they have an actual design to present to argue that these are unreasonable snow loads based on the design of the roof. I would think that is the appropriate time to make that argument. Again, these are just site characteristics. How they impact the design is more of a COL item.

CHAIRMAN POWERS: I understand. It just looks incongruous.

MR. HARVEY: You're correct. We don't think this is the right time to make that argument. When you have an actual design in place, they can then come forward with an argument.

CHAIRMAN POWERS: The other members had questions they would like to pose.

MR. ROSEN: Well, I have just a couple of comments to refresh what I've been asking about and discussing if I may. With respect to bluff subsidence, which we talked about a lot, I understand that what has been committed here is that safety related structures will be set back to avoid bluff subsidence affects.

If that's not my understanding, then correct me. If that is so, I guess that means that is a condition of the license or the staff will impose that as a condition of the license, or will you leave that up to the applicant to follow through with his promise?

MR. ANAND: It's my understanding that this will be a COL action.

MR. ROSEN: So that when the COL comes in you will assure yourself that there is enough setback.

MR. ANAND: Right.

MR. ROSEN: Okay. We talked a little bit

about transmission reliability and grid reliability. I must confess that I felt that the answers were less than fully satisfactory. I would hope that we would have a much more thorough explanation of those subjects, if not for the full Committee than certainly by the COL.

MR. ANAND: Definitely, sir.

MR. ROSEN: I also felt that this discussion of the Quachita River lineament was extended to the southeast. We talked about that.

MR. ANAND: Correct.

MR. ROSEN: It's very close to the Grand Gulf site.

MR. ANAND: Right.

MR. ROSEN: I did not either understand or put much credence to the answers that were given as to why one wouldn't be able to say that Quachita River lineament approached much closer to the site than was shown on the drawings.

CHAIRMAN POWERS: And if it did?

MR. ROSEN: Well, I don't know. I never got to that question. I suppose I should ask that first but I didn't. I asked the other one first, what if it got there. It looks like there's no good argument to say it didn't get there, but I would be willing to listen to the argument of what if. That wasn't offered.

CHAIRMAN POWERS: I mean, if you've got -- it seems to me you've got no historical seismicity in the area to sustain any consequence to it.

MR. ROSEN: Well, I would be willing to listen to that argument but I don't think it was offered.

CHAIRMAN POWERS: It's offered in depth in the seismic section.

MR. ROSEN: It wasn't offered here.

CHAIRMAN POWERS: Yeah, but in the seismic discussion in both the submission and in the SER. You will be persuaded that if you are earthquake adverse, this is the site to flock to. It will make Houston look like a part of southern California. Any other comments?

DR. KRESS: Yeah, if I may, because I've got to leave. I meant to ask, I guess, Jay Lee, Grand Gulf was one of the new Reg. 1150 reports where they did basically for the Grand Gulf plant itself uncertainty in the Level 3. I was wondering if, No. 1, if any of that information was used to judge site suitability or, as a more general question, does Level 3 uncertainties and number of plants on the site have any rolling site suitability of this type?

MR. LEE: The Level 3 analysis is done in the environmental report and we used that in preparing the environmental impact statement.

DR. KRESS: I see. That's where we would go to see that.

MR. LEE: Yes.

DR. KRESS: Okay. We don't review the environmental impact statement here, do we?

MR. LEE: I don't believe you do in the HRS.

CHAIRMAN POWERS: There's no reason that we can't, we just don't.

DR. KRESS: Um-hum. Do you guys look at it?

MR. LEE: Yes, we do.

DR. KRESS: Okay. I guess that was the only question I had. I've got to leave.

CHAIRMAN POWERS: Thank you for attending the portion that you could, sir.

Okay, we come now to the point where we need to give both the staff and the applicant some background on what to present to the full Committee. It seems to me that we need to agree among yourselves who will present the site description. Then I would suggest that a status report on the slides you presented where you said the areas of agreement.

MR. ANAND: Yes.

CHAIRMAN POWERS: All right. Three or slides earlier than where you stand right now. This summary list on 19 of where the open items were is kind of the essential information. I'll look to the other members to offer their advice. I think the maps and what not that were presented during the applicant's presentation were excellent for giving somebody an idea of what the site looks like.

It seems to me that the cross sectional information showing the soil column and the conclusion that that soil is dense and undisturbed for long periods of time is a crucial piece of information. But getting to it should be done quickly. You have an excellent visual that shows it.

DR. WALLIS: Listening to you I was given the impression the applicant would describe the site and then the staff with the survey of issues and so on. I felt that there was more technical information than what the applicant presented. Technical information should be put across.

CHAIRMAN POWERS: It seems to me -- I mean, they have to do some sort of a balance but it pointing out, the land there and the soil information, and then the seismicity.

CHAIRMAN POWERS: I think most people react to this site by saying it's mud. You come back and say this is relatively hard mud that is undisturbed. I think that is an extremely important point. It hasn't moved and there is nothing moving. That I thought was effective.

Any other points that people would like to make?

DR. WALLIS: How long do they need for this?

CHAIRMAN POWERS: Say again?

DR. WALLIS: How long does this presentation need to be?

CHAIRMAN POWERS: Well, they are offered a time slot of an hour and a half and instructed that 45 minutes is available for presentation and 45 minutes for questioning. If they are smart, they will avoid like crazy bringing up anything on the probabilistic hazard analysis except for the results. The process they should avoid least they get an education in some of the subtleties.

DR. WALLIS: The applicant has something like 20 minutes maybe?

seems to me that these maps that show the site and the cross section and the fact that the seismology is --

DR. WALLIS: Technical evidence.

CHAIRMAN POWERS: -- minimal around the site are two pieces of crucial information. Then the summary slides that you present that say, "Hey, we can't make any statements now about the acceptability of the site but we can say in these segmented areas we can draw some conclusions."

Then you have this slide 19 which says, "We've still got open items, 23 open items in these various areas," which constitutes a core presentation that would give the rest of the Committee kind of the essential picture of things.

DR. BONACA: How much time do we have for the full Committee?

MR. EL-ZEFTAWY: Hour and a half.

CHAIRMAN POWERS: Hour and a half. We are a little bit shorter this time because June is a horrible month for us.

DR. BONACA: Also these slides of the earthquakes.

CHAIRMAN POWERS: Yeah, the historical seismography slide.

DR. BONACA: Two of them that you are

CHAIRMAN POWERS: Well, I'll leave it to the staff and the applicant to work that out between the two of them.

Are there any other comments that people would care to make?

DR. BONACA: I accept the point about looking at future conditions rather than the past. Not for this application here but as a mind set for projecting bounding. I mean, people are bounding your future predictions and you are assuming that the past will give you the bounding lines. Moving from that mind set may be valuable in general as a review.

You may find that one particular parameter should be maybe expanded out because also you have to bound some higher value there. I don't know what parameter now but I'm saying that it's just a question of a mind set that I think has to be changed a little bit.

DR. WALLIS: I think you may be trending the weather. I mean, if you could show that the higher temperature increased.

CHAIRMAN POWERS: Nobody has been able to do that. I am promised we are going to get a letter that is going to explain to us why they should not do that. Any other comments? Thank you all.

MR. ANAND: Thank you very much.

CHAIRMAN POWERS: These are challenging documents to prepare as the application is challenging to review and terribly challenging for the members to read. I think you have done about as well across the board as anybody could do. With that I will adjourn us.

(Whereupon, at 1:07 p.m. the meeting was adjourned.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards Early Site Permits Subcommittee

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Eric Mollen
Official Reporter
Neal R. Gross & Co., Inc.

Presentation to the Advisory Committee on Reactor Safeguards

Safety Review of the Grand Gulf Early Site Permit Application

Presented by
Raj Anand
Project Manager
New, Research and Test Reactors Program
May 16, 2005

Purpose

- Brief the Subcommittee on the Grand Gulf early site permit (ESP) application and the status of the NRC staff's safety review of that application

- Support the Subcommittee's review of the application and subsequent interim letter from ACRS to the Commission

- Answer the Subcommittee's questions

Agenda

• Background and Milestones	5 min
• Grand Gulf ESP Application	5 min
• Draft Safety Evaluation Report (DSER)	5 min
• Future Oriented Items	5 min
• Summary of Open Items	5 min
• DSER Conclusions	5 min
• Presentation Conclusions	5 min
• Discussion / Subcommittee questions	5 min

Background and Regulatory Framework

- Subpart A to 10 CFR Part 52 governs ESPs
- Subpart B to 10 CFR Part 100 contains applicable siting evaluation factors
- 10 CFR 52.23 requires ACRS to report to Commission on portions of application that pertain to safety (i.e., Site Safety Analysis Report)
- Grand Gulf is third of three ESP applications the NRC staff is currently reviewing – First is North Anna, Second is Clinton, and Third is Grand Gulf

Completed Milestones

- System Energy Resources (SERI) submitted ESP application by on 10/16/2003
- Staff docketed application on 11/21/2003
- Staff issued draft safety evaluation report (DSER) on 4/7/2005
- Staff issued draft environmental impact statement on 4/21/2005

Purpose of ESP Process

- Separates, to the extent feasible, review of site from review of design
- Allows resolution of site-related issues separated from design related issues
- Allows ESP holder to "bank" site for future use

Future Milestones

- ACRS interim letter to the Commission assumed by end of June 2005
- Staff issues FSER on October 21, 2005
- Staff provides FSER to ACRS also in October 2005
- ACRS Subcommittee meeting on November 22, 2005, and Full committee meeting on December 8, 2005
- ACRS letter to the Commission assumed December 2005
- Staff incorporates ACRS letter and issues FSER as NUREG by 01/28/06
- Mandatory hearings begin early 2006
- Commission decision assumed October 2006

Grand Gulf ESP Application

- Proposed ESP site is adjacent to existing Grand Gulf Nuclear Unit 1 site
- ESP applicant, System Energy Resources (SERI), is a owner of the ESP site, subsidiary of Entergy Corporation
- SERI has no plans to perform activities at ESP site under 10 CFR 50.10(e)(1), therefore no site redress plan is submitted

Grand Gulf ESP Application

- SERI requests ESP site be approved for total nuclear generating capacity of up to 8600 MWt, with max 4300 MWt per unit
- Each unit may be one large reactor or multiple smaller reactors
- SERI has chosen not to submit a specific design but instead has submitted a plant parameter envelope (PPE) based on a number of current and future reactor designs
- Staff's review of PPE values in ESP application limited to whether they are reasonable

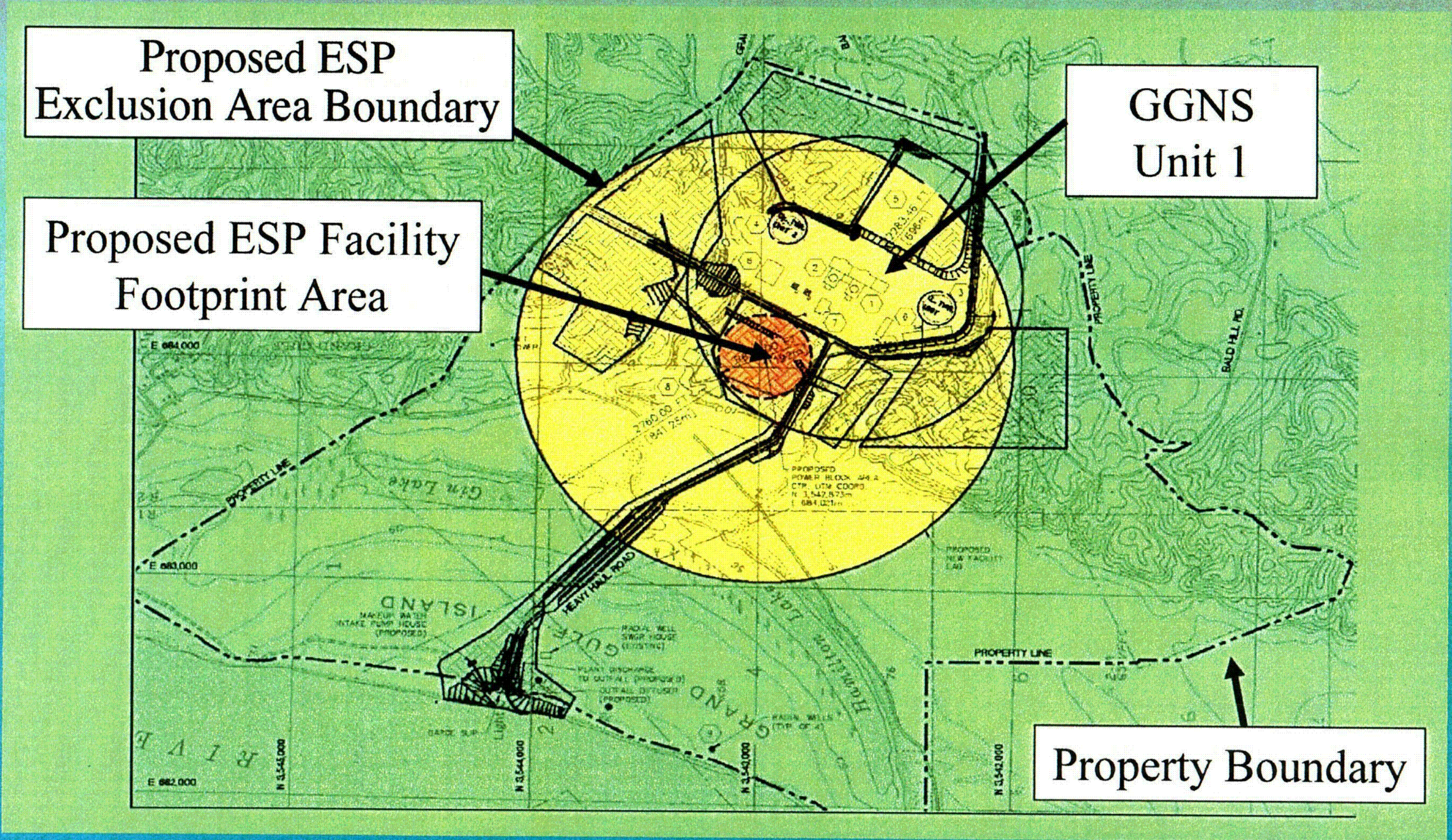
Grand Gulf ESP Application

- Original Grand Gulf Nuclear Site was designed for two units. Construction of second unit was halted prior to completion. Switch yard for both the units was completed
- SERI plans to use existing switchyard for the proposed unit(s)
- Normal heat sink comprised of closed loop circulating water system, pumps, water basin and cooling tower(s)
- SERI considering use of the Mississippi River for intake and discharge structures
- SERI seeks 20-year ESP term

Safety Review Areas and Lead Staff Reviewers

- Meteorology: Brad Harvey
- Hydrology: Goutam Bagchi (contract support from Pacific Northwest Laboratory) (PNNL)
- Site Hazards: Kaz Campe (contract support from PNNL)
- Geology/seismology: Yong Li (support from U.S. Geologic Survey and BNL)
- Demography/Geography: Jay Lee
- Emergency Planning: Joe Anderson (consultation with Federal Emergency Management Agency)
- Quality Assurance: Paul Prescott
- Physical Security: Al Tardiff
- Radiological Consequence Analysis: Jay Lee

GGNS Site and Environments



C01

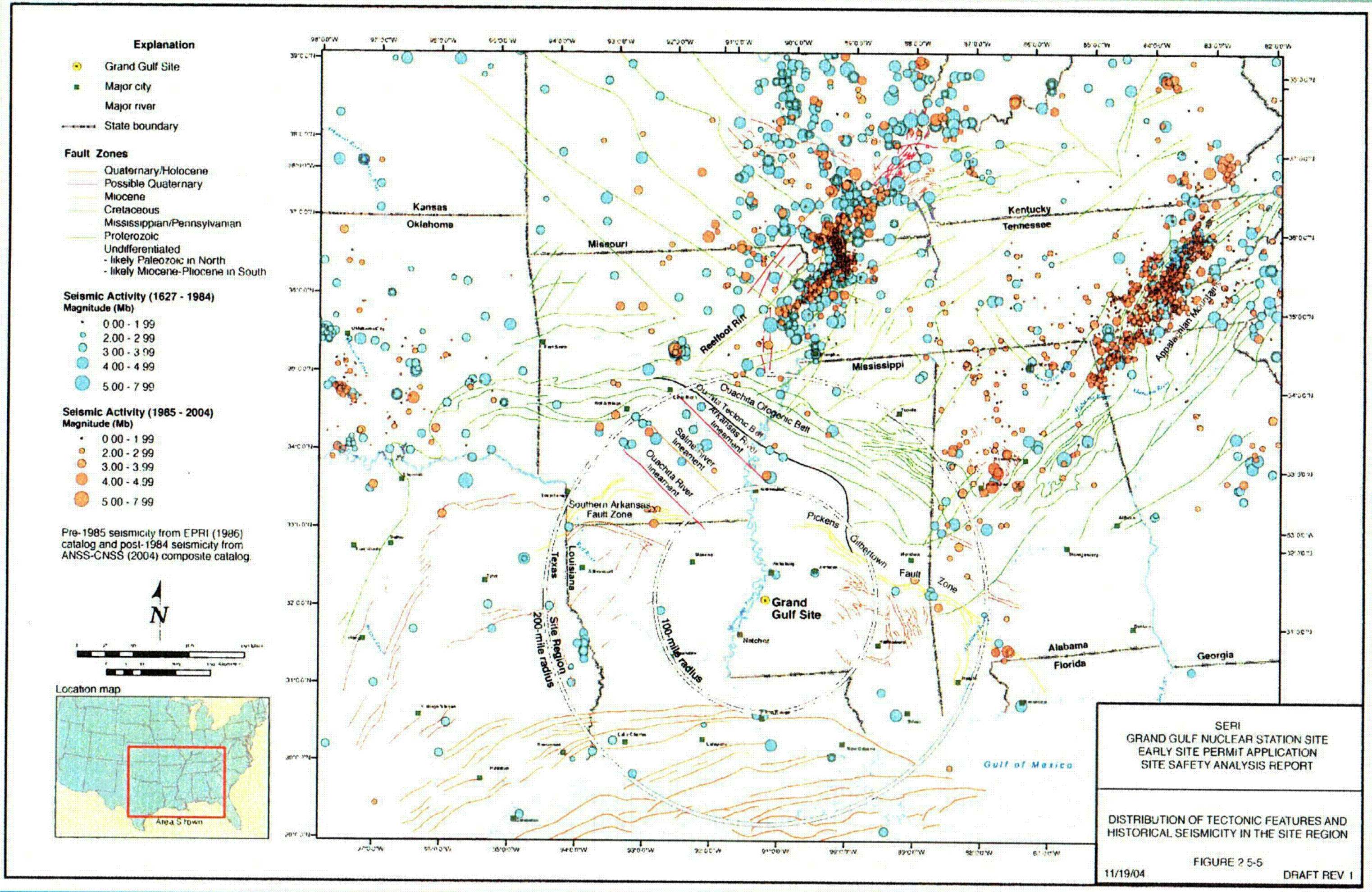
ESP Site Features

- Location of the ESP site
- Cooling water use
- Flooding in Mississipppi River
- Local Intense Precipitation
- Effects of Probable Maximum Flood
- Flood Carrying Capacity of Mississippi River near the ESP site
- Effects of low water
- Ground water use

Seismic

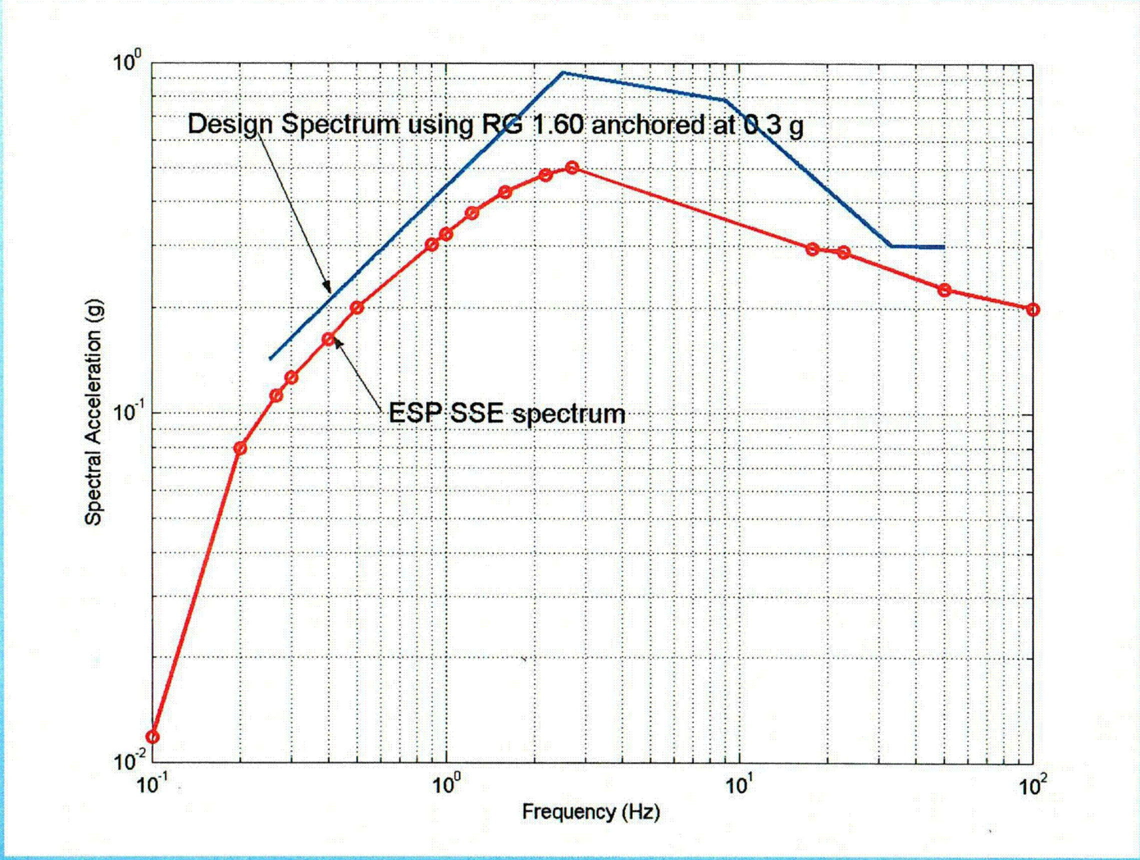
- The ESP is located in a relative low seismic region.
- No earthquake recorded within 25 miles radius.
- No active faults mapped within 90 miles radius
- The ESP site is a deep soil site
- Seismic hazard estimate using Regulatory Guide 1.165

Seismic Background of Grand Gulf ESP Site



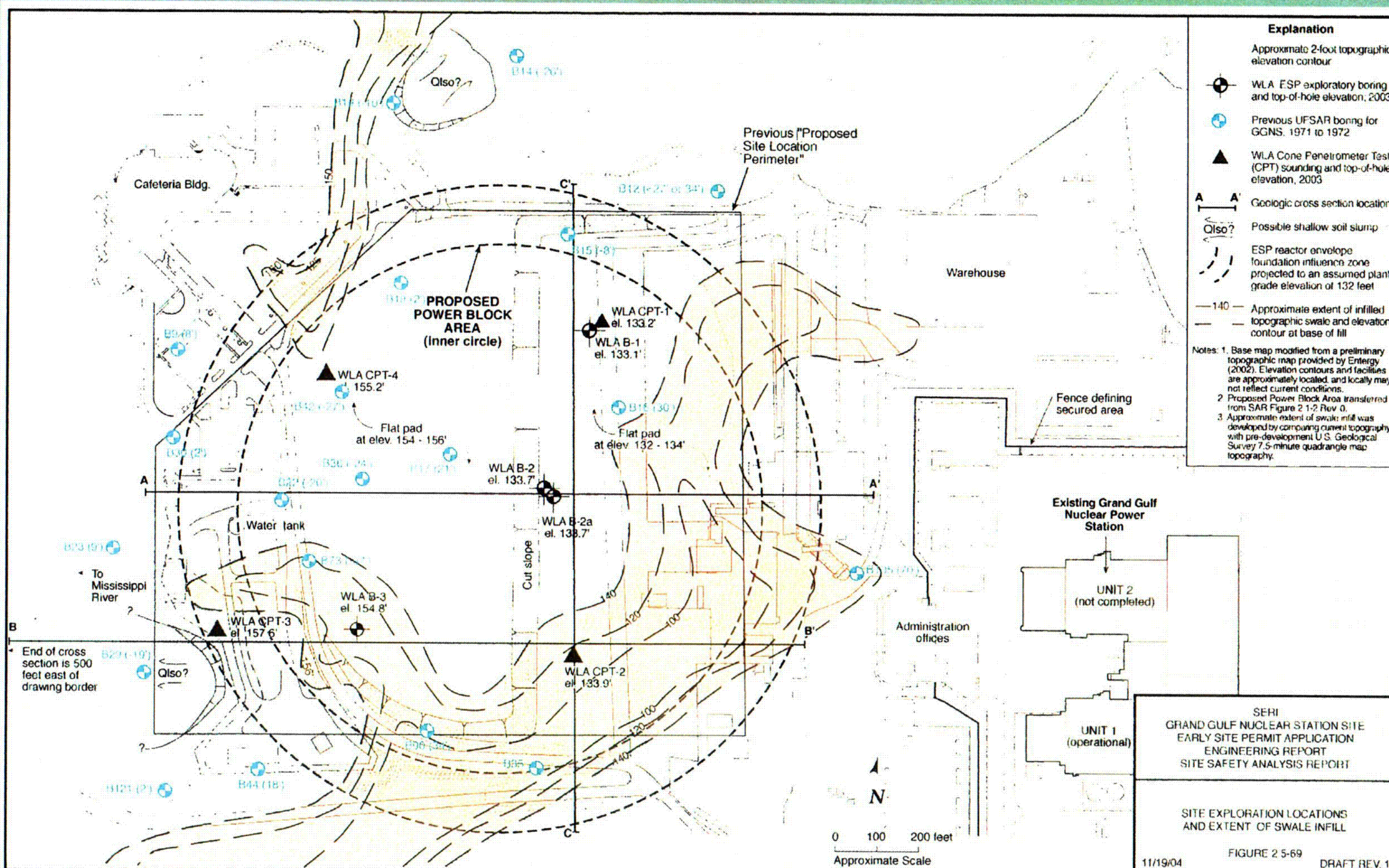
C02

Grand Gulf SSE vs RG 1.60 Diagram



C03

Boring Locations



C04

Emergency Planning

- SERI has elected to seek acceptance of "major features" of emergency plans as provided in 10 CFR 52.17(b)(2)(i)
- NRC/FEMA have issued draft guidance document, Supplement 2 to NUREG-0654/FEMA-REP-1
- Generic industry concern with degree of finality associated with major features
- Staff can grant finality as to the overall description but will need to address implementation details at COL

Summary of Open Items

There are 23 open items in the DSER

- Exclusion Area Authority and control (1)
- Population Distribution (1)
- Meteorology (5)
- Hydrology (7)
- Seismology and Geology (5)
- Emergency Planning (4)

DSER Conclusions

- DSER defers general regulatory conclusion regarding site safety and suitability to FSER after open items addressed
- Some conclusions from individual sections without open items
  - Applicant has provided appropriate quality assurance measures equivalent to those in 10 CFR Part 50 Appendix B
  - Site characteristics are such that adequate security plans and measures can be developed

DSER Conclusions

- Additional conclusions from individual sections without open items
  - Applicant has established appropriate atmospheric dispersion characteristics to support design basis radiological calculations
  - Based on PPE and site characteristics, site meets radiological dose consequence criteria in 10 CFR 50.34(a)(1)

DSER Conclusions

- Additional conclusion from individual section without open items
  - Potential hazards associated with nearby transportation routes, industrial and military facilities pose no undue risk to facility that might be constructed on the site

Presentation Conclusions

- Staff issued DSER for SERI's ESP application on April 7, 2005
- Open item responses expected by June 21, 2005
- Looking forward to seeing interim ACRS letter and to briefing the Subcommittee and the full Committee during November/December, 2005 on final results of staff's review of this application

Backup Slides

Open Items

- 2.1-1, Control of exclusion area
  - Applicant must have control over exclusion area or irrevocable right to obtain control
  - Legal issue being addressed in Office of General Counsel
- 2.1-2, Weighted transient population data
  - The applicant needs to provide weighted transient population in the projected population density and population center
- 2.3-1, Applicant needs to provide 100-year return max/min dry-bulb temperatures

  values recorded at Jackson, MS during 1896-2003 (107°F/-5°F)
  - 110°F was recorded at Vicksburg MS (08/31/200)
  - -8°F was recorded at St. Joseph LA (01/27/1940)

Open Items

- 2.3-2, Applicant needs to provide 48-hour probable maximum winter precipitation

- 2.3-3, Applicant needs to provide design basis site characteristic to assess potential for freezing in UHS water storage facility

- 2.3-4, Applicant needs to identify a 3-second gust wind speed that represents a 100-year return value used to determine wind loading

Open Items

- 2.3-5, Applicant needs to identify Atmospheric Dispersion and Deposition Factors for nearest milk Cow and meat cow

- 2.4-1, Applicant needs to provide corrected UTM coordinates of the center of the proposed powerblock and/or revise Figure 2.1-1 in the SSAR to show the correct location and coordinates.

- 2.4-2, Applicant needs to provide information on the elevation (depth) of the zone that could be disturbed by the construction of the new facility, such that the local subsurface environment and its alignment with the existing hydrogeological environment could be altered.

Open Items

- 2.4-3, Applicant to provide more details regarding dewatering wells to allow the staff to determine whether ground surface subsidence could affect safety-related structures and piping. Provide information related to the location of dewatering wells in relation to safety-related structures and associated monitoring of the ground water table.
- 2.4-4, Applicant to provide more details regarding the floodwater level estimation, including data and methods used to arrive at the floodwater elevation of 133.25 feet MSL.

Open Items

- 2.4-5, Applicant to revise and present estimates of the local intense precipitation as shown in Table 2.4-7 of the SSAR using the guidelines of HMR 52.
- 2.4-6, Applicant to provide further description of the rationale for considering Sr-90 and Cs-137 in the radionuclide transport analysis.
- 2.4-7, Applicant to factors, such as soil, sediment, and rock characteristics; adsorption and retention coefficients; ground water velocity; and distances to the nearest body of surface water are important to hydrological radionuclide transport. Provide these site characteristics from onsite measurements

Open Items

- 2.5-1, Applicant to provide justification for not updating the background seismic source for the ESP site.
- 2.5-2, Applicant to provide and evaluate the criteria or weights used for ranking of model clusters and the judgements involved in balancing data consistency and adherence to seismological principles in the EPRI 2003 ground motion evaluation. Explain how recordings from a single earthquake can provide well-resolved values of both crustal quality factor (Q) and site kappa, also explain why the Q value of 317 at 1 Hz is much lower than values found in other studies of eastern North American earthquakes, and why other studies find less frequency dependence of Q in the eastern North American than in the western North American.

Open Items

- 2.5-3, Applicant to provide an explanation why the magnitude and distance bin corresponding to the SRSZ makes no contribution to the hazard deaggregation
- 2.5-4, Applicant to provide justification on applying the generic shear wave velocity profile derived from Memphis area to the ESP site and on its applying kappa value derived from ground motion observation on the Mississippi embayment in the sensitivity test.
- 2.5-5, Applicant to provide the basis for the selection of values of BE, UB, and LB and other parameters for the base case profile.

Open Items

- 13.3-1, Various additional details on offsite emergency response measures
  - Based on FEMA review of Supplement 2 acceptance criteria
- 13.3-2, Applicant responsibility for making information available to offsite authorities for distribution
- 13.3-4, Additional information on evacuation time estimate (ETE)
  - Clarify whether results of the 2003 ETE study were discussed with officials from the States of Mississippi and Louisiana involved in implementing traffic management plans

Open Items

- 13.3-3, Adequacy of technical support center (TSC), emergency operations facility (EOF), and operations support center (OSC)
  - No evaluation or decision has been made by applicant as to whether the existing Unit 1 OSC and EOF facilities could or would be shared for proposed new reactor(s)
  - TSC facility would not be shared; Part 52 design certifications establish TSC design criteria, which would need to be incorporated as appropriate

Presentation to the Advisory Committee on Reactor Safeguards

Early Site Permit Application for the Grand Gulf Nuclear Station Site

May 16, 2005
Entergy / System Energy Resources, Inc.

Entergy®

Entergy

Entergy ESP Team

- Entergy
  - William Eaton, Vice President Engineering
  - George Zinke
  - Kenneth Hughey
  - Michael Bourgeois
- Enercon
  - Guy Cesare
  - Al Schneider
  - Ralph Berger
- William Lettis & Associates
  - James Hengesh
  - Jeff Bachhuber
  - Martin McCann

Entergy

Presentation Agenda

- Introduction
- General Information
- ESP Application: Purpose & Overall Approach
- ESP Duration and COL Application Process
- GGNS Site & Environs
- Site Climatology, Meteorology
- Geological, Seismological, and Geophysical Analysis
- Emergency Planning
- Draft SER Open Items

Entergy

General Information

- ESP Site Safety Analysis Report (SSAR) prepared to meet 10 CFR 52.17
- Format, content followed guidance of Reg. Guide 1.70
- Proposed new facility, located on existing Grand Gulf Nuclear Station site
- GGNS Unit 1 licensed June 1982

Entergy

General Information, Cont'd

- Site Owner and ESP Applicant - System Energy Resources, Inc. (SERI)
- GGNS Unit 1 Operator - Entergy Operations, Inc.
- ESP Application Preparer - Entergy Nuclear Potomac, Inc.

Entergy

General Information, Cont'd

- Active participation in extensive Pre-Application activities (NRC, NEI, Industry) in 2002 - 2003 timeframe
  - Considered beneficial to overall product;
  - Efficiency of Applicant and NRC Staff resources
  - Early development of staff positions for issues
- Application submitted: October 16, 2003

Entergy

ESP Application: Purpose & Overall Approach

- Purpose
  - Exercise Regulatory Processes
    - New Regulations (10CFR 52, 10CFR100.23, 10CFR 2)
    - Dated Guidance Documents
    - Mandatory Hearing Process – Early Resolution
    - Establish Early Site Permit Cost/Value
    - Establish Repeatable Predictable ESP and Site Suitability Process
  - Establish Suitability of Entergy Site for Additional Unit(s)
    - Defer Technology Selection to COL
    - Resolve Appropriate "matters" with "finality" (10CFR52.39)

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Purpose & Overall Approach, Cont'd

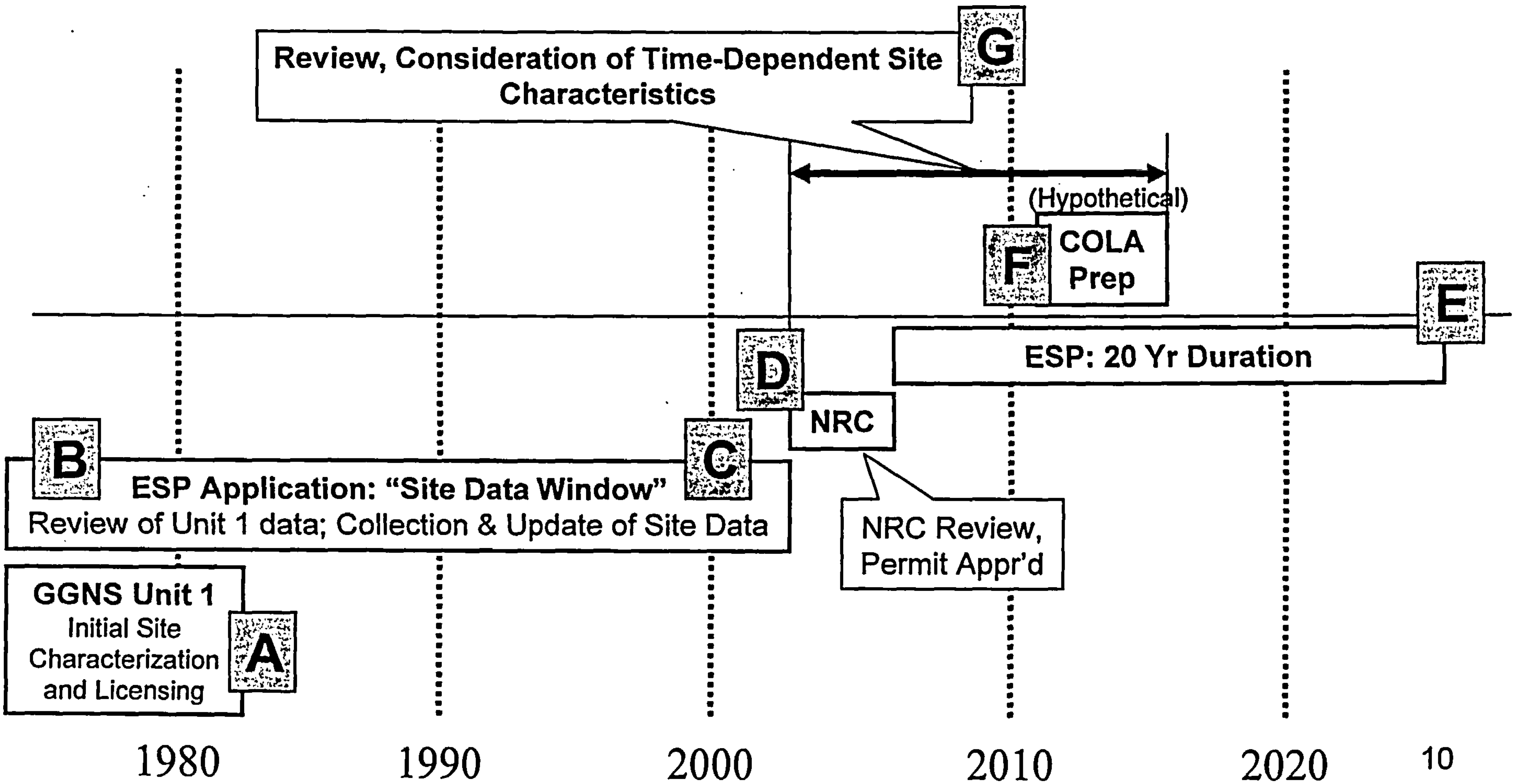
- Overall Approach
  - Application Content
    - Site Characteristics
      - Geography and Demography
      - Nearby Industrial, Military and Transportation Facilities and Routes
      - Meteorology
      - Hydrologic Engineering
      - Geology, Seismology, and Geotechnical Engineering
    - Site Safety Assessment
      - Non-Seismic Siting Criteria
      - Dose Consequences from Normal Operations
      - Accident Dose Consequences
      - Geologic and Seismic Siting Factors

Purpose & Overall Approach, Cont'd

- Overall Approach (continued)
  - Application Content (continued)
    - Environmental Report
    - Emergency Planning Information
  - Use of Existing Site Licensing Information
  - Plant Parameter Envelope
    - Facility parameters, as needed to support site suitability analyses, established by "surrogate" Plant Parameter Envelope (PPE) approach
  - ESP Duration
    - 20 Year
    - 10CFR52.39 Finality
    - 10CFR52.79 COL Application Content and Process

ESP Duration And COL Application Process

General Timeline, Consideration of ESP Data at COL Stage



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ESP Duration And COL Application Process, Cont'd

- Time-dependence of site characteristics fundamentally considered in development of ESP SSAR and Emergency Planning Information
  - In general, expectations of future: reflective of past
  - Population projection
- COL Application Process
  - Reactor technology/design selected
  - Identification of site-related design margins
  - Risk Significance of Site Characteristics Established

Entergy

ESP Duration and COL Application Process, Cont'd

- 10CFR52.79 Comparison
  - Requirement: "...information sufficient to demonstrate that the design of the facility falls within the parameters specified in the early site permit..."
  - Prudent & Reasonable COL Applicant (Entergy) Considerations
    - Safety Margins
    - Potential for change/variation in ESP site characteristics
      - Since ESP issuance
      - Duration of COL
    - Review of Regulatory Issues Since Permit Issuance
    - Relevant Operating Experience
    - Safety and Risk Significance

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ESP Duration And COL Application Process, Cont'd

- 10CFR52.79 Comparison (continued)
  - Site information review
    - Selected information confirmed and/or augmented as necessary and appropriate to identify/resolve risk significant issues
  - Design and/or monitoring considerations
  - Examples
    - Population (permanent and transient)
    - Man-made hazards in vicinity of site
    - Meteorological conditions
    - Seismic

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ESP Duration and COL Application Process, Cont'd - Examples

PARAMETER	POSSIBLE SITE INFORMATION REVIEW APPROACH AT COL APPLICATION
Population	- Latest census; confirm projections remain valid - Possible need to update Evacuation Time Estimate
Man-Made Hazards	- Survey of transportation systems for substantial change (highway with closer approach) - Consult with FAA and USAF re: air traffic - Consider new industry and possible impact
Meteorological	- Consult operating unit regarding changes in annual wind patterns, temp/humidity data summary; consider advances in climatology
Seismic	- More data obtained in accordance with Regulatory Guidance in location of safety related foundations

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GGNS Site and Environs

- Location: Claiborne County, MS; eastern bank of Mississippi River
- GGNS Site Property - Approx 2100 acres
- Nearest "population center": Vicksburg, MS (approx. 25 miles N)
- Principal town in site vicinity: Port Gibson, MS (6 miles, SE)

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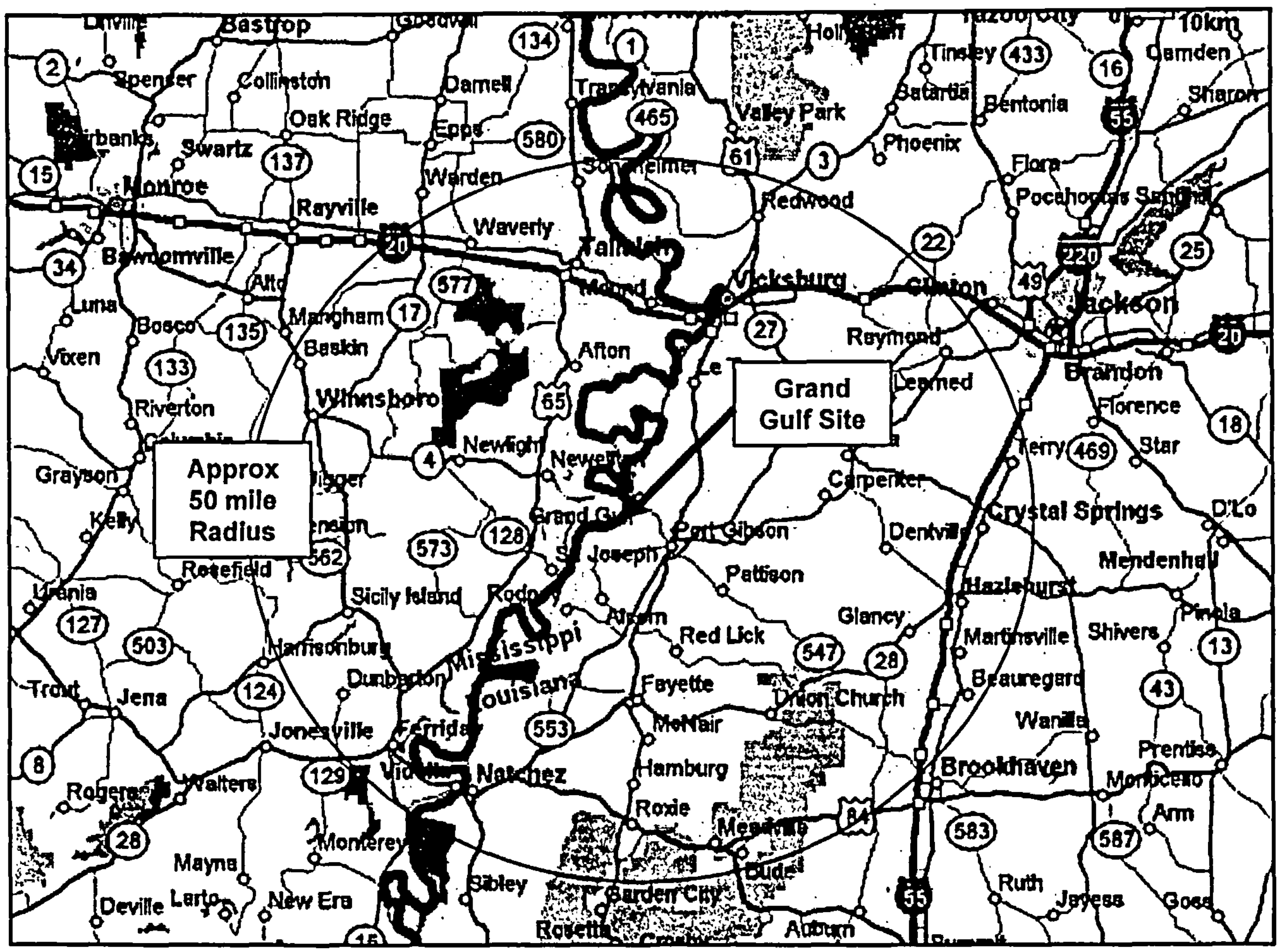
GGNS Site and Environs, Cont'd



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GGNS Site and Environs, Cont'd

- Exclusion area boundary, revised to encompass proposed new facility
  - No residents within EAB; not traversed by rail or navigable waterway; one county road crosses through EAB
  - New EAB, wholly contained with GGNS site property boundary
- Low Population Zone - 2 mile radius (essentially unchanged from Unit 1)

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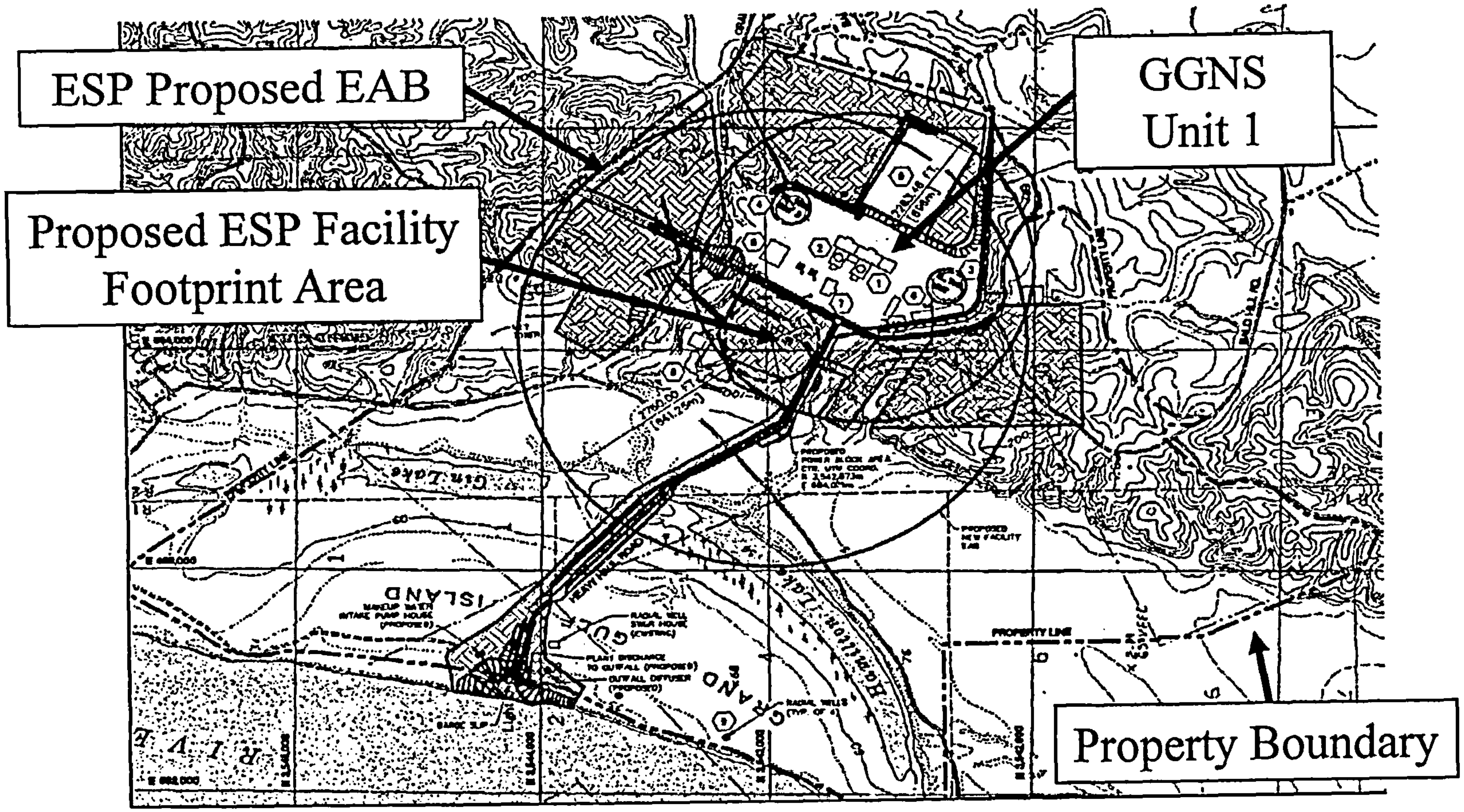
GGNS Site and Environs, Cont'd



Entergy

GGNS Site and Environs, Cont'd

- Site Area Population
  - Permanent (2000 Census)

    0 to 10 Miles: 10,000 (approx)

    10 to 50 Miles: 325,000 (approx)
- Projections
  - Methodology: MS and LA State
  - Estimated growth, Low to Modest

    2030 (Permit Expiration): 8%

    2070 (Facility End-of-Life): 19%

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GGNS Site and Environs, Cont'd

- Generally rural, remote area; land use, forestry and agriculture; limited industry (primarily lumber)
- No commercial airports with 10 miles; closest at 65 miles (Jackson Intl)
- Closest major highway (US 61), 4.5 miles East of site
  - Minimum safe distance, explosive truck cargo calculated to be 0.3 miles (Unit 1 UFSAR)

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GGNS Site and Environs, Cont'd

- No active rail lines or military installations in vicinity
- Closest gas/oil pipeline: 4.75 miles (4", natural gas)
- Current air traffic corridors (commercial and military) evaluated met NRC criteria for no undue risk
- Mississippi River, important river transportation corridor; 1.1 miles from ESP site

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GGNS Site and Environs, Cont'd

- At proposed EL 132', site is located 65' above normal MS River levels.
  - River West bank levee structure: EL 103'
  - River flood height, >29' below site grade
- Consideration of river-borne hazards
  - Updated shipment information considered
  - Distance and river bluff provide protective feature
  - Unit 1 UFSAR analyses, as supplemented, and conclusions remain applicable

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Site Climatology, Meteorology

- Data sources supporting SSAR
  - NWS Stations at Vicksburg, Jackson and Unit 1 Met tower
  - National Climate Data Center
  - Extensive data collection in support of Unit 1 licensing (1970's) utilized
- General climate: humid, tropical
- Characterized by short cold season; long warm season; infrequent snow/ice events; frequent summer thunderstorms

Entergy

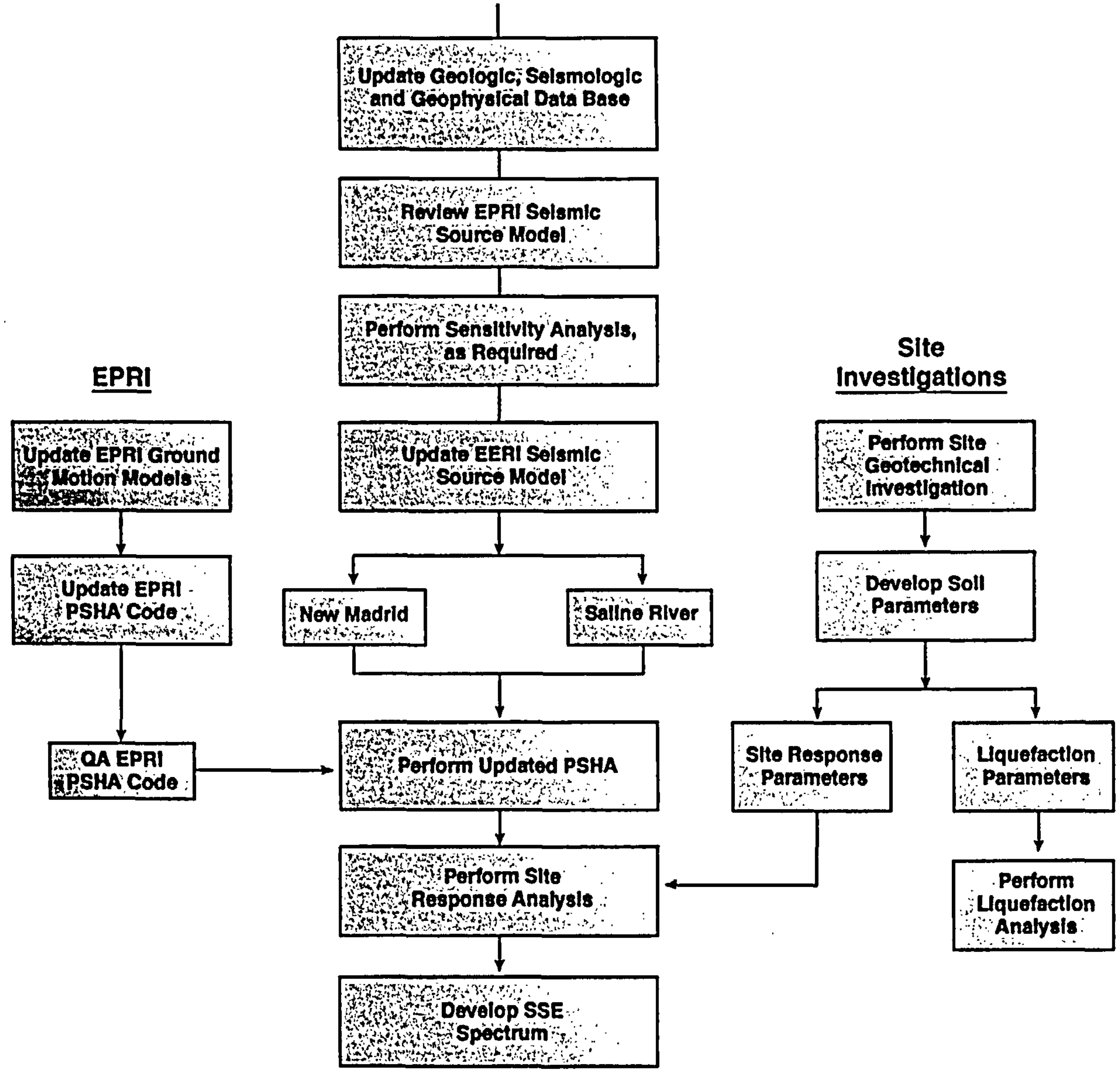
Site Climatology, Meteorology, Cont'd

- Current data, NWS and/or Unit 1 Met Tower: Applied appropriate exceedance criteria to develop ambient dry bulb, wet bulb temps and humidity
- Historic data (1896-2003): Used to support long term reviews, required to determine historic extremes

Geological, Seismological and Geophysical Investigations for the Grand Gulf ESP Site

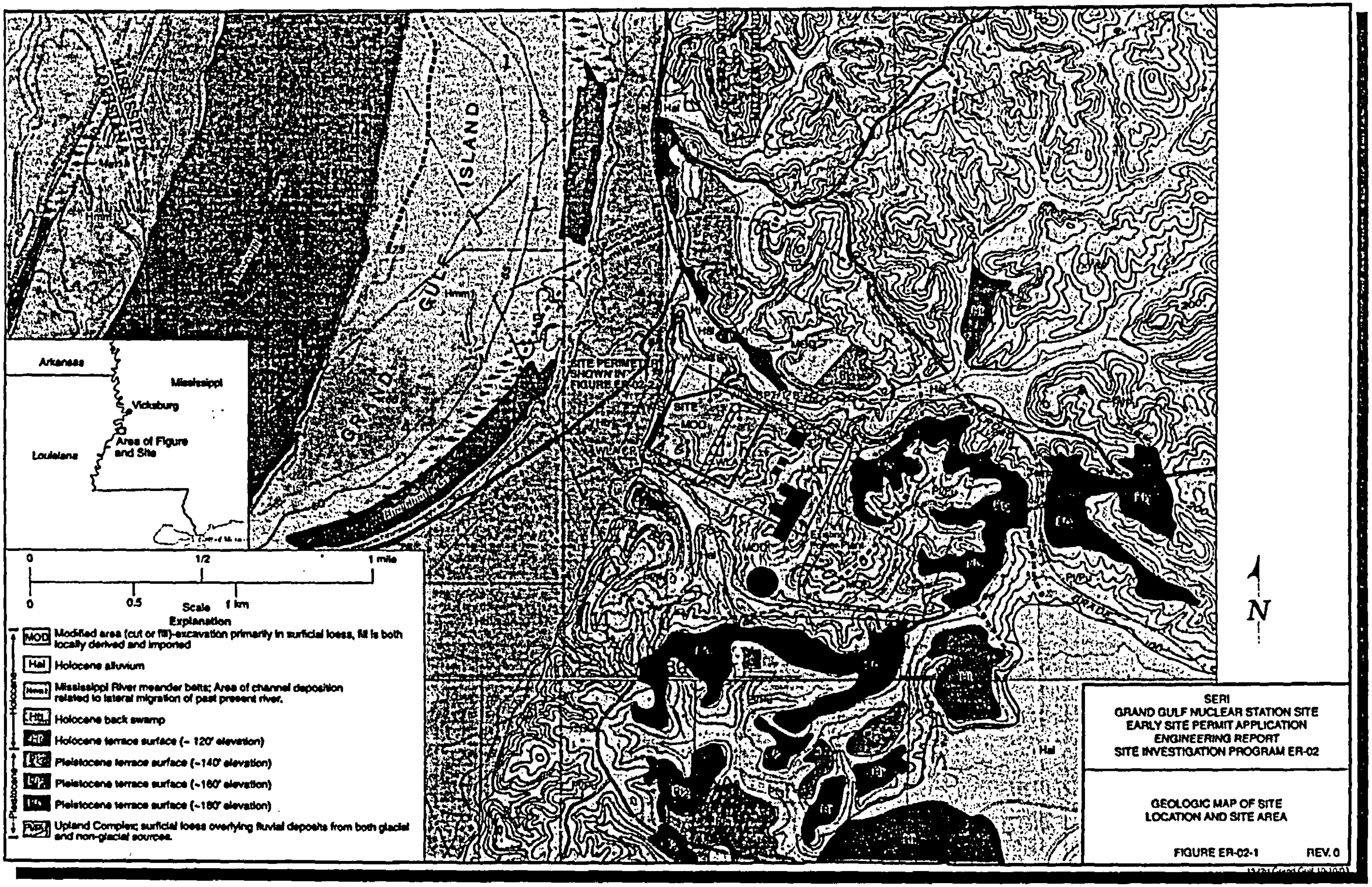
- *Geologic and Geotechnical Site Characterization*
- *Regional Geology*
- *Seismic Source Characterization*
- *PSHA, Site Response and SSE*

Grand Gulf ESP Ground Motion Analysis



Geologic & Geotechnical Site Characterization

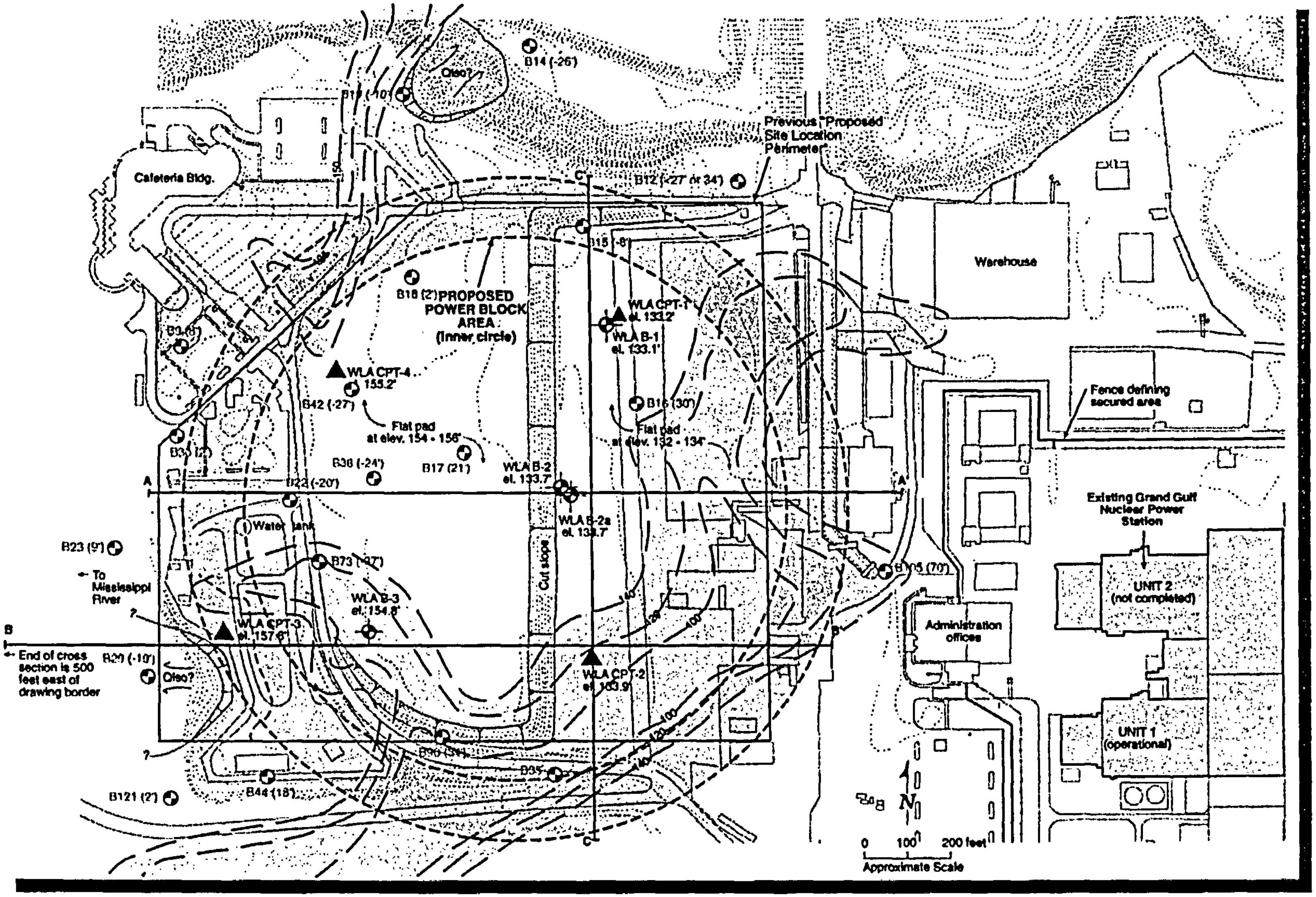
- ***Goals of ESP Site Exploration***
- Characterize subsurface conditions in ESP area with existing and new data
- • Perform sufficient new exploration to confirm and refine site stratigraphy
- • Evaluate site variability
- • Develop site profile for ground motion response
- • Identify possible seismic hazards
-


ISLAND
GULF
GRAND
Arkansas
Mississippi
Vicksburg
Area of Figure and Site
Louisiana
SITE
MOD
0
1/2
1 mile
0
0.5
1 km
Scale
Explanation
Holocene
Pleistocene
MOD Modified area (cut or fill)-excavation primarily in surficial loess, fill is both locally derived and imported
Hal Holocene alluvium
Mississippi River meander belts; Area of channel deposition related to lateral migration of past present river.
Holocene back swamp
Holocene terrace surface (~ 120' elevation)
Pleistocene terrace surface (~140' elevation)
Pleistocene terrace surface (~160' elevation)
Pleistocene terrace surface (~180' elevation)
Upland Complex; surficial loess overlying fluvial deposits from both glacial and non-glacial sources.
N
Hal
SERI
GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
ENGINEERING REPORT
SITE INVESTIGATION PROGRAM ER-02
GEOLOGIC MAP OF SITE LOCATION AND SITE AREA
FIGURE ER-02-1
REV. 0

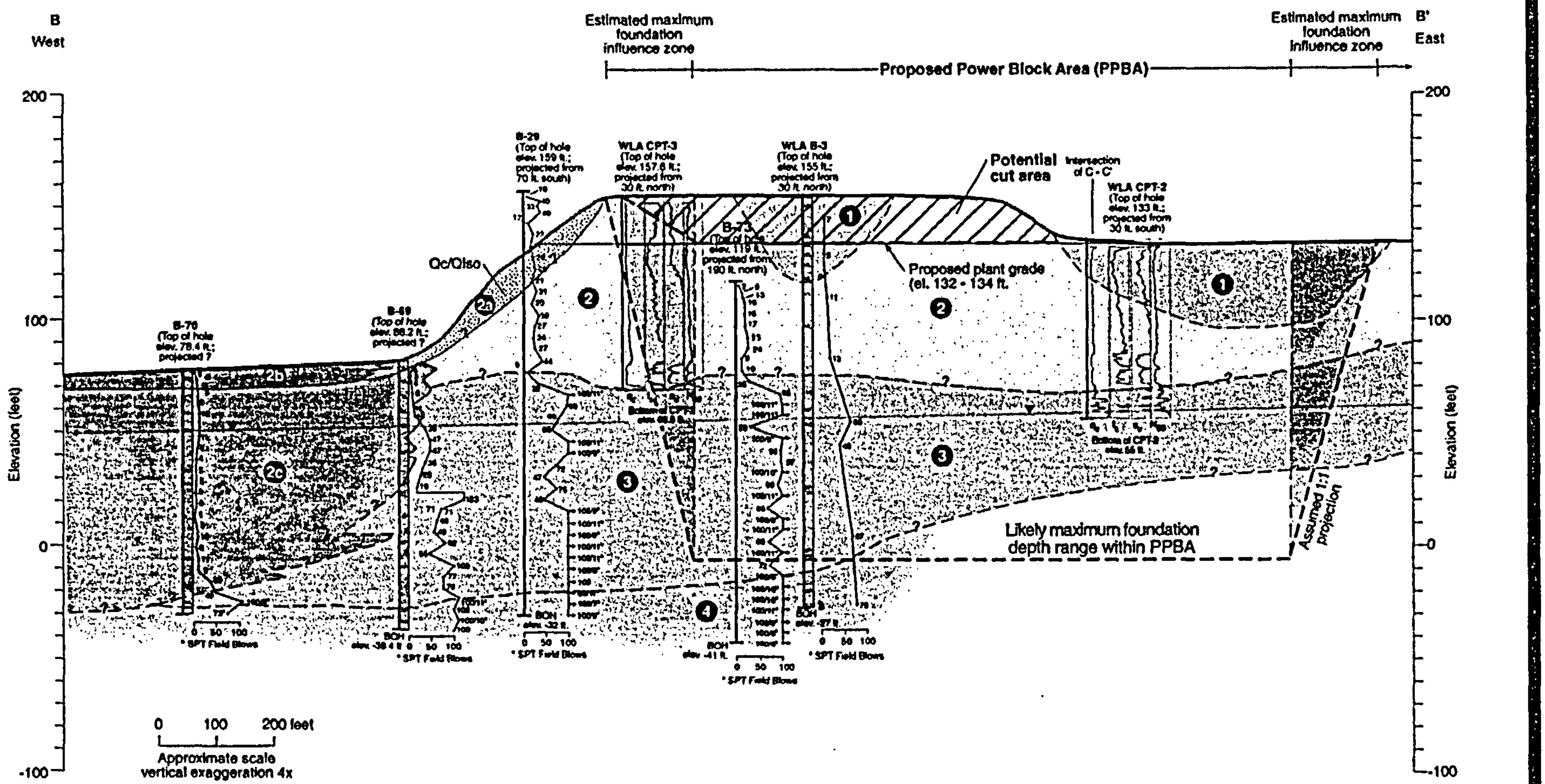
Investigations Completed

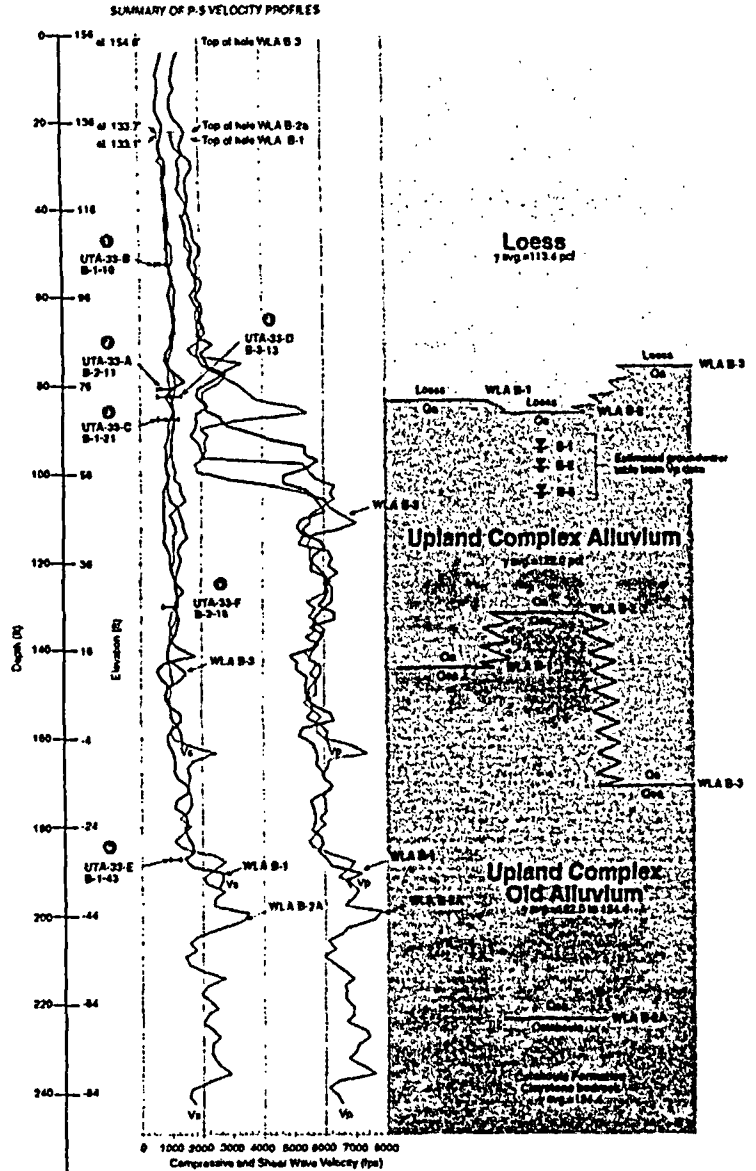
- • Data Review (e.g., FSAR, published maps)
- • 3 New borings (142 to 238 feet deep)
- • 4 CPT soundings (75 to 98 feet deep)
- • 3 P-S borehole velocity surveys
- • Laboratory index testing (Eustis)
- • 6 Dynamic soil tests (UTEXAS)
- • Future work in COL phase for facility design

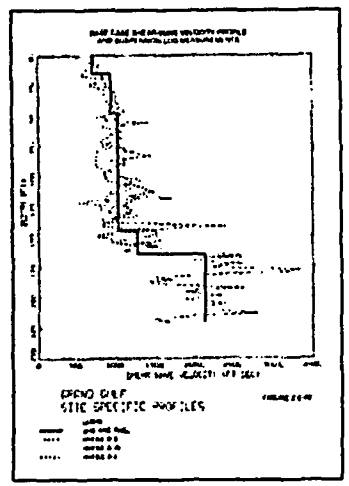
Existing and New Boring/CPT Locations

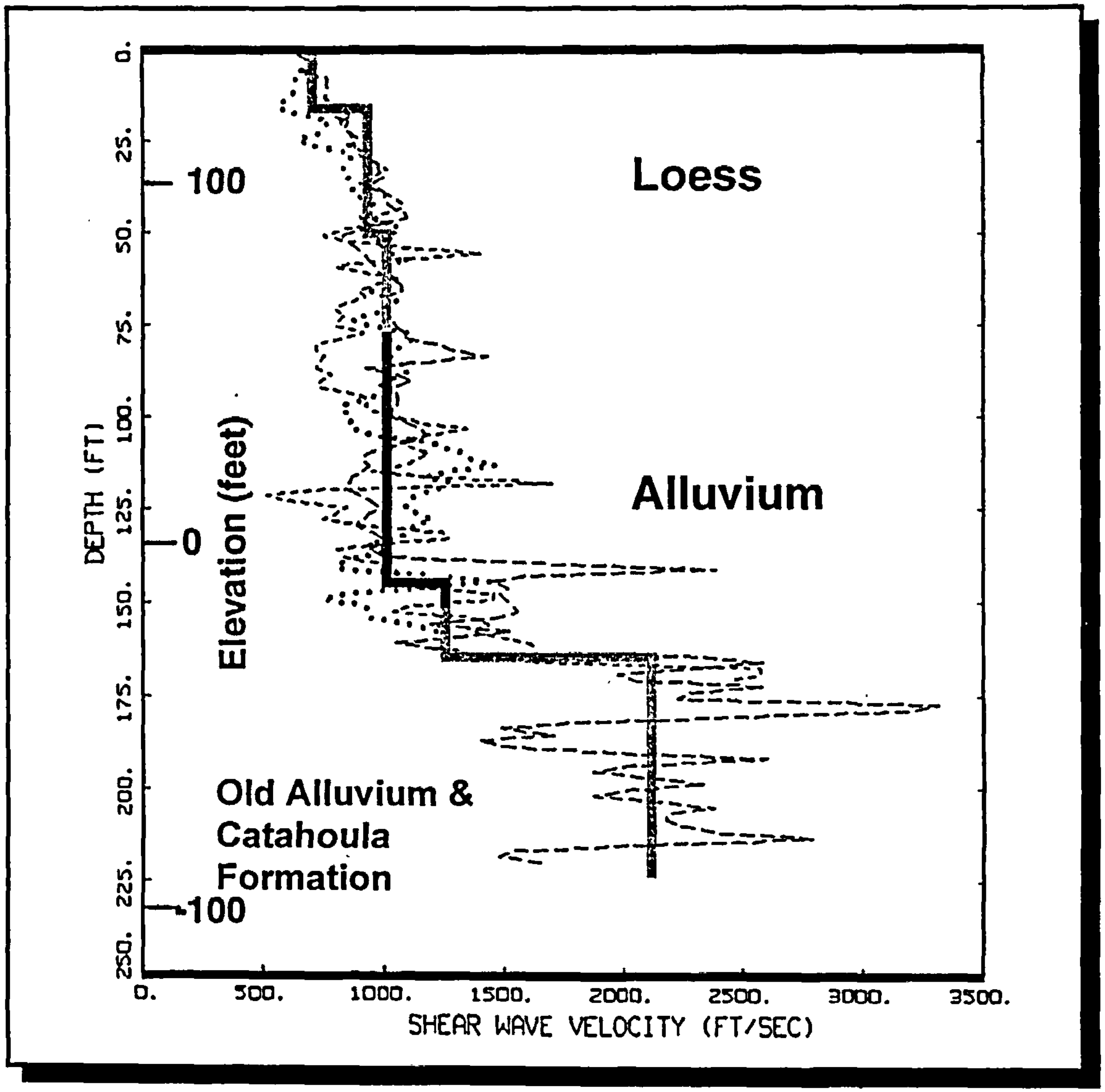


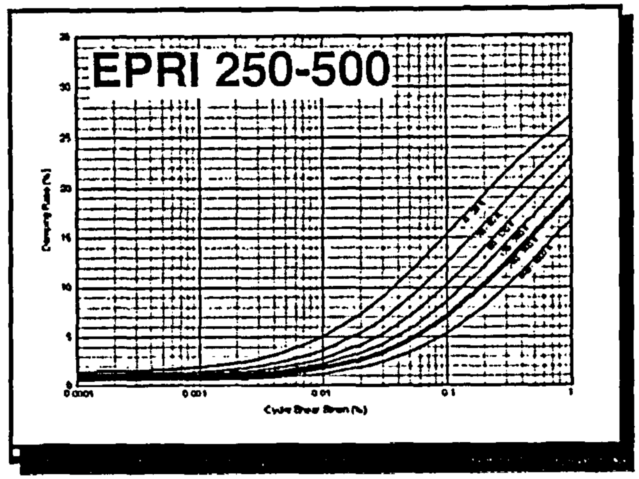
Geologic Section B-B'

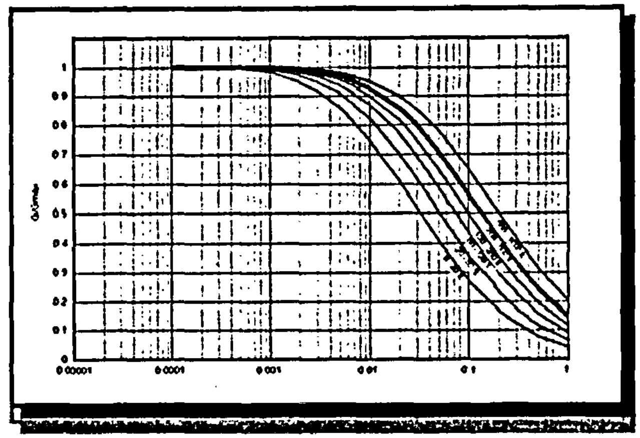



SUMMARY OF P-S VELOCITY PROFILES
Top of hole WLA B-3
Top of hole WLA B-2a
Top of hole WLA B-1
Depth (ft)
Elevation (ft)
Loess
Upland Complex Alluvium
Upland Complex Old Alluvium
Estimated groundwater table from Vp data
Vs
Vp
0 1000 2000 3000 4000 5000 6000 7000 8000
Compressive and Shear Wave Velocity (fps)
FIGURE 2.5-80




Loess
Alluvium
Old Alluvium &
Catahoula
Formation
Elevation (feet)
100
0
-100
DEPTH (FT)
0.
25.
50.
75.
100.
125.
150.
175.
200.
225.
250.
0.
500.
1000.
1500.
2000.
2500.
3000.
3500.
SHEAR WAVE VELOCITY (FT/SEC)

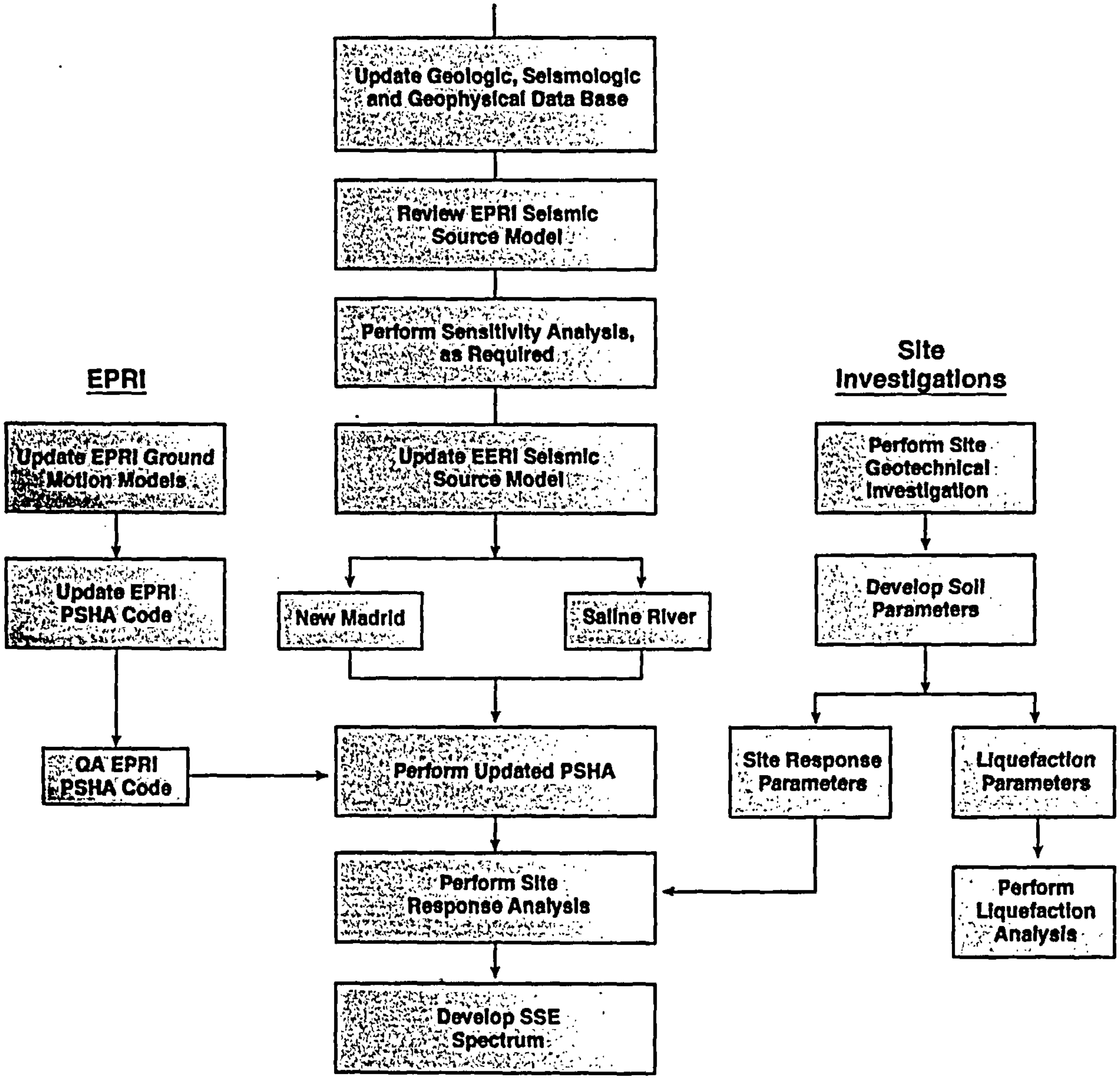

EPRI 250-500



Geologic & Geotechnical Hazards/Constraints

- Positive evidence for no significant geologic hazards
- Extension of foundations below loess and upper alluvium will mitigate any possible hazards from seismically-induced ground failure, settlements, or slope failure
- Old alluvium and Catahoula Formation are resistant to settlement, and have provided good support for existing plant
- Groundwater dewatering/control procedures will be required

Grand Gulf ESP Ground Motion Analysis



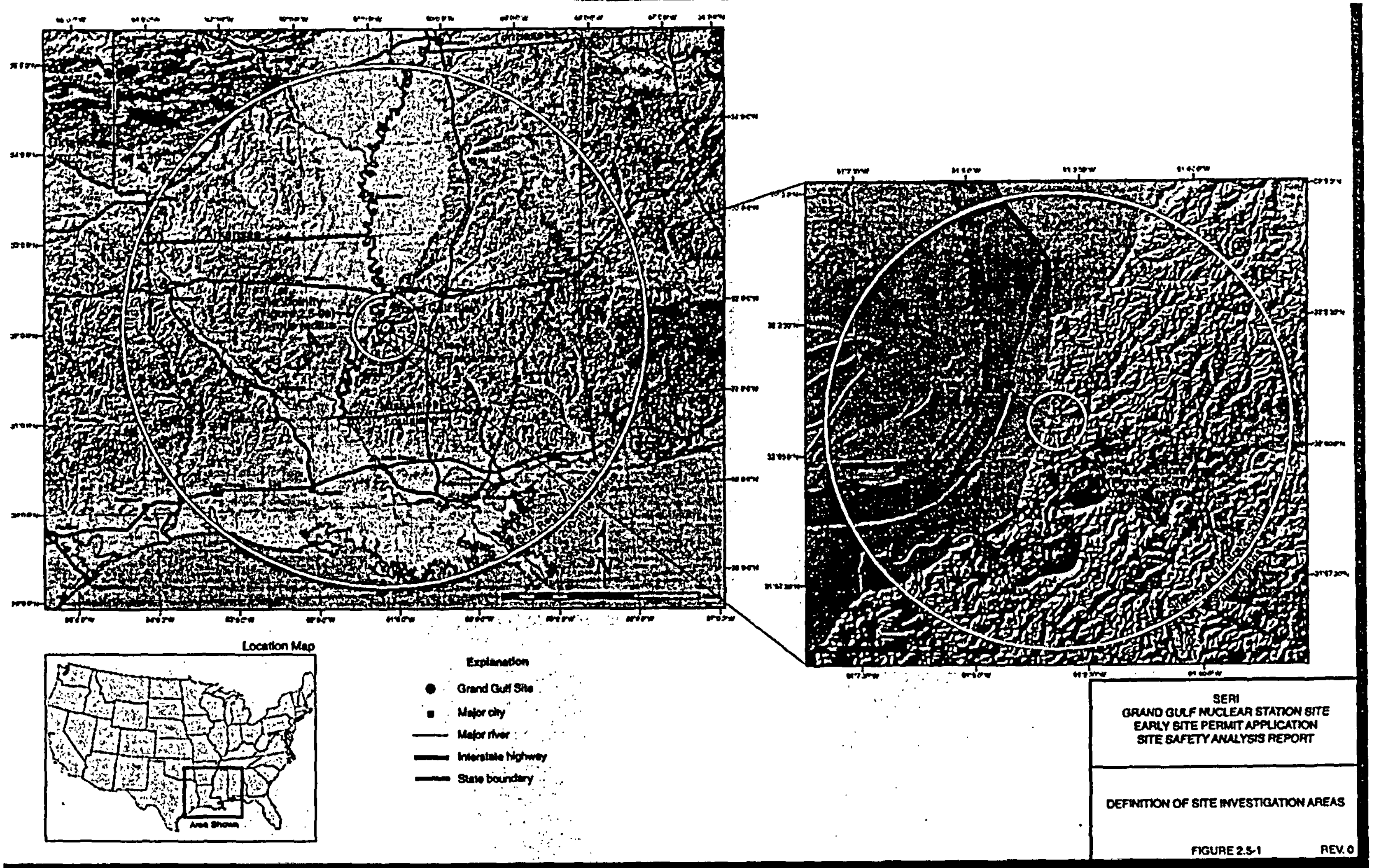
Seismic Site Investigations Technical Approach

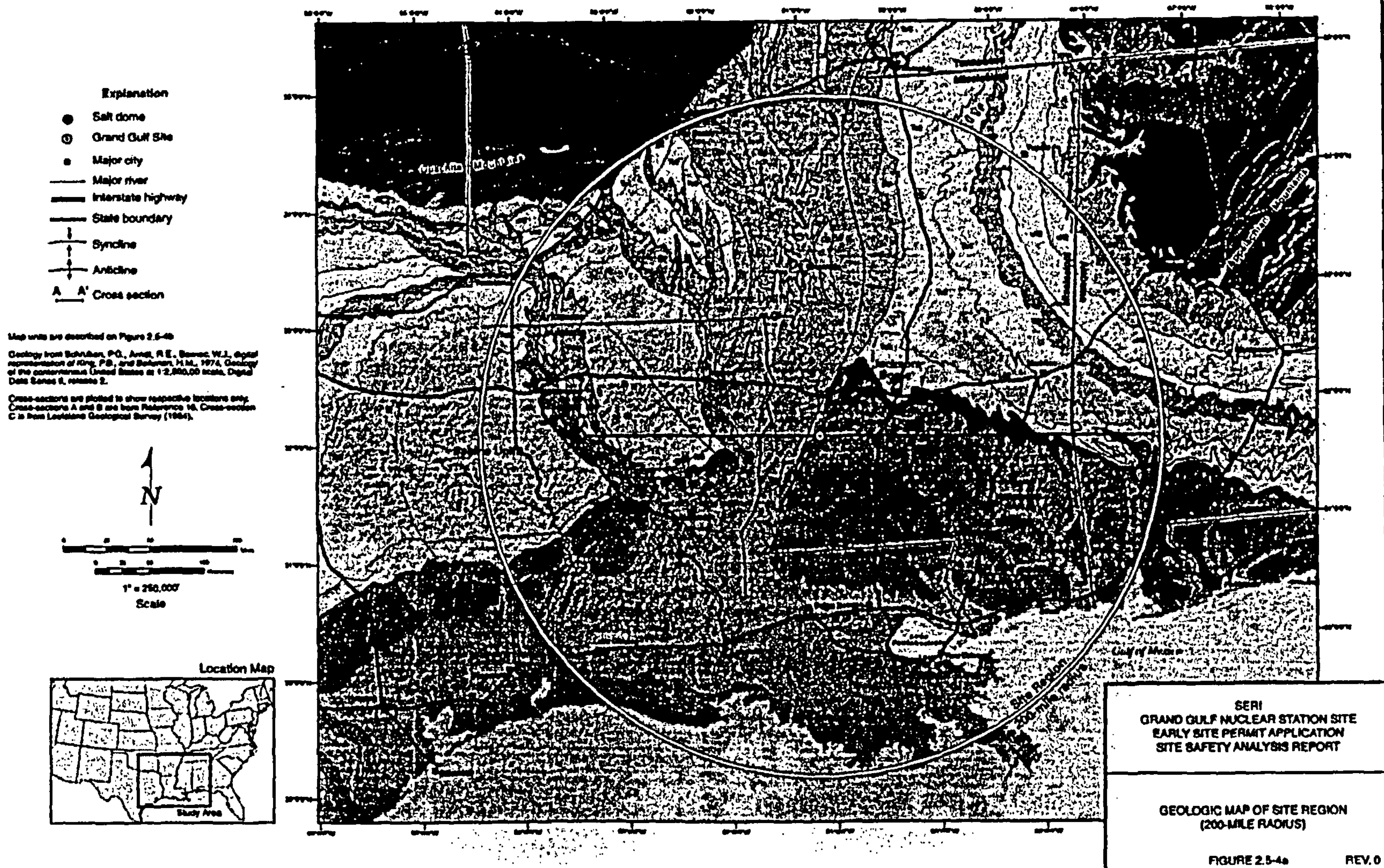
- Followed guidance provided in US NRC Regulatory Guide 1.165
- Adopted EPRI (1986) methodology to develop SSE ground motions

Technical Approach, cont'd

- Reviewed geological, seismological and geophysical data to update database for area with 200 miles of Grand Gulf ESP site
- Updated seismic source and ground motion models
- Updates include:
  - New Madrid Seismic Zone characterization
  - Saline River Source Zone
  - Ground motion attenuation models

GGNS Site Location

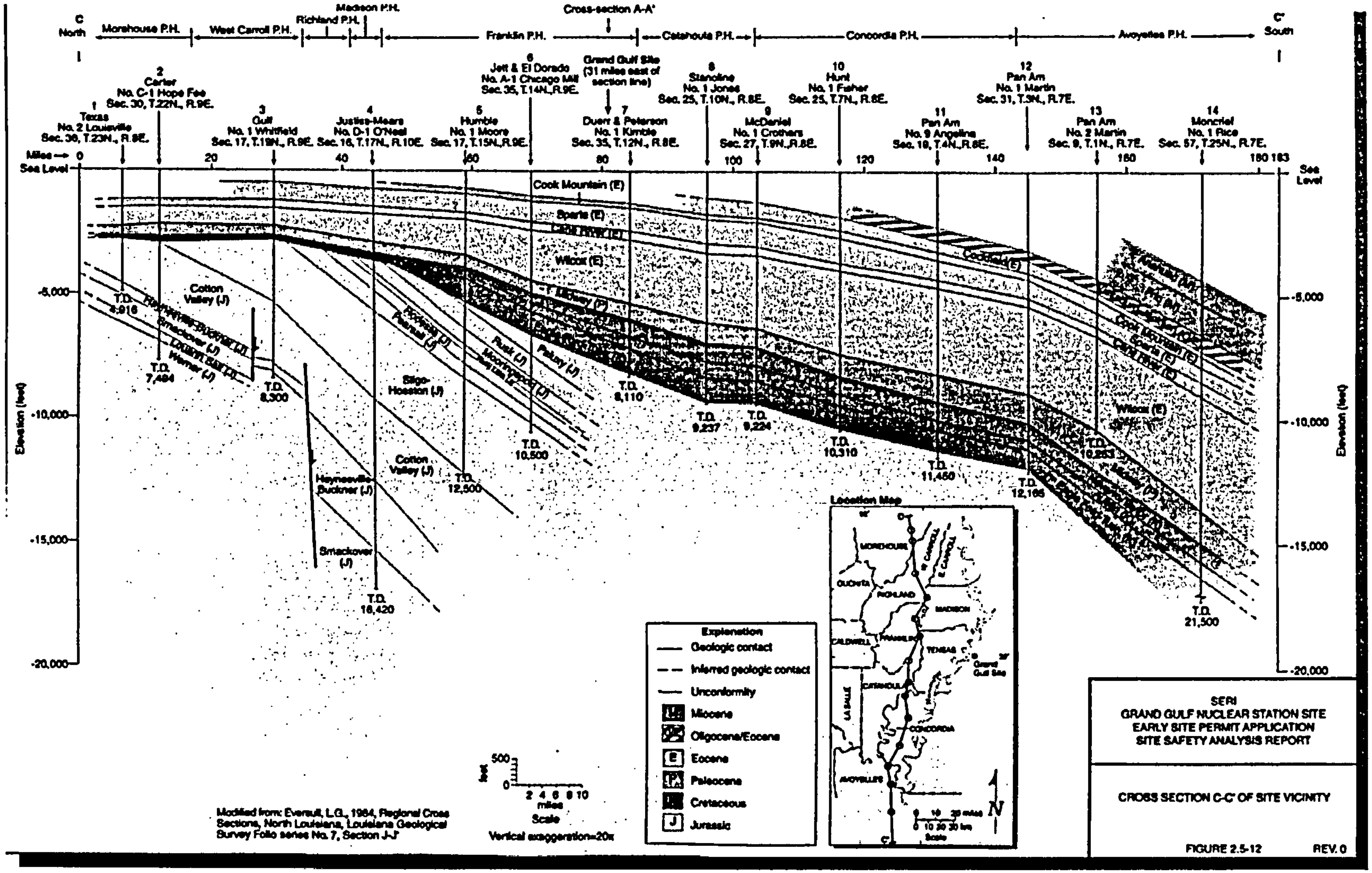




SERI
GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
SITE SAFETY ANALYSIS REPORT

GEOLOGIC MAP OF SITE REGION
(200-MILE RADIUS)

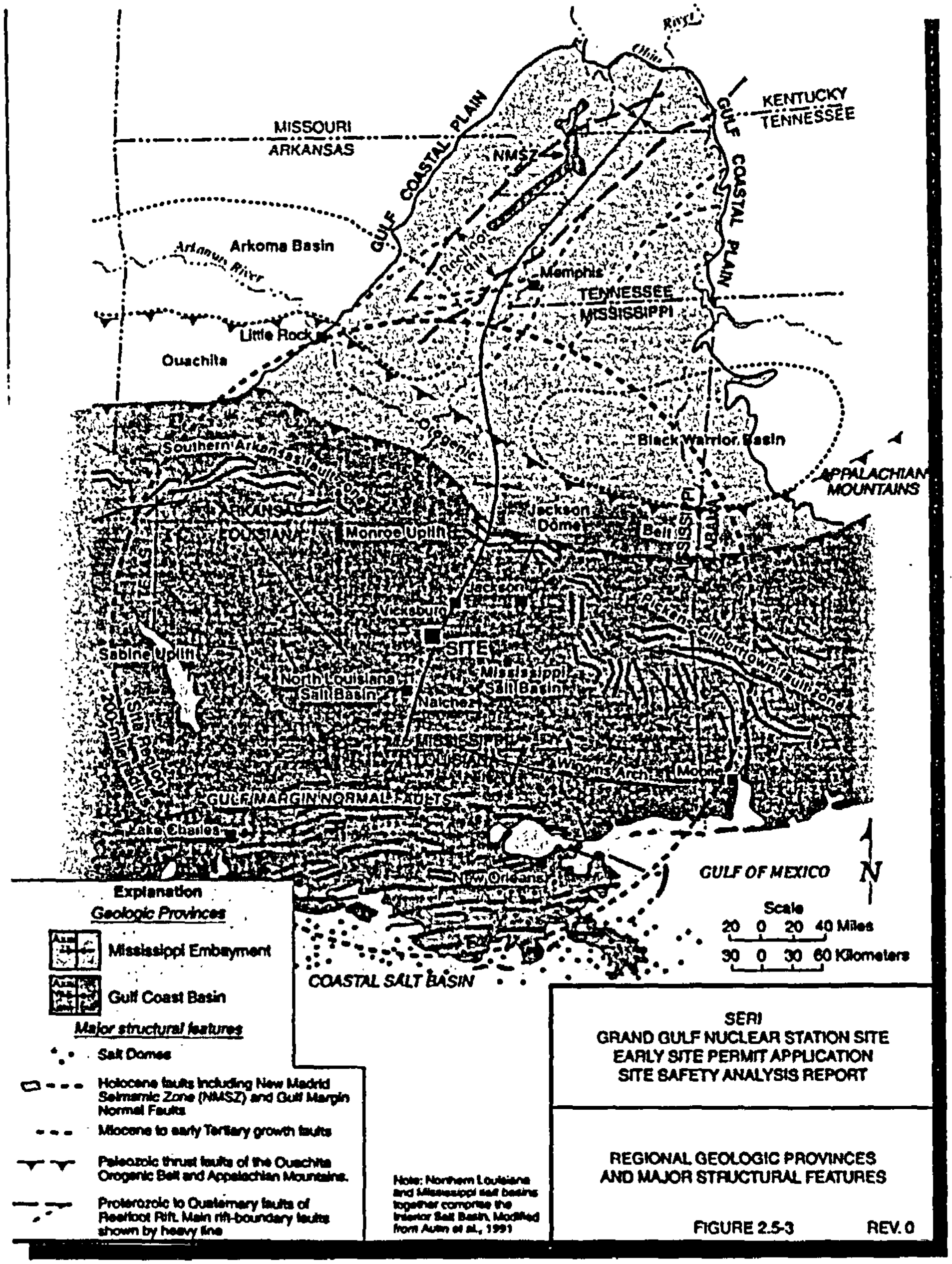
FIGURE 2.5-4a REV. 0



SERI
GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
SITE SAFETY ANALYSIS REPORT

CROSS SECTION C-C' OF SITE VICINITY

FIGURE 2.5-12 REV. 0



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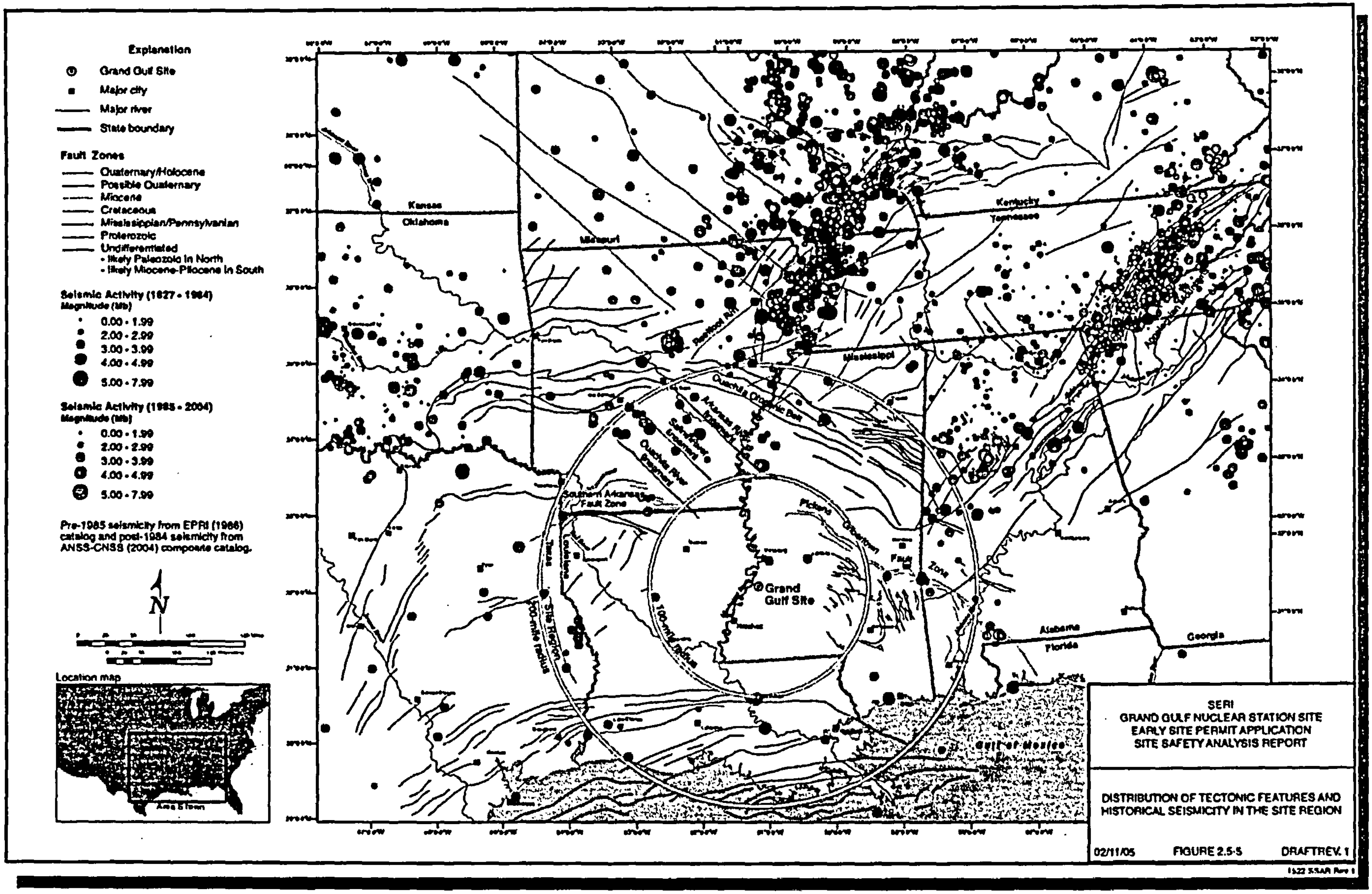
EARLY SITE PERMIT APPLICATION
SITE SAFETY ANALYSIS REPORT

REGIONAL GEOLOGIC PROVINCES AND MAJOR STRUCTURAL FEATURES

FIGURE 2.5-3 REV. 0



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GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
SITE SAFETY ANALYSIS REPORT

DISTRIBUTION OF TECTONIC FEATURES AND HISTORICAL SEISMICITY IN THE SITE REGION

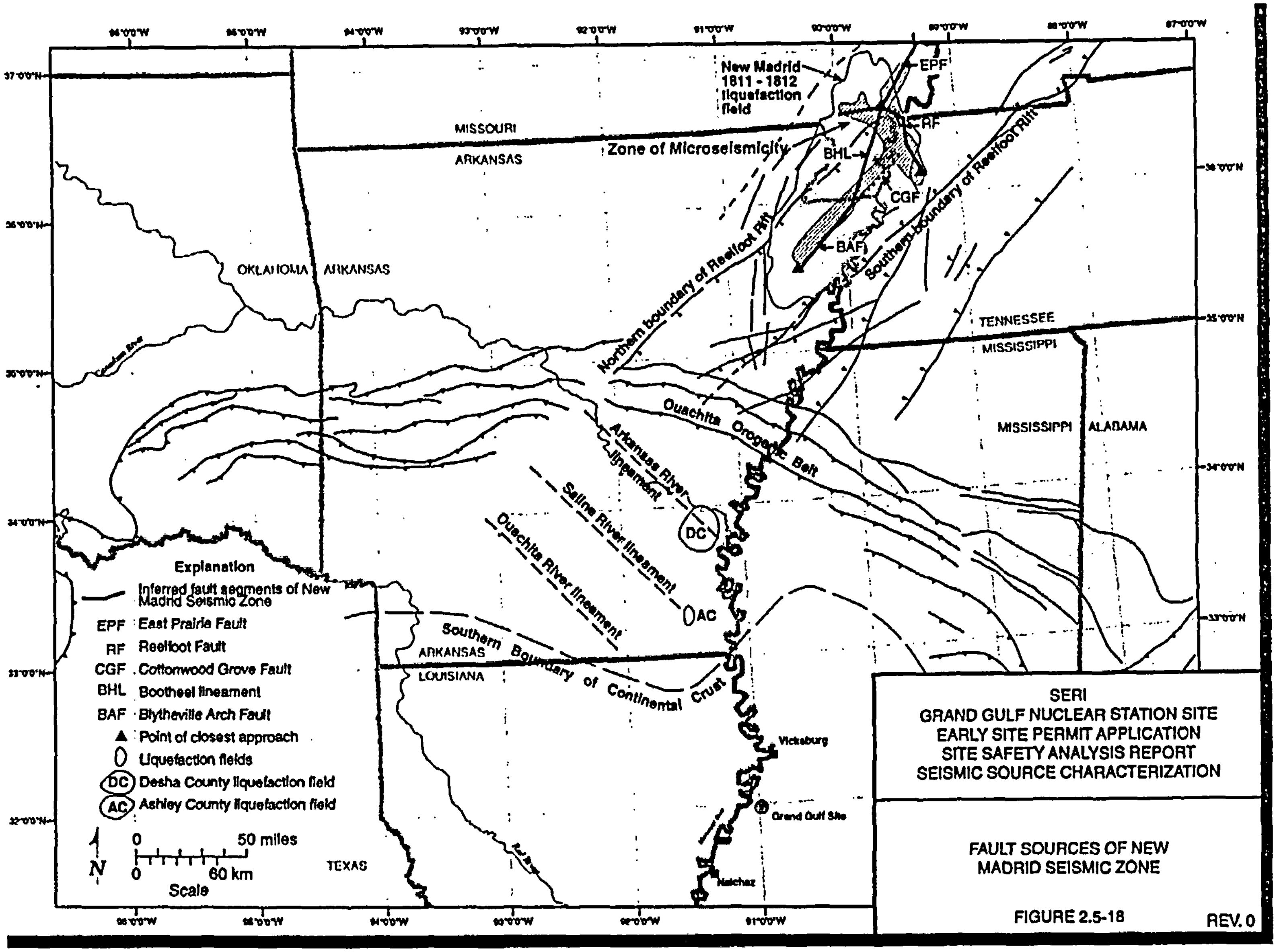
02/11/05 FIGURE 2.5-5 DRAFT REV. 1

Seismic Source Characterization for Grand Gulf ESP Site

- Evaluated source geometry
- Maximum earthquake magnitude
- Earthquake recurrence
- Seismic source model area included 200-mile radius Site Region, plus NMSZ

Seismic Source Characterization for Grand Gulf ESP Site

- Seismic source model for 1986 EPRI SOG Project is acceptable for most of model area
- Added characteristic earthquake model for NMSZ
- Added new Saline River Source Zone
- Replaced ground motion attenuation model



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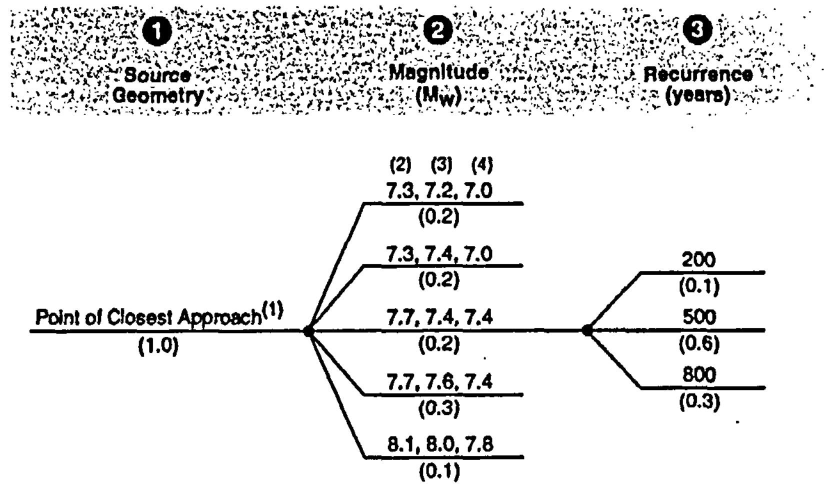
GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
SITE SAFETY ANALYSIS REPORT
SEISMIC SOURCE CHARACTERIZATION

FAULT SOURCES OF NEW MADRID SEISMIC ZONE

FIGURE 2.5-18 REV. 0



(1) Point of closest approach refers to the point on each of the East Prairie, Reelfoot fault, Blythville Arch segments of the New Madrid Seismic Zone that is closest to the Grand Gulf site. See Figure CP-01-16 for segment and point of closest approach locations.

(2) Blythville Arch: weighted average = M_W 7.6

(3) Reelfoot Fault: weighted average = M_W 7.5

(4) East Prairie Fault: weighted average = M_W 7.3

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GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
SITE SAFETY ANALYSIS REPORT

LOGIC TREE
FOR NEW MADRID SEISMIC ZONE

FIGURE 2.5-45 REV. 0

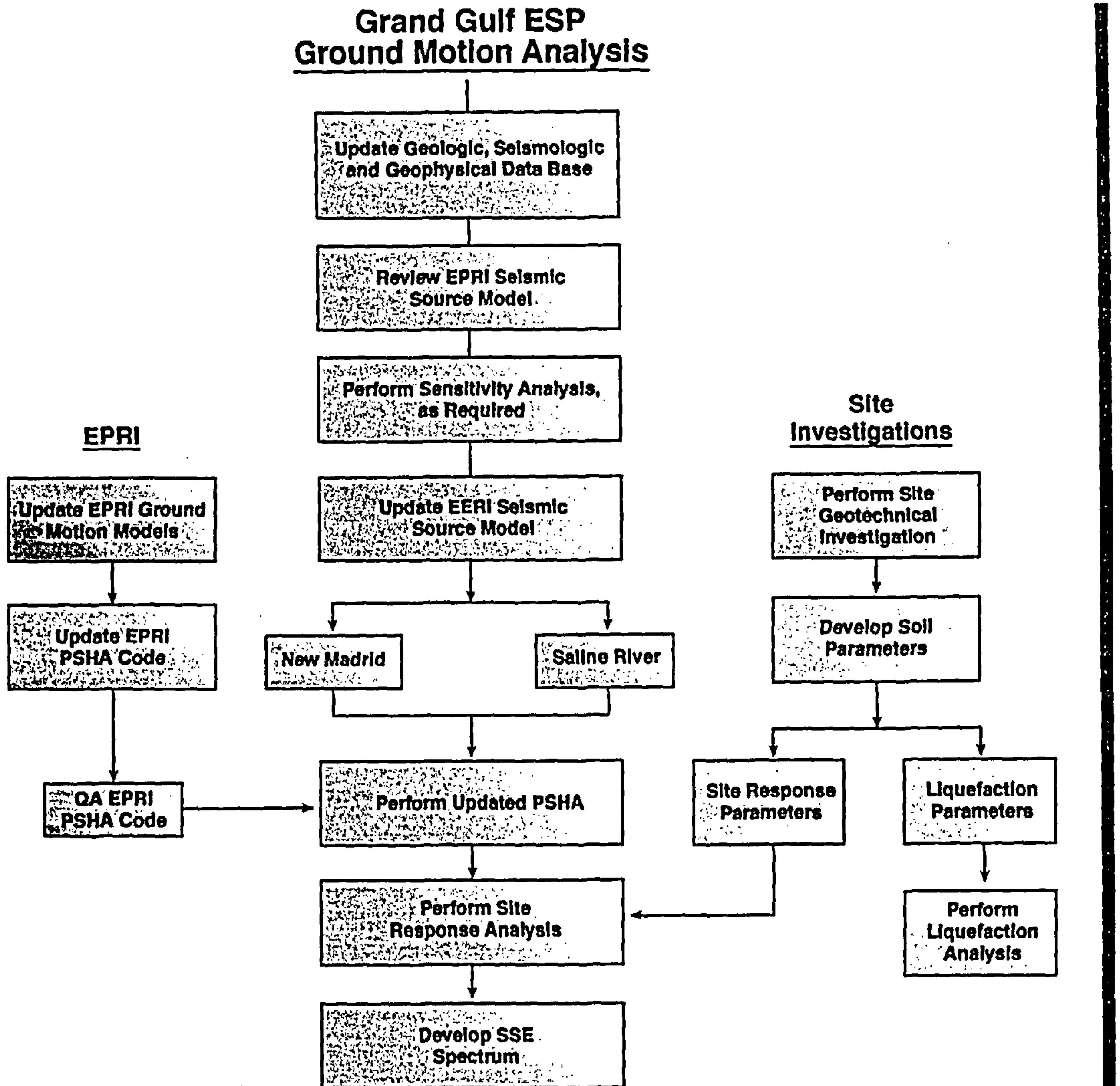
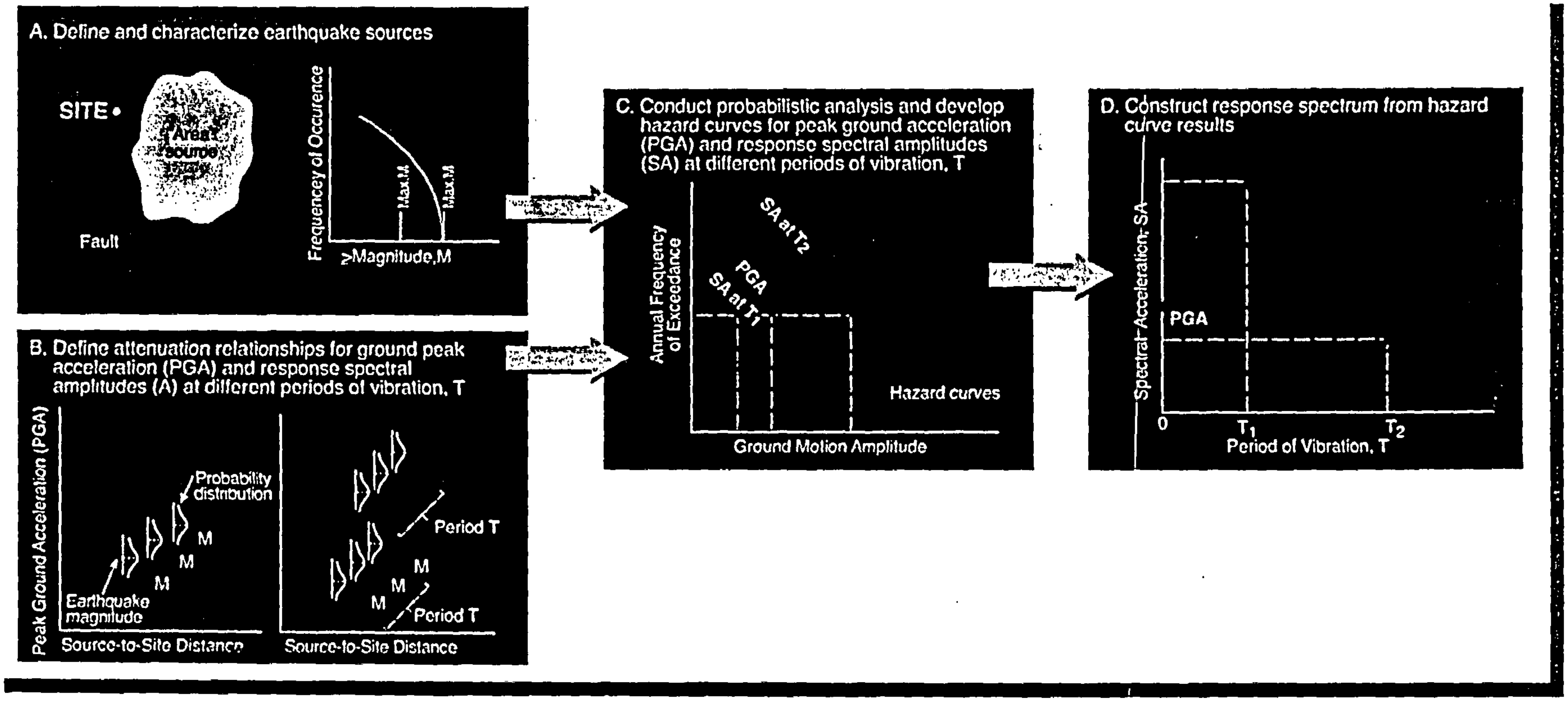

Grand Gulf ESP
Ground Motion Analysis
Update Geologic, Seismologic and Geophysical Data Base
Review EPRI Seismic Source Model
Perform Sensitivity Analysis, as Required
Update EERI Seismic Source Model
New Madrid
Saline River
EPRI
Update EPRI Ground Motion Models
Update EPRI PSHA Code
QA EPRI PSHA Code
Perform Updated PSHA
Perform Site Response Analysis
Develop SSE Spectrum
Site Investigations
Perform Site Geotechnical Investigation
Develop Soil Parameters
Site Response Parameters
Liquefaction Parameters
Perform Liquefaction Analysis

Illustration of PSHA Process



GGNS SEISMIC HAZARD RESULTS FOR
Sa(5 Hz) FOR ROCK SITE CONDITIONS

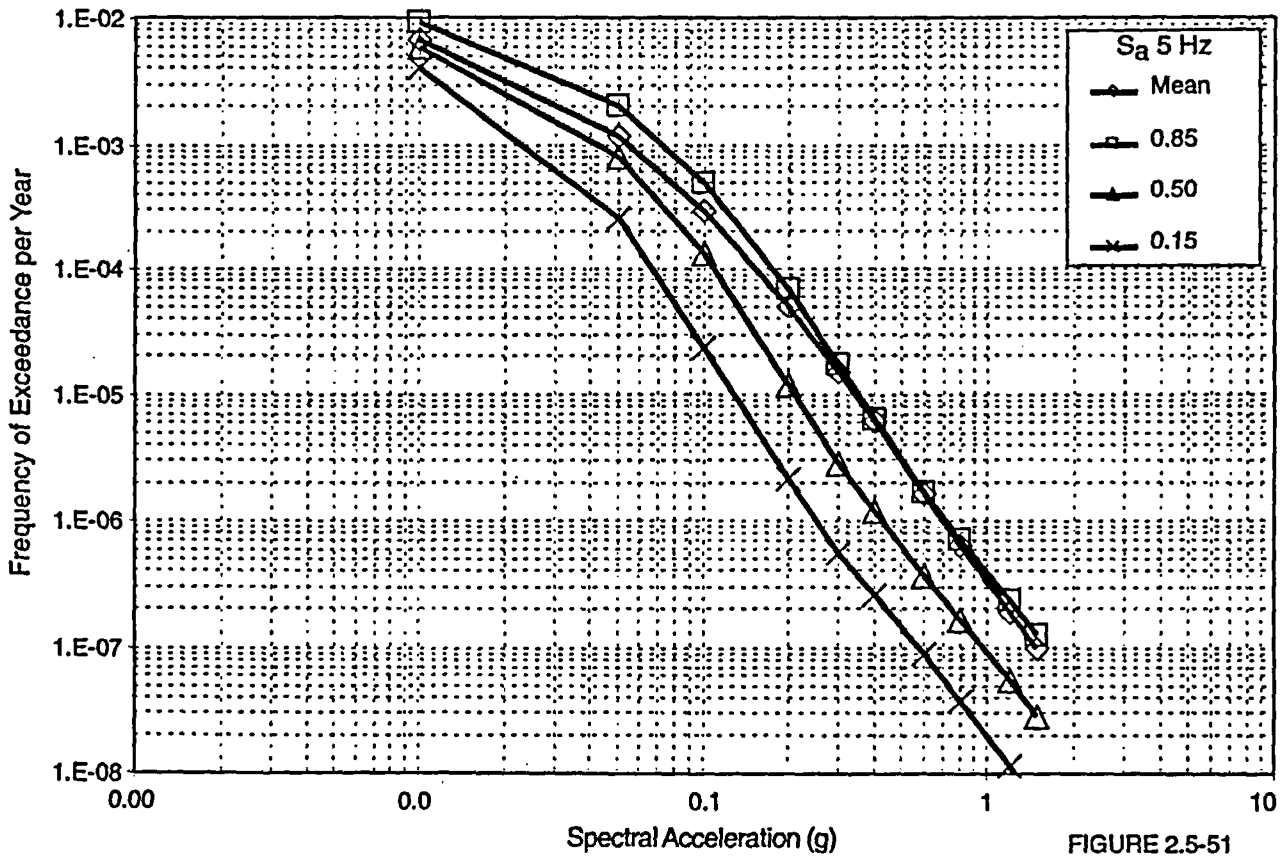


FIGURE 2.5-51

DEAGGREGATION FOR HIGH FREQUENCY (Sa(5-10Hz)) GROUND MOTIONS AND AT THE GGNS ESP SITE

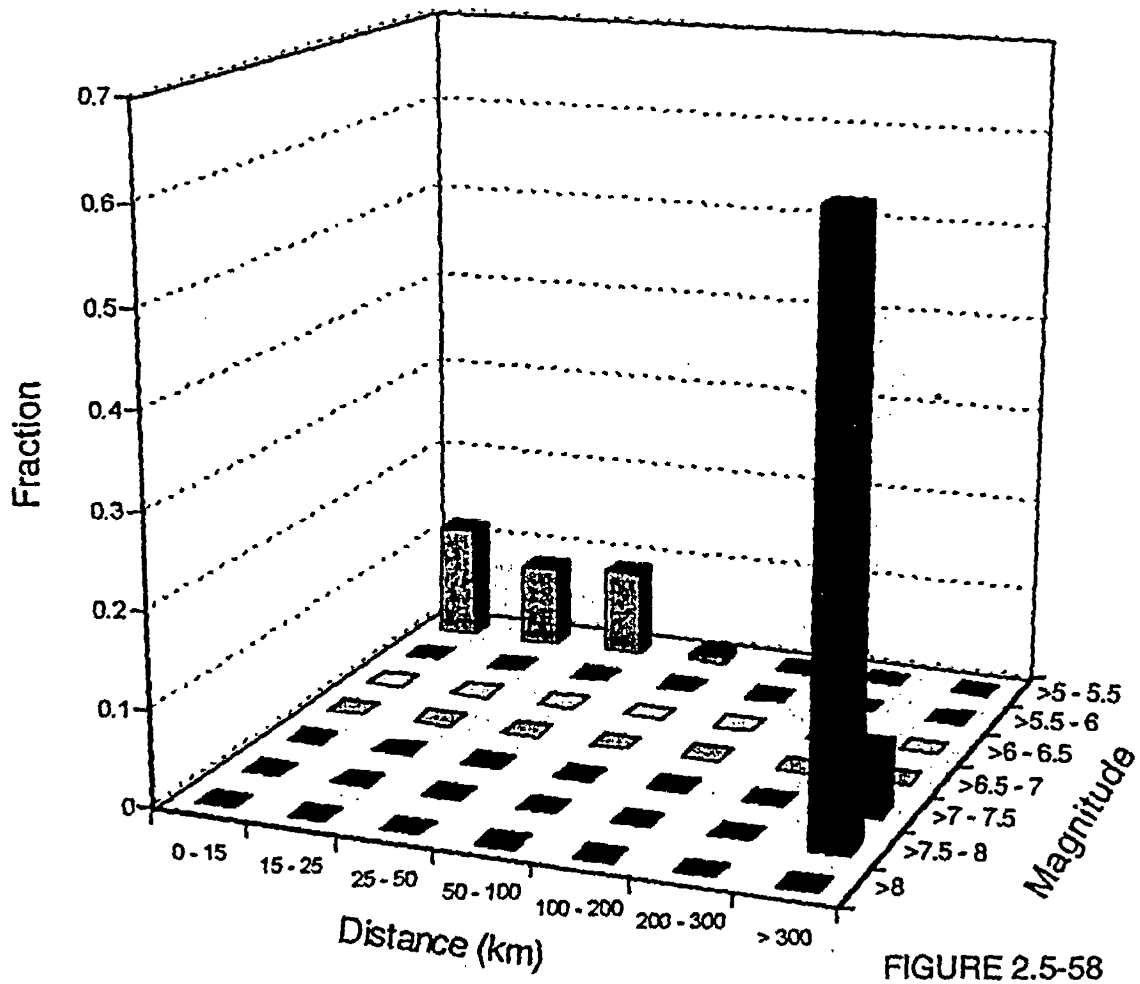
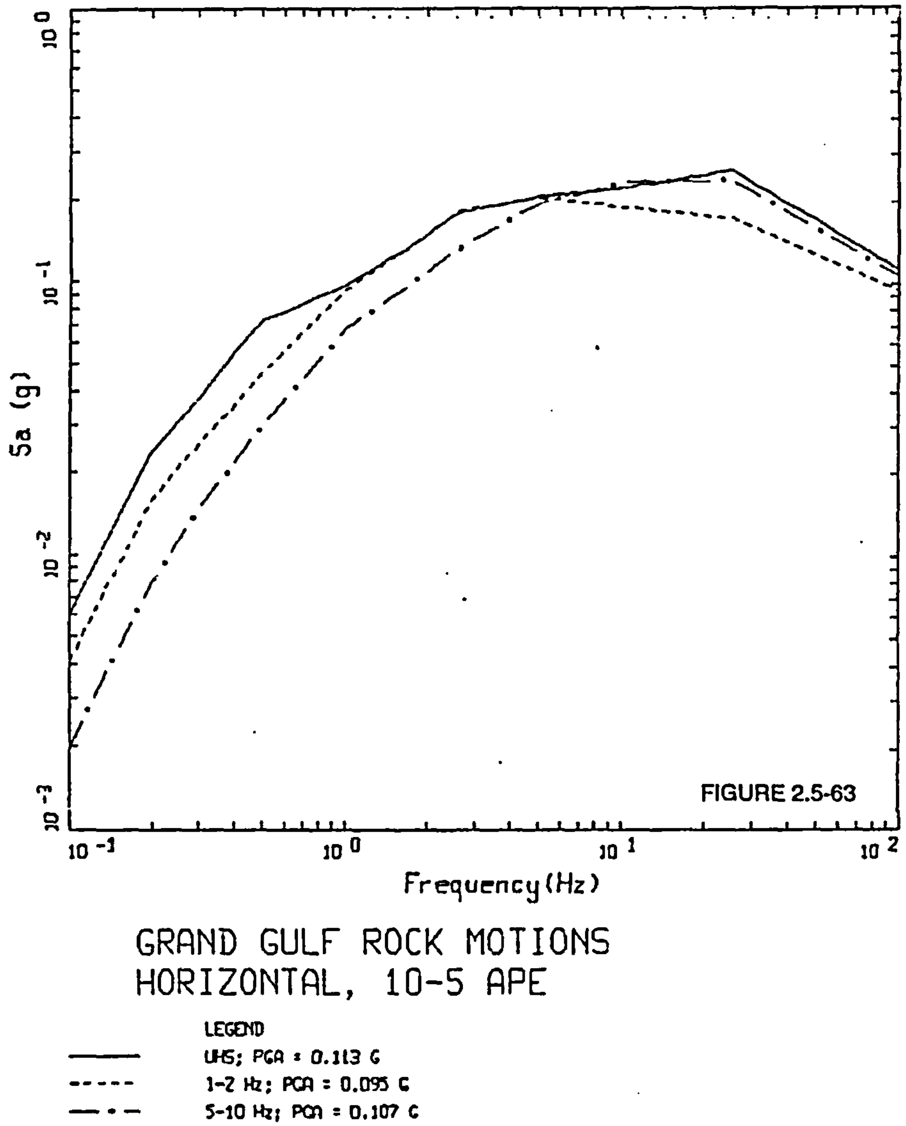


FIGURE 2.5-58

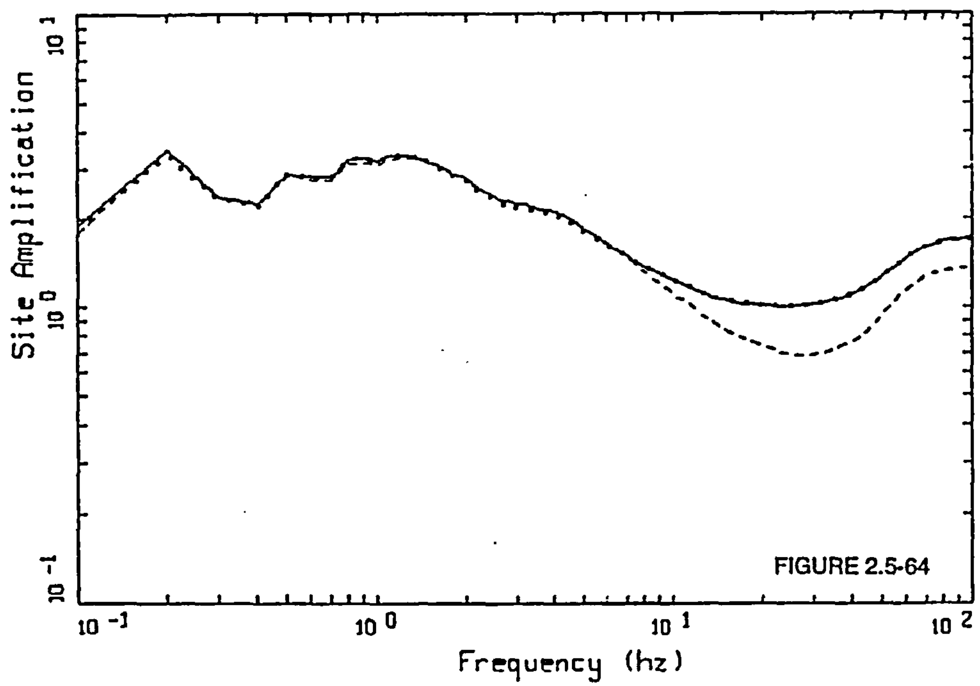
Controlling Earthquakes

Frequency Range (Hz)	M_C	D_C
1 – 2.5 (All Distances)	7.55	386.4
1 – 2.5 (Distances > 100km only)	7.68	470.0
5 – 10	6.94	175.5

MEDIAN 10-5 APE HARD ROCK UHS AND CORRESPONDING SCALED 1 TO 2 HZ AND 5 TO 10 HZ SPECTRA, EXTENDED TO 0.1 HZ FOR SITE RESPONSE ANALYSES.

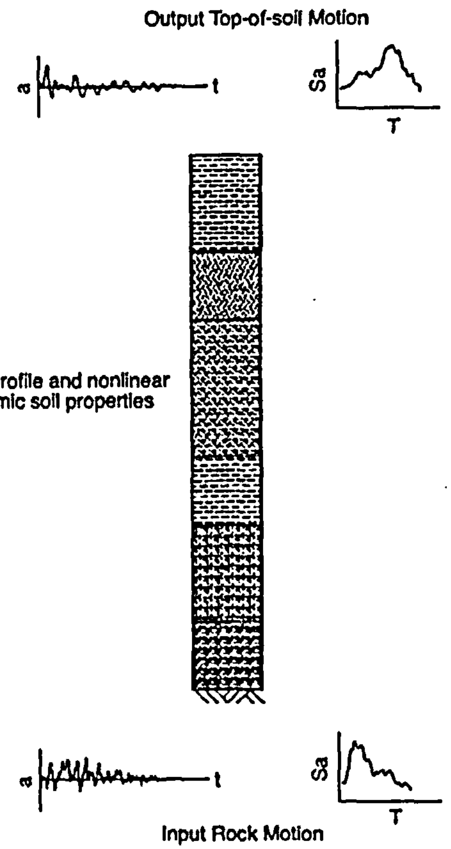


MEAN TRANSFER FUNCTIONS
CORRESPONDING TO 1 TO 2 HZ AND 5 TO
10 HZ SCALED SPECTRA (FIGURE 63) AND
ENVELOP: TOP OF LOESS

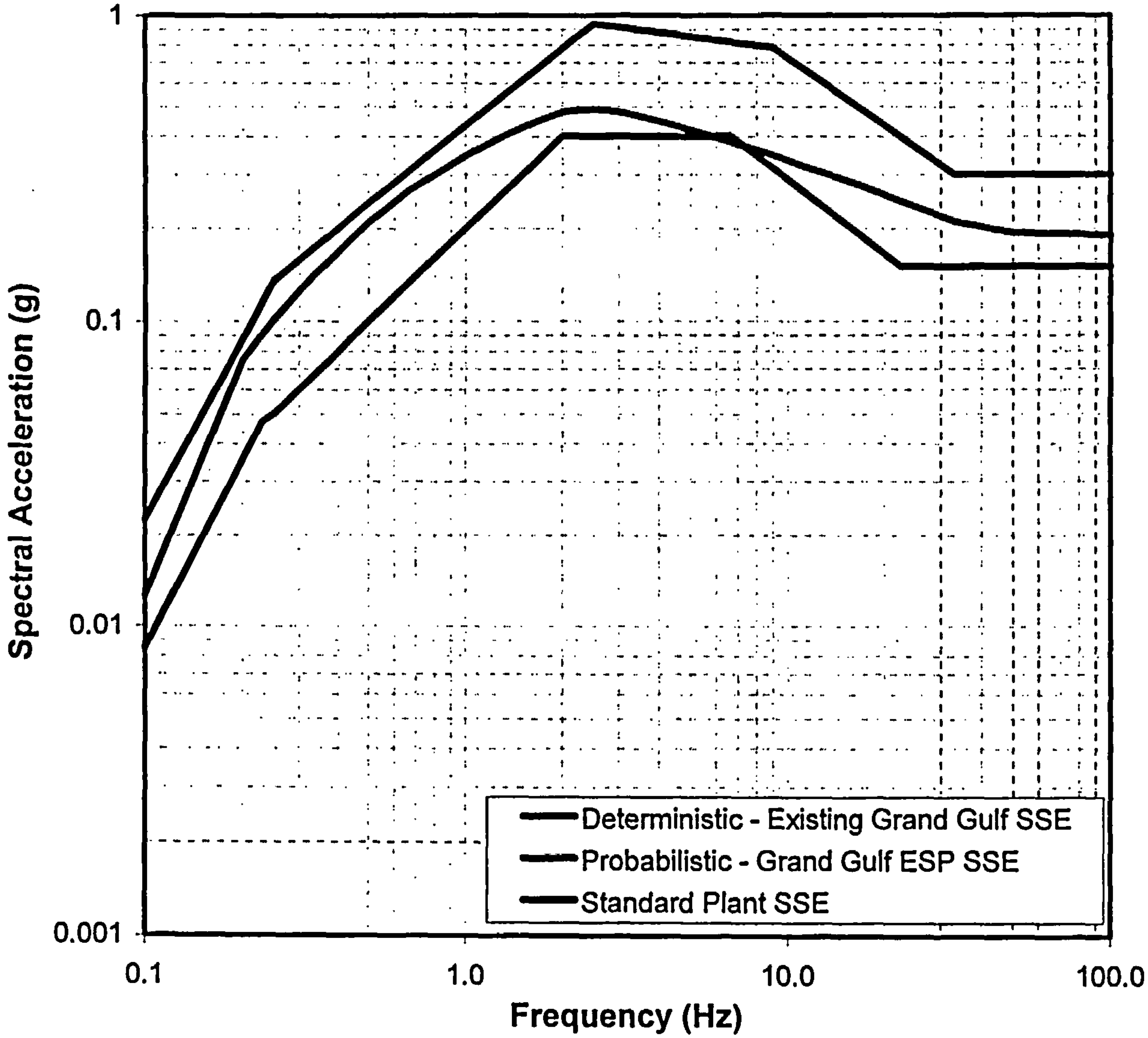


TOP OF LOESS
MEAN AMPLIFICATION

LEGEND
ENVELOPE
MEAN 1-2 HZ
MEAN 5-10 HZ



Comparison of SSE Ground Motions



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Emergency Planning

- Application based on Major Features option (§52.17(b)(2)(i))
- Proposed location is on site supported by an integrated, operational emergency plan and organization re: GGNS Unit 1
- Full advantage taken of existing On-site and Off-site plans, alert systems, etc.

Entergy

DSER Open Items

- 23 Open Items
- Responses due June 21
- Status matrix attached

DSER OPEN ITEM MATRIX

Item	OI No.	DSER Section	Subject	DSER Open Item Proposed Resolution
1	2.1-1	2.1.2.3	Demonstrate that the applicant has control over the exclusion area or has a right to obtain such control.	Discussing with Staff
2	2.1-2	2.1.3.3	Include weighted transient population data in Tables 2.1-1 and 2.1-2 of the SSAR.	Weighted transient population will be included in the SSAR for distances from 10 miles out to 30 miles from the ESP site; Tables 2.1-1 and 2.1-2 of the SSAR will remain as is for "permanent" resident population data. The 0 – 10 mile transient population distribution is provided in the ESP application Part 4 EPI section, and will not be revised. The response will provide information sufficient to show compliance with Part 100 population center distance criteria and RG 4.7 population density (criteria applies, explicitly for areas out to 20 miles, as noted in DSER).
3	2.3-1	2.3.1.3	Provide acceptable 100-year return period maximum and minimum dry-bulb temperatures.	100-year return maximum and minimum temperatures will be provided in SSAR Section 2.3.2.1.2.
4	2.3-2	2.3.1.3	Provide the 48-hour probable maximum winter precipitation (PMWP) that can be used with the 100-year snowpack to define the extreme winter precipitation load site characteristics.	The SSAR will be revised to provide the 48-hour PMWP to be used with the 100-year snowpack to determine extreme winter precipitation design loads.
5	2.3-3	2.3.1.3	Identify an additional ultimate heat sink (UHS) meteorological site characteristic for use in evaluating the potential for water to freeze in the UHS water storage facility.	Response will specify the number of degree Fahrenheit-days below freezing as a site characteristic based on 72 yrs of data.
6	2.3-4	2.3.1.3	Identify a 3-second gust wind speed that represents a 100-year return period for the ESP site.	Response will specify a 3-second gust wind speed as a site characteristic.

Item	OI No.	DSER Section	Subject	DSER Open Item Proposed Resolution
7	2.3-5	2.3.5.3	Identify x/Q and D/Q values for the nearest milk cow and meat cow.	Atmospheric dispersion and diffusion coefficients for the nearest milk and meat cows will be identified in the response, and appropriate sections of the SSAR and ER will be revised.
8	2.4-1	2.4.1	Provide corrected UTM coordinates of the center of the proposed powerblock and/or revise Figure 2.1-1 in the SSAR to show the correct location and coordinates.	Corrected UTM coordinates of N3,543,261 meters and E684,018 meters will be indicated in the response, and will be shown on relevant drawings and in the text of the SSAR, ER and EPI parts of the application.
9	2.4-2	2.4.1	Provide information on the elevation (depth) of the zone that could be disturbed by the construction of the new facility, such that the local subsurface environment and its alignment with the existing hydrogeological environment could be altered.	Information to be provided; primarily a COL issue
10	2.4-3	2.4.1	Provide more details regarding dewatering wells to allow the staff to determine whether ground surface subsidence could affect safety-related structures and piping. Provide information related to the location of dewatering wells in relation to safety-related structures and associated monitoring of the ground water table.	Information to be provided; primarily a COL issue
11	2.4-4	2.4.1	Provide more details regarding the floodwater level estimation, including data and methods used to arrive at the floodwater elevation of 133.25 feet MSL.	Information will be provided
12	2.4-5	2.4.2	Revise and present estimates of the local intense precipitation as shown in Table 2.4-7 of the SSAR using the guidelines of HMR 52.	Response will provide revised local intense precipitation values for the site based on the methodology of HMR 52.
13	2.4-6	2.4.13	Provide further description of the rationale for considering Sr-90 and Cs-137 in the	New analysis performed

Item	OI No.	DSER Section	Subject	DSER Open Item Proposed Resolution
			radionuclide transport analysis.	
14	2.4-7	2.4-13	Factors, such as soil, sediment, and rock characteristics; adsorption and retention coefficients; ground water velocity; and distances to the nearest body of surface water are important to hydrological radionuclide transport. Provide these site characteristics from onsite measurements.	Information to be provided
15	2.5-1	2.5.2	Provide justification for not updating the background seismic source for the ESP site.	Justification to be provided
16	2.5-2	2.5.2	Provide and evaluate the criteria or weights used for ranking of model clusters and the judgments involved in balancing data consistency and adherence to seismological principles in the EPRI 2003 ground motion evaluation. Explain how recordings from a single earthquake can provide well-resolved values of both crustal quality factor (Q) and site kappa, also explain why the Q value of 317 at 1 Hz is much lower than values found in other studies of eastern North American earthquakes, and why other studies find less frequency dependence of Q in the eastern North American than in the western North American.	Generic ESP issue with EPRI work. Generic response submitted on Dominion docket. Generic information will be provided.
17	2.5-3	2.5.2	Provide an explanation why the magnitude and distance bin corresponding to the SRSZ makes no contribution to the hazard deaggregation.	Explanation to be provided
18	2.5-4	2.5.2 & 2.5.4	Provide justification on applying the generic shear wave velocity profile derived from Memphis area to the ESP site and on its applying kappa value derived from ground	Justification to be provided

Item	OI No.	DSER Section	Subject	DSER Open Item Proposed Resolution
			motion observation on the Mississippi embayment in the sensitivity test.	
19	2.5-5	2.5.4	Provide the basis for the selection of values of BE, UB, and LB and other parameters for the base case profile.	Information to be provided
20	13.3-1		Provide responses to the following issues related to State and local emergency plans:	NA
	a	13.3.3.7	Describe the communications arrangements with fixed and mobile medical support for the State of Mississippi and with mobile medical support for Claiborne County.	No new information to be provided; resolve at COL
	b	13.3.3.8	Describe the dissemination of information regarding the special needs of the handicapped to the general public in the State of Louisiana on a periodic basis.	No new information to be provided; resolve at COL
	c	13.3.3.11	Describe the means for the use of radioprotective drugs for emergency workers and institutionalized persons within the plume exposure pathway EPZ in the States of Louisiana and Mississippi whose immediate evacuation may be infeasible or very difficult.	No new information to be provided; resolve at COL
	d	13.3.3.12	Describe the State of Mississippi's guidance related to bioassay or whole body counting for determining offsite emergency worker doses from the uptake of radioactive material (e.g., ingestion)	No new information to be provided; resolve at COL
	e	13.3.3.13	Clarify the apparent inconsistencies between the LPRRP and Enclosure I to Attachment 2 to LPRRP Supplement II regarding the description of contacts and arrangements for local and backup hospital services.	No new information to be provided; resolve at COL

Item	OI No.	DSER Section	Subject	DSER Open Item Proposed Resolution
	f	13.3.3.13	Describe the special radiological capabilities for the hospitals listed in Tab 2 of LPRRP Chapter 10.	No new information to be provided; resolve at COL
	g	13.3.3.11	Provide information regarding the availability and capacity of school buses or other transportation methods, the availability of drivers, and the process for mobilizing transportation for students, residents, transients, and special needs populations in Claiborne County and Tensas Parish during an evacuation (e.g., evacuations may require a single trip or they may require return trips).	No new information to be provided; resolve at COL
	h	13.3.3.11	Provide a map(s) illustrating evacuation/shelter areas in the State of Mississippi for the MREPP Annex O.	No new information to be provided; resolve at COL
	i	13.3.3.11	Information on shelter capacities is not contained in, and therefore, not evaluated by FEMA under the LPRRP. Provide sheltering capacities for relocation centers in the State of Louisiana or documentation of evaluation performed to determine whether adequate capacity exists.	No new information to be provided; resolve at COL
21	13.3-2	13.3.3.8	Describe in Part 4 the applicant's responsibility for making information available to offsite authorities for distribution consistent with MREPP Annex J.	No new information to be provided; resolve at COL
22	13.3-3	13.3.3.9	Describe the adequacy of the TSC, OSC, and EOF and related equipment used to support emergency response activities, to address, with specificity, such facility and equipment features as location, size, structure, habitability,	No new information to be provided; resolve at COL

Item	OI No.	DSER Section	Subject	DSER Open Item Proposed Resolution
			communications, staffing and training, radiation monitoring, instrumentation, data system equipment, power supplies, technical data and data systems, and record availability and management.	
23	13.3-4	13.3.3.11	Address whether discussions on results of the 2003 ETE study were held with officials from the States of Mississippi and Louisiana involved in implementing traffic management plans, according to Appendix 4 to NUREG-0654/FEMA-REP-1 and NUREG/CR-4831, or provide confirmation that State reviews were not required based on discussions with appropriate officials.	No new information to be provided; resolve at COL