Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Subcommittee on Early Site Permits

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Wednesday, September 7, 2005

Work Order No.: NRC-581 Pages 1-*

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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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SUBCOMMITTEE ON EARLY SITE PERMITS

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WEDNESDAY,

SEPTEMBER 7, 2005

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ROCKVILLE, MARYLAND

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The subcommittee 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.

SUBCOMMITTEE MEMBERS:

DANA A. POWERS, Chairman

MARIO V. BONACA, Member

THOMAS S. KRESS, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER

ACNW MEMBER:

WILLIAM J. HINZE, Member

ACRS/ACNW STAFF:

MEDHAT EL-ZEFTAWY

PANELISTS:

DON ANDERSON

ALLIN CORNEL

EDDIE GRANT, Exelon

KATHERINE HANSON

BOB KENNEDY

MARILYN KRAY, Exelon

WILLIAM MAHER

THOMAS MUNDY, Exelon

CARL STEPP

ROBERT YOUNGS

NRC STAFF:

TOM CHENG

BRAD HARVEY

CLIFF MUNSON

JOHN SEGALA, Office of Nuclear Reactor Regulation

A-G-E-N-D-A

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

8:31 a.m.

CHAIRMAN POWERS: The meeting will now come to order.

This is a meeting that would ACRS Early Site Permits Subcommittee. I'm Dana Powers, the Chairman of the Committee. The other ACRS members in attendance are Mario Bonaca, Tom Kress, William Shack, Jack Sieber. Graham Wallis has the intention of joining us later in the day.

We also have the benefit of Bill Hinze from the ACNW attending and participating in this meeting. Welcome, Bill. Glad to have you here.

As you're all aware this is our third meeting dealing with early site permits. For today's meeting the Subcommittee will review and discuss the NRC's Staff's draft safety evaluation report regarding the Clinton early site permit and the Applicant's submittals for the ESP.

The Subcommittee will, as usual, gather information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full Committee.

Dr. Mel El-Zeftawy is the cognizant ACRS Staff engineer for this meeting.

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 August 17, 2005.

A transcript of this meeting is being kept and this transcript will be made available as stated in the *Federal Register* notice. To prepare this transcript 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.

This third permit is a little bit different from the ones that we've looked at in the past. For one thing we're not going to have to look at any depth at the direct effects of hurricanes. We will, however, delve somewhat deeper in seismic issues, again looking further at the New Madrid seismic zone.

The organization of this meeting is to treat the non-seismic aspects of the Applicant this morning and devote this afternoon to looking at the seismic issues and the rather novel approach to seismic embodied in this application.

In this time of what I would call all Katrina all the time news, I can't resist commenting on some issues pertinent to other early site permits that have come up.

I note that Gary Yohe of Wesleyan University indicates in his study that hurricanes are becoming stronger and longer lasting than in the past.

Chris Landsea of the National Oceanic and Atmospheric Administration indicates hurricane activity is in a natural cycle of increasing intensity.

William Gray of the Tropical Meteorology Project argues that the past 35 years has been a mild and unusual hurricane activity, but we may be entering an era of greater than normal hurricane activity.

Staff, however, clings to its belief that past hurricane activity can be, in fact, inferred directly to the future in assessing these early site permits.

With that introduction, I think we turn now to -- unless other members have introductory comments they would like to make? Then we will turn to the Clinton early site permit. Again, it's not very dependent on hurricanes. And understand, Marilyn Kray, you will begin the discussion. Welcome.

MS. KRAY: Yes, sir. Thank you.

CHAIRMAN POWERS: Tell us about Clinton.

MS. KRAY: Thank you. And good morning. My name is Marilyn Kray. I'm the Vice President of Project Development for Exelon Nuclear.

We appreciate the opportunity to be here with you this morning. We recognize today's meeting is a milestone, not only for Exelon within the scope of our project, but also as within the Dominion and the Grand Gulf meeting it is a milestone for the industry within the scope of the new plant considerations.

We acknowledge the significant effort taken by the Staff to result in the issuance of both the draft 6 evaluation report and its supplement. If you turn to the next slide, Exelon will be presenting the information in the following order:

We will provide with an introduction of the Exelon team members as well as our extended project support organization.

We will also provide overall information regarding our ESP applications form and content and definition of the applicant.

With respect to the site, we'll share with you a perspective at the state and county level, then honing in down to the actual site layout.

We'll share with you also the project objectives; that is why Exelon has taken on this project and how it fits with our overall strategy.

The overview of the site safety evaluation report and the emergency preparedness will also be provided.

And then lastly we'll address the safety issues. As you mentioned, however, we'll be reserving the seismic issues for the afternoon session.

The Exelon project team, if I could just take a minute to introduce. I served as the project executive sponsor. To my left is Tom Mundy, he is the project manager. To my right is Eddie Grant, you'll be hearing from him. He was responsible for both the safety and the emergency preparedness aspect. And then Bill Maher who is the back of the room has been our lead for the environmental issues.

With that, I'll turn it over to the project manager Tom Mundy.

MR. MUNDY: Thanks, Marilyn.

I just want to spend a moment introducing the project support team, the individuals that were the primary developers of the application and have been the primary means of support for the NRC review of the application.

Exelon's prime contractor in the development of RESP application was CH2M Hill. They were also responsible for the preparation of the environmental and redress portions of the application, geotechnical information and the emergency planning information provided in our application.

Subcontractors to CH2M Hill supporting the development of the application are WorleyParsons, the former Gilber Commonwealth entity, then Parsons now WorleyParsons.

Responsible for the site safety analysis report contained within our application, Geomatrix Consultants was responsible for the seismic related information.

As part of our project team CH2M Hill retained a Seismic Board of Review responsible for the review of all seismic and geotechnical information prepared by CH2M Hill and Geomatrix. That board is chaired by Dr. Carl Stepp. The other participants to that board are Drs. Allin Cornel, Dr. Walt Silva and Dr. Kevin Coppersmith. Some of those individuals will be here today for the afternoon session. At that time I'd like to reintroduce them. We also have some other individuals here this morning that supported our seismic effort and seismic related information. I'll introduce them this afternoon.

There are a number of other subcontractors used by CH2M Hill that played a smaller role, particularly in the site field exploration work, the geotechnical information. I won't list them, but there was a number of other supporting groups.

Exelon retained directly RPK Structural Mechanics Consulting to support our seismic review effort, particularly around a performance-based methodology.

We also utilized the services of Sargent and Lundy to perform an independent technical review of all information in the application excluding the seismic and geotechnical information. So they were our independent reviewer for the application before it was submitted to the NRC.

Geotechnical information in the application was independently reviewed by the Department of Energy's Idaho Geotechnical branch, Idaho National Laboratory Geotechnical branch.

And the seismic and geotechnical information was also independently assessed by our Seismic Board of Review.

And lastly, legal counsel support has been provided by Morgan Lewis.

Let me introduce a few people that are today in support of this morning session.

From Morgan Lewis is our attorney Steve Frantz.

From WorleyParsons we have John Ioannidi the site safety analysis report project manager and task leader responsible for the preparation of the SAR.

We have Mike Cambria also a task leader for the preparation of the site safety analysis report and the technical leader for the rad consequences analysis.

And we also have Dr. Bernie Holcomb from CH2M Hill, our environmental report lead responsible for the preparation, development of the environmental report.

We have a number of other individuals here, but their participation relates to the afternoon session. I'm going to hold introductions of those individuals until that time.

And that we're moving to slide 5, and I'd like to turn it over to Eddie Grant.

MR. GRANT: All right. Good morning. My name is Eddie Grant. As Tom mentioned, I was the lead for the site safety information and for the emergency planning.

What I'd like to do this morning is lead you through some of the general information related to the early site permit. As part of the background certainly you're aware that the early site permits are submitted in accordance with Subpart A of Part 51. The application content is in according §51.17. And our particular application contained five parts, as indicated here in this slide:

The administrative information in according with 50.33 which identifies the applicant and its relationships.

The major portion that you would be interested in the site safety analysis report, where we've identified primarily the site characteristics and done any analysis, and provided that analysis.

The emergency planning information that was provided to identify what particular situations are available there at the site for providing emergency response.

We also had an environmental report that was a complete report that addressed the construction and operation of a future plant.

And then optional piece under 52.79 is to provide a site redress plan, which Exelon did choose to do. Our application included a site redress plan, and that addresses the information that would occur or how we would replace the site or restore the site should we begin to do any work under a limited work authorization that would be authorized under the ESP and then decide not to continue for some reason. This would identify what we would do to restore the site to its original condition.

I'd like to start on a wide level, statewide here in this case. State of Illinois, the site location is near the city of Clinton in central Illinois on Clinton Power Station property.

AmerGen owns this property and it's approximately 13,000 acres. There's plenty of room for additional stations. It was originally designed for two units. Clinton Power Station was going to have two units. A second unit was subsequently canceled and therefore, there's available space and/or water supplies there for that unit.

The Applicant is Exelon Generation Company, a limited liability corporation, who is a wholly owned subsidiary of Exelon Corporation. And as indicated above, AmerGen which actually owns the property then is a subsidiary of Exelon Generation.

As you can see, I indicated that this is in the center of the state. I'm not sure how well you can read these, as they're fairly small. But off to the southwest there is the city of Springfield. Directly south of Clinton is Decatur. To the right is Champaign Urbana. And north of the site and the city of Clinton is the Bloomington normal area.

CHAIRMAN POWERS: Can you give me specific distances?

MR. GRANT: I can. Decatur is 22 miles.

CHAIRMAN POWERS: Is that 22 miles to the city center or to the boundary?

MR. GRANT: I'm not certain of that. I believe, actually, that these are distances from the site and they would be not a lot of difference since the site boundary is about a half mile --

CHAIRMAN POWERS: There could be a substantial difference between the boundary of the city, the city limits of the city and the center of the--

MR. GRANT: The Decatur city boundary, yes. I'm not certain. I do not know of these distances. Decatur, however, the distance again approximately 22 miles. Bloomington is then approximately equal distance, it's almost 22 miles north. Normal is just beyond the Bloomington area there, so they make up a metropolitan area. Champaign Urbana is 40 miles to the east, Urbana a little bit further. Springfield is 45 miles to the southwest.

There are airports at Bloomington, Decatur, Springfield, Champaign and Peoria, Peoria being a little further way there to the northwest.

This gets us in a little closer and provides a 50 mile EPZ, ingestion pathway EPZ circle is the outer dotted circle. As you can see, there are a few urban areas within the 50 mile area. Some of those we've discussed already. The one that we've mentioned so far that's outside of the 50 miles would be Peoria, although it's just barely outside.

Some of the populations in these areas: For instance, Bloomington is around 65,000 people; Champaign is about the same size, 65/68,000; Urbana adds to that as they're just east of Champaign, another 36,000; Springfield is approximately 113,000. They're the largest metropolitan area in that circle. Peoria is about the same size as that, another 113,000. But a large portion of this 50 mile ingestion EPZ has a population density of less than 20 people per square mile. Were it not for these large metropolitan areas it would very low population.

The average including those is approximately 97 people per square mile. So less than a 100.

One thing or one item I would point out here is a railroad that does run near the site. And it runs along this highway 54 near the site, which is here and then on up highway 54. And that is the nearest railroad to the site.

MEMBER SIEBER: That's the old Wabash Railroad?

MR. GRANT: It was the --

MEMBER SIEBER: Or the Illinois Central?

MR. GRANT: -- Illinois Central, correct. It's now Canadian National, I believe. They changed over and they call it the Gilman line for some reason. I'm not sure why that is.

CHAIRMAN POWERS: Will you in the course of the presentation get into your population projections?

MR. GRANT: I did not have a plan for that, but we can discuss that if you would like.

CHAIRMAN POWERS: Yes. I was confused about how it was done.

MR. GRANT: Okay.

CHAIRMAN POWERS: I understood that for

the population centers out away from the site, at some distance that you used Census data to do the projections. But in closer you used projections from the University of Illinois for the counties?

MR. GRANT: I do not recall using the University of Illinois. My recollection is that it was all based on Census data that we had taken the last two sets and projected using the differences there.

You may recall that it indicated that we're actually looking at a drop in the Census in the area.

CHAIRMAN POWERS: That is what I found remarkable, since all the population centers went up and yet in the local area things went down. And I didn't quite understand why that would be.

MR. GRANT: Well, one possibility for that is that most of the area is farming community. And as the farms get larger, combined operators, there are fewer people to operate those farms so the density would drop.

Bill, can you help me with that? Do you have any information on the population distribution information?

MR. MAHER: This is Bill Maher with Exelon

Corporation.

Part of the population projections deals with some of the manufacturing capabilities within the area of the site. Recently what has fed into the population projections is a drop in certain large employers within that area, and that feeds into the population projection drop.

MR. GRANT: Thank you.

CHAIRMAN POWERS: I guess what I'm struggling with is I don't understand where you got the data on the population drop. And I had thought, apparently incorrectly, that you had used some stuff from the University of Illinois.

MEMBER SHACK: Actually, it's Illinois State University.

CHAIRMAN POWERS: Okay. And so I said okay, that's a different source but I don't know too much about source. And things like you're talking about changing employments of major industrial concerns or whatnot; I'm left confused on why I'd have all these population centers with not huge, but some growth over the next 40 years and locally it's dropping down. I just don't know how you got that number.

MR. GRANT: Well, it depends a little bit on what you refer to as locally. If you're talking about within the ten mile EPZ, the next slide does provide a little bit of information there. Those cities within ten miles are very small cities. We're talking cities of 200, 300, 400 --

CHAIRMAN POWERS: And 80 going to 78 and things like that.

MR. GRANT: Right.

CHAIRMAN POWERS: I would have expected overlaying any trends in the way we do agriculture in this country or employment, if you would, have a trend of suburbanization of major population centers on top of it. And so I came away saying I don't know how they got these numbers.

MR. GRANT: I do not have an answer for you. On that I would have to look into it further.

CHAIRMAN POWERS: Okay. Please continue.

MR. GRANT: All right. Going on then to slide 8, this does take a look at a little closer, ten mile EPZ in this case. As I indicated, it is mostly rural. You'll see to the left there a little bit of gain in population, and it's the city of Clinton. To the west Dewitt is the little blue square slightly north and mostly east of the site. Weldon is southeast there and the little city of Wapella to the northwest.

As I indicated earlier, these cities are very small. Dewitt is the closest city. It has a population of approximately 200, and it's about 2½ miles from the site. So it's fairly close.

Weldon to the southeast is 450 people, and it's about 5½ miles from the site.

Clinton at 7 miles is the largest within the ten mile area, and it has a population of approximately 7500.

Within the ten mile circle there is a population currently or at the last Census of approximately 12,000 people.

And as indicated by the light color there, most of the areas I indicated before is less than 20 people per square mile. You really only get in those smaller cities any other population densities, higher population densities.

CHAIRMAN POWERS: You have in your text a treatment of transients and, by in large, they appear in the winter months to be people that work at companies here but don't live within the ten mile zone. But you have thus curious phraseology in there that says these are conservatively treated as transients. Conservative relative to what? Ignoring them altogether or --

MR. GRANT: Certainly.

CHAIRMAN POWERS: Okay. I just read the word and I didn't understand conservative relative to what.

MR. GRANT: Okay. Now this, as you indicated in the close in area within the ten mile is where we are projecting a drop in the population. If I remember correctly, there was a slight increase in the 50 mile EPZ, but not significant.

CHAIRMAN POWERS: Not major.

MR. GRANT: But still an increase over there. And that would account for, as you indicated, the metropolitan areas and the increases that would occur there. This would, again, mostly be farming communities and small industries.

I'd like to move in a little closer to the site. This particular one shows the site area. The boundaries run roughly parallel to the two arms of the lake there. And the AmerGen property, as I indicated before, is just under 14,000 acres.

The Clinton Lake takes up about almost 5,000 acres of that, 4895 acres. This lake was constructed specifically to provide cooling for the Clinton Power Station. The dam in the lower left there was constructed by Illinois Power. It dams up the Salt Creek, which is the larger -- this particular area here is Salt Creek. And the other arm is the North Fork of Salt Creek. It just below the confluence of those two arms where they come together and such that you get this U shaped lake.

The lake goes approximately 14 miles back up the arm there of Salt Creek and approximately 8 miles up the North Fork.

There are three highways that cross the property. The largest one there is highway 54 that I mentioned before, this line here. Highway 10 comes across the southern boundaries. And highway 48 is this north/south area here. They all cross the property.

A couple of other major highways in the area. Back over here in Clinton is a highway 51 that's heavily traveled. And you see up here is an interstate highway, 74.

As I also had previously indicated that the one railroad that it runs closest to the site runs roughly parallel to highway 54 in the area of the site. There is another railroad back down here, but it's not used much and is quite a bit further from the site.

CHAIRMAN POWERS: In the course of your

planned presentation will you discuss any of the details of the dam construction?

MR. GRANT: I can tell you yes. We'll see if it is sufficient detail for your purposes, but I will provide some details there.

CHAIRMAN POWERS: Just a question. I confess a substantial ignorance in dam construction.

MR. GRANT: All right. There are -- well, that's probably sufficient.

I would point out a few other items on this slide. As it indicates here, normal pool elevation for this particular lake is about 690 feet. I will identify some other elevations later that will give you some relationships there.

The discharge flume from the site; the water comes out of the plant and runs along this item here, which is the discharge flume, such that the water then must travel back down this direction to get out the dam. And is unlikely to flow back up stream here to go into the intakes, which are on this arm of the lake.

The other thing I would point out is the ultimate heat sink. Now that's the ultimate heat sink for the Clinton Power Station. It would also provide makeup water for the ultimate heat sink, which would be a cooling tower if we need one. It depends on the design that we decide to build, which we have not yet decided. But if we do require an open heat sink, then the Clinton Power Station open heat sink would provide makeup water for that cooling tower, which is the type of ultimate heat sink that we would use.

The ultimate heat sink was originally constructed for both Units 1 and 2 of the Clinton Power Station. With Clinton Unit 2 being canceled, there is quite a bit of capacity available there. And we've identified that there is sufficient for all of the designs that we are looking at.

MEMBER SIEBER: How much flows are in those creeks?

MR. GRANT: Flow in the creeks? That was in the application but I did not pull those numbers out to bring with me.

MEMBER SIEBER: That's the major factor in the heat capacity of that system is how much flow.

MR. GRANT: Certainly. Again, I would say that there was -- the original purpose for the lake was for two units, Clinton Power Station 1 and 2. And we did look at the heat capacity. We believe that there is plenty for the additional units that we're looking at depending on the designs that we use. But of all those that we looked at and the plant parameter envelop methodology that we used that had the highest value for heat load. But I don't remember the numbers.

MEMBER SIEBER: I would presume, not to belabor the point, since this summer has been pretty dry that the flow isn't very high. Because in effect what that lake does is collect rain water.

MR. GRANT: Correct. I'm not sure what you mean or how that works.

MEMBER SIEBER: Well, if it collects rain water and it doesn't rain, that means there's no flow.

CHAIRMAN POWERS: I got the impression that was the reason for the change in thermal design for the second plant.

MEMBER SIEBER: Right. Okay.

MR. GRANT: Okay. For the next slide I'd like to move again even a little closer in such that we're now between the two arms of the lake and showing an exclusion area boundary for the specific site. The exclusion area boundary is a 1,025 meters from the center of the early site permit property. And that property or the main footprint for the power block is the large blue rectangle. It does show blue up here? Yes. Okay.

The other rectangle, blue rectangle there to the southwest would be for the normal heat sink cooling towers are projected there. And although it's somewhat unrecognizable just to the southeast of the larger rectangle for the power block footprint there is a small rectangle there as well. And that's where the ultimate heat sink cooling towers would be placed. Just in case you can't see it, it's this little area here that almost looks like a smudge.

We would also build another intake structure about 65 feet from the existing intake structure for Clinton Unit 1.

This yellow line here, what we've done is tried to indicate as had shown that the ultimate heat sink was this area here, and what happens is for Clinton Unit 1 there is a discharge on this side. This is a berm that runs down the length here and the discharge is on this side such that then during an accident situation water runs around this berm and then back to the intake so that there is cooling in that portion while it is moving through that area.

There is also a submerged dam across this point that keeps water from flowing out through the other dam should there be a breach in that dam or some other problem. So that water is held in this piece.

And again, this flow here for the ultimate heat sink for Clinton Power Station.

Again, here you can see the discharge channel very clearly. Where it goes out here, that runs about 3½ miles out to the other arm of the lake to provide cooling.

There would be some switchyard expansion as well. The switchyard is over on this side. This, again, is highway 54 and the railroad runs, again, parallel to that that is closest to the site.

Another shot here to provide a little different perspective and to provide information on the ESP location. The yellow outline here is where we anticipate putting the major structures. This area is where the Clinton Power Station is, this being Unit 1. Here is what would have been Unit 2.

We did look using Unit 2 area but because of the interferences with some of the other existing structures, we decided that it would simpler to simply move back over into this area where there is plenty of open space. When Unit 1 was constructed this was lay down area, so it's already been impacted and it's a pretty flat area.

Back over here again is the ultimate heat sink area and the discharge comes out this way and back down.

MR. HINZE: Excuse me.

MR. GRANT: Sure.

MR. HINZE: Would you do the cooling towers again, the proposed cooling towers where they --

MR. GRANT: This area is much large -- this is all of those areas combined. The major power blocks would be in this portion here. The normal heat sinks would be back towards this side. And the ultimate heat sink would be in this area.

MR. HINZE: Thank you.

MR. GRANT: Again, normal discharge would be back out over here to the discharge channel, but ultimate heat sink makeup would be from the Clinton Power Station ultimate heat sink.

This is just a slightly different view from a different direction. Again, here's Clinton Power Station, the Unit 2 hole, the overlap for the area is here. and, again, wide flat area that was lay down area.

In this I would point out, this is the Unit 1 intake structure. We would be looking at another intake structure in this area here. A berm is not drawn in, but it runs back out this way. Out flow from service water for Unit 1 comes here, and we'd back around here to provide cooling and makeup for ultimate heat sink purposes.

This view is from the north/northwest. You won't find these last two pictures in the application anywhere, but they're provided to help with understanding.

MR. HINZE: Could you give us just a brief idea of the berm construction?

MR. GRANT: I'm sorry.

MR. HINZE: The berm construction.

MR. GRANT: Berm construction. Yes, sir.

Can I hold off on that just a few minutes?

MR. HINZE: Sure.

MR. GRANT: I believe I do have some information on that later that can provide you some information.

At this point, though, that's the brief overview of the site location and the related information around that.

I'd like to take a second and tell you about our project objectives. Certainly the main objective is to reserve the site for future use. I mean, that is the purpose of an early site permit overall. Along with that, though, we wanted to demonstrate the ESP process. As you're certainly aware, this being the third one that you've looked at, this is a new process. We wanted to see that it can work smoothly, that is of value. And so one of the things that Exelon was looking at was to establish the ESP cost and value associated with an early site permit.

We wanted to exercise and test these new processes for early site permits. And later on then, that early site permit would be referenced, hopefully, by a COL application and that interface and see how that interface would work as well.

There are some new methods out there. Part 100 has been revised since the last plant was built. Now it calls for the PSHA and more than using the site historical information. So we wanted to test that method and along with the regulatory guide that goes with it.

We wanted to look at finality. This is kind of a new concept with regard to plants that are not yet constructed. Getting an early site permit is intended to establish finality on certain issues ahead of time so that those are resolved and complete. And one interesting point we'll be looking at is when the ESP is referenced then in a COL how that finality carries through.

We wanted to establish a precedent for early site permits. We've seen three of these now and in some areas we are very much alike, and so we expect that the process is repeatable and predictable. But in some areas you've seen differences. And so it will be interesting, not only to this Committee I'm sure, but to the rest of us to see how that proceeds then in the future early site permits.

CHAIRMAN POWERS: Suppose that for reasons unknown to any of us that DeWitt became the yippee haven of Illinois ten years from now and the population screamed up to 10,000.

MR. GRANT: Yes.

CHAIRMAN POWERS: Then what?

MR. GRANT: Well, that would be an impact. I'm presuming that this is a projection beyond the time when the early site permit has been approved.

CHAIRMAN POWERS: Right.

MR. GRANT: Okay. And we've established area demography already under the early site permit. However, under Par 52 when you get into the COL application, 52.79 requires that you take a look at what was established under the early site permit. If there are major differences, those would be required to be addressed in the COL application. So certainly that major difference in demography would be something we would need to look at, both with projects on dose calculations and certainly in the emergency planning area.

With that, I'd like to get into the approach there that was used for the application in the safety area. There was, as I indicated, two sets of documents related to the safety area.

The site safety analysis report. In developing the site safety analysis report we tried to make maximum use of the existing information. We had an awful lot of information based on Clinton Power Station. It is the site that we're trying to get approval for to place an additional site on. So it seemed logical at the time to use as much of that information as we possibly could. This afternoon you'll hear one good example of where we were able to make use of quite a bit of that information.

CHAIRMAN POWERS: In fact, I found in reading the safety analysis report it would have been useful if I'd had at hand the FSAR for the existing unit. It wasn't essential, but it would have been useful to have reviewed that.

MR. GRANT: Okay. It could have been

provided upon request?

The major purpose of the site safety analysis report is to establish the site characteristics. Those are one of the major features, I guess, of the -- that is the major feature of the site safety analysis report to establish the basis then for how that would be referenced and compared to whatever plant we might build under a COL application.

Because we had not decided what plant we might build at some future date, we established a plant parameter envelop. Took a look at seven different designs. Took many of the bounding area or bounding parameters from those seven designs and developed a box, essentially, that says that if we build something within this box meaning certain flow rates and certain sizes, power capabilities that then the evaluations that were done for dose consequences, thermal discharges those types of things would be bonded by what we have identified in the site safety analysis report analyses.

CHAIRMAN POWERS: I can very much appreciate how you would do that with those plants, the six or seven that you looked at that have been certified.

In your text when it was written you were very confident that ESBWR would be here in 2004 going through the certification process. Well, it's fallen a bit short on that. So they don't really have an established plant parameters for the ESBWR or the pebble bed or the gas reactor that were in your set.

MR. GRANT: Yes, sir.

CHAIRMAN POWERS: And you're more of a gambler than I might be here.

MR. GRANT: Well, yes and no. It isn't imperative that we had final parameters established, design parameters established for the various designs. We took the best information that was available at the time for those various designs and used those bounding parameters recognizing, as you've just pointed out, that should some of those parameters change and they would then be found to not be within the bounding parameters, that if we reference one of those designs, certified designs in this early site permit in a COL application that we would have to reconcile the difference between the actual plant characteristics and the plant parameter envelop bounding value that we used.

MS. KRAY: Marilyn Kray.

You are correct as far as there is a risk associated with that. And we, as the Applicant, together with the other three applicants communicated with the respect reactor vendors to essentially put that risk on them.

So in this case with General Electric we said to them provide us your bounding cases. Now, they had the benefit of having the ABWR, which in most cases did bound those parameters. But as they go forward and continue to develop the design of the ESBWR, they recognize that should they go outside that, then they would place themselves for these three ESPs in the scenario that Eddie described, which is not where they want to be, and that is that they would not be covered by the existing permits should they be approved.

So there was a lot of interaction among the three applicants and the reactor vendors to share with them what that situation was and for them to provide us with the appropriate values.

MR. GRANT: And I would like to stress that even though we used seven different designs to come up with that plant parameter envelop, that in no way limits us to any of those seven designs. Should there be another design developed tomorrow, as long as it fits within that plant parameter envelop it should be acceptable on the site.

In the emergency planning information under the early site permit again, maximum use of the existing plans. There is an existing plan for Clinton Power Station that is in two parts. There is a standard Exelon plan and then there is an appendix to that that specifically addresses Clinton Power Station. And then there are the state and local plans that are existing as well. And they really are not dependent on the station that would be at a particular site. They are really developed based on an event at a location such that they're almost directly applicable in all aspects for the new site.

There are a couple of options within 52.17, which is the necessary information to be provided in an early site permit application. One of those is to provide a complete and integrated emergency plan. We did not choose to do that at that time. We chose the other option, which is to establish major features.

Now some difficulty has been encountered in establishing exactly what is a major feature. The utilities did all not have the same understanding of a major feature that the staff had at the time that we begun. We have since come to agreement on those major features. Still not necessarily what we would like them to be, but --

CHAIRMAN POWERS: As you may well be aware, the Committee has written on that particular subject.

MR. GRANT: We did see your writing on that subject, yes.

But we are pursuing those major features. The Staff has, I believe, identified approval for the major features. And we're moving forward in that area.

In the SAR, again site characteristics are the major thing that we're trying to establish within the early site permit. Geography/demography which is dependent on the location, for example, identifies the nearest city. We've talked a little bit about that earlier which city was the closest, which is of course Clinton Power Station or city of Clinton. I'm sorry.

We talked a little bit about nearby hazards. We identified the railroad. There is a pipeline also near the site that was evaluated. We looked at chemicals in the nearby area and we'll project what chemicals would be utilized at the station and then at Clinton Power Station

CHAIRMAN POWERS: I have to comment that I particularly enjoyed reading that section. It's fascinating by in the hell did they get this piece of information.

MR. GRANT: I'm sure it was a lot of investigation.

CHAIRMAN POWERS: It reflected a lot of investigation, I'll have to say that.

MR. GRANT: Another particular area of site characteristics is the meteorology. We looked at wind speeds, of course, dispersion, tornados; those types of things.

Hydrology was quite well reviewed.

CHAIRMAN POWERS: Meteorology. I did not understand quite your treatment of snow pack and maximum 48 hour precipitation. Just to refresh your memory, I think if you go through the formula that are given, you end up with something like a 110 pounds per square foot loading on your structures. You indicated you did not think that was reasonable.

MR. GRANT: Correct.

CHAIRMAN POWERS: And then set out to prove that you had about 35 pounds per square foot. And I have to say I did not follow that at all.

MR. GRANT: I'm sure I am not prepared to explain it to you either.

I would point out that although the application does say 35 pounds, there was some extensive review of that by the Staff. And I believe we did result in a change to that such that the number is now 40 pounds per square foot.

CHAIRMAN POWERS: I'm aware of that, too.

MR. GRANT: It has changed a bit.

CHAIRMAN POWERS: But we started at 110. And I couldn't get to 35, going to 40 didn't help me.

MR. GRANT: Yes. The 110, there was a methodology process that we went through and identified and said when you do this it comes out at 110. That did not make sense to us either, which is why we went through another process and --

CHAIRMAN POWERS: I understood that the results seemed to be a little heavy and that you set about doing something else. I just didn't follow what the something else was.

MR. GRANT: All right. We can take a look at that.

Geology and seismology is the last area. Certainly that is covered as far as site characteristics. All of this information is contained in Chapter 2. You'll find these are like 2.1, 2.2, 3, 4, 5.

And there is a table that identifies the site characteristics in Chapter 1, along with the plant parameter envelop. And they are separate categories or separate columns because they are separate numbers where we identify something associated with the site or we just picked a value to use.

CHAIRMAN POWERS: And I have to admit that that particular table confused me at first. But by the time I was done with it, I said no this is a good idea. It actually made it much clearer what came from where.

MR. GRANT: Thank you. We had similar comments from the Staff.

CHAIRMAN POWERS: Yes. It took me a while to get use to it. Eventually I said yes, it was a good idea.

MS. KRAY: It took us a while internally as well.

CHAIRMAN POWERS: Okay. I'm glad I'm not the only one that's struggling with that.

MS. KRAY: No. And we had a lot of internal discussion about design feature versus site characteristics. It was a very philosophical discussion for a while.

MR. GRANT: Right.

CHAIRMAN POWERS: I can well imagine.

MR. GRANT: The difference between a site characteristic and a site parameter and a design parameter and design characteristic and which ones are actuals and which ones are chosen for use. And it was lots of fun.

CHAIRMAN POWERS: Okay.

MR. GRANT: This is a slide that we've put in to provide some of the elevation information that I mentioned earlier and to identify a couple of the site characteristics. One is the site grade, which is approximately 735 feet mean sea level and the resulting probable maximum flood, not the one that you saw in the original application but the resulting one after discussions and interactions with the Staff, 715.5 feet mean sea level.

And just to put this in relation then to the rest of the station --

CHAIRMAN POWERS: I've got to ask.

MR. GRANT: Certainly.

CHAIRMAN POWERS: 715.5, presumably not 716 or not 715?

MR. GRANT: Yes.

CHAIRMAN POWERS: You really honest believe these numbers to this accuracy?

MR. GRANT: No. But the calculation

methodology gives you a number and --

CHAIRMAN POWERS: Can you give me some idea of --

MR. GRANT: I could probably give you range there. For instance, if you come down a little further, 708.9 is the probable maximum flood calculation still water level. If you then begin to do the additional calculations to worry about wave runup and any kind of sloshing or surge or whatever might go along with that, then it get really difficult.

CHAIRMAN POWERS: Yes.

MR. GRANT: That builds that then up to the 715.

CHAIRMAN POWERS: You did a good job on that wave washup.

MR. GRANT: Thank you.

We certainly could have rounded these off a bit. But the calculations come out. And you got these wonderful calculators now that give you seven digits. We did at least cut that back to one digit beyond the decimal point.

A little bit about the dam for the lack, not the dam on the ultimate heat sink but the lake dam. The top of that is at a 711.8. So you can see that once you begin all this wave movement that overtops the dam there. But keep in mind that this probable maximum flood does not effect site grade. There's nearly 20 feet of difference there between the probable maximum flood and site grade. So it really is not an issue for this site.

Again, some other numbers there. The 100 year flood is approximately 697 feet mean sea level, which is about seven feet above the normal pool level for the lake.

The 100 year drought would drop that down to 681 or so.

Minimum allowed operating level, that is the number that is used at this point, 677, for Clinton Power Station where they have tech spec that once the lake drops below 677 they're required to take action. We expect that our site would have a similar restriction or our plant once it is built.

We get down to that ultimate heat sink then and the baffle that I mentioned that runs down the middle there and the dam back over at the point, from the point that runs across the lake there to keep the water in the ultimate heat sink should something happen to the lake dam, which is further down at the confluence. The top of the baffle is at 676, which keeps the water separated because it would be at approximately 675 feet mean sea level, which is the top of that dam underneath that is under the water.

There was quite a bit of detail in, I believe, the application on the dam construction. I believe the bottom portions of it have some concrete. I don't know all the detail there.

CHAIRMAN POWERS: You mentioned something called riprap.

MR. GRANT: Riprap. Yes, sir.

CHAIRMAN POWERS: And what is riprap?

MR. GRANT: A bunch of big rocks.

CHAIRMAN POWERS: Big rocks. Okay. I just saw the word and I looked it up in my dictionary. Did not help at all.

MR. GRANT: Yes. When you drive across an earthen highway that goes across the lake and you look down along the side there, you see all those big rocks. It's riprap.

CHAIRMAN POWERS: Big rocks wouldn't do; we had to call it riprap?

MR. GRANT: Some civil engineer came up with that, I suppose. I don't know.

MR. HINZE: It's usually big gravel rather than big rocks, isn't it?

MR. GRANT: I'm not qualified to tell you the difference between gravel and rocks.

CHAIRMAN POWERS: I'm stunned at the knowledgeability of my colleagues and as usual, humbled.

MR. GRANT: The bottom of the ultimate heat sink 668.5 so you can see there that the depth of the ultimate heat sink 6½/7 feet, somewhere in that range.

Towards the bottom of the slide there as it indicates in Chapter 3, you're probably familiar with FSARs for larger applications for the operation of a plant which has 18 or 20 chapters, depending on how many subjects you're covering these days. For the site safety analysis report I'm sure you noticed we have only the introductory chapter, the site characteristics chapter and then some analysis which we placed in Chapter 3. Those safety assessments or analyses include the radiological effluents, the thermal discharges and the accident dose consequences. These are the areas required, again, to be addressed under 52.17 as part of the application.

A couple of other areas that are in there, "there" being Chapter 3 of the SAR, is security plan development and emergency plan development. Primarily there we're looking only to affirm that we would not anticipate any significant impediments to development of either of those plants. Certainly we did not expect to identify any impediments since there are in place security plan and emergency plan for the station that exists there now.

CHAIRMAN POWERS: You go through some substantial discussion and even critique of the Gaussian plume model because of the location of the lake and whatnot. And discuss things like the change in friction on the ground. But in the end you end up with a Gaussian plume, is that correct?

MR. GRANT: To the best of my recollection, yes.

CHAIRMAN POWERS: And it was an interesting discussion of it because the lake does perturb things quite a bit.

MR. GRANT: I'm not sure that we would --

CHAIRMAN POWERS: But in the end you come back and say well we're going to use a Gaussian plume, but here are the issues that lead to questions here.

MR. GRANT: Right.

CHAIRMAN POWERS: And then you use a plausibility argument and say well it's not much of perturbation.

MR. GRANT: We would expect that there

wouldn't be much of a perturbation. It is one of the things, however, that we would look at the COL application once we've decided what type of tower we would use.

CHAIRMAN POWERS: Well, I guess my question -- I mean, that's about the level of which it's written; somehow we don't think this is a big perturbation.

MR. GRANT: Yes.

CHAIRMAN POWERS: And I said, gee, I wonder how they know.

MR. GRANT: Well, that good be a long philosophical discussion. But I would indicate that certainly once the plant begins to operate if we saw something different --

CHAIRMAN POWERS: I mean, you do draw analogy to your plume coming out of your existing cooling towers and make arguments there. And I wondered if that's how you knew, and things like that.

MR. GRANT: Those existing cooling towers would be at other locations and, hopefully, similar locations. But, yes, we draw the best analogies that we can.

A little bit about the emergency planning area. As I indicated just moments ago, we concluded that there were no significant impediments to developing adequate emergency plans for this area. Again, no surprise since there is one in place already.

We did establish the contacts with the proposed response agencies. That is a requirement of 52.17 for the application. That's one of the things that we must do.

In fact, both of those first two bullets are not optional. Those are requirements for the early site permit.

And the third bullet there to establish the major features, that was an option. It was not requirement, but we did choose to provide that information and establish those major features. Again, to get some finality in those particular areas.

This information is, again, contained in the emergency plan document and also a little bit of it in Chapter 3 were required by the discussions.

A short summary here of the draft safety evaluation issues, other than the seismic ones. This would be the draft SER portion that came out in February. We certainly since had interactions with the staff. We believe all these items to be resolved such that there are no outstanding safety issues in these areas. There may be one or two minor points that we're still working on. But, again, no significant issue.

Just a short summary. There was one legal item, one QA item, 3 meteorological items, 6 emergency planning items and 21 hydrology items. But these don't reflect by their numbers the significance, by any means. Any one of the individual items could overwhelm the rest of those as far as significance.

I would also indicate that the emergency planning area, each one of those had several parts. So those were not necessarily, again, indicative. And, again, we understand these all to be satisfactorily resolved at this point.

There were five confirmatory items which are all Staff actions to be taken. Four of those have been completed. The one remaining item is that they would confirm that when we submit a revised application that it actually includes the information that we've provided in the responses to the request for additional information. We expect to provide that in the November time frame, so that should be easy to resolve and complete the item as well.

The original February draft SER also contained 14 proposed permit conditions and 8 proposed

COL action items. I think the Staff is planning to tell you a little bit more about what they've been doing in those areas as they begin their discussions. I would only say that we expect those will change somewhat.

Just a quick note on the schedule. I think the Staff is going to cover this in more detail. We're currently looking at approximately a 46 month schedule for our early site permit with a final Commission decision in May of '07. I think we'll see you again, supposedly, in March after a final SER comes out in February assuming everything goes on schedule.

In summary, we have provided an application for an early site permit with a site that's next to an existing operating plant.

MEMBER KRESS: Tell me a little more about the status of that plant with respect to extending power upgrade. So you have one or do you plan on going in for one?

MR. GRANT: For Clinton Power Station?

MEMBER KRESS: Yes.

MR. GRANT: They have been upgraded. Let's see if I can find the numbers on that.

Got the original operating license in

1986. I don't seem to have the numbers on the power upgrade. Oh, here we go.

In 2002 there was a 20 percent power upgrade. They were originally 2894 megawatts thermal, current operating license is 3473 megawatts thermal. So they've already been upgraded approximately 20 percent.

MEMBER KRESS: And the license extension?

MR. GRANT: I don't know that there's been a decision made on that yet. I would presume that they will. It's a fairly modern plant, runs well.

MEMBER KRESS: '86, that's pretty modern.

MR. GRANT: Yes.

MS. KRAY: '86, right. We haven't for any of our younger plants in Clinton is about the youngest.

MEMBER KRESS: That's the youngest one.

MS. KRAY: We have not made that decision. The inclination, assuming the economics would be favorable, would certainly to be extended. But there's been no deliberation or decision at this time.

MEMBER KRESS: Thank you.

MEMBER SIEBER: This is a BWR/6.

MEMBER KRESS: MARK 3 BWR/6.

MEMBER SIEBER: MARK 3.

MR. GRANT: Correct. A similar design at Grand Gulf, Perry and River Bend.

MEMBER SIEBER: Perry is a sister to --

CHAIRMAN POWERS: They've got at least another year of training and indoctrination on this plant before they can come in with a license extension.

MEMBER KRESS: Oh, that's right. Has to many years experience, yes.

CHAIRMAN POWERS: They just don't quite know enough about this. You guys go learn a little more before you graduate.

MR. GRANT: All right. Again, we have fulfilled our purposes of identifying the site characteristics.

We have established a plant parameter envelope that says that if we build something within this envelop, that the plant should fit within this site and be acceptable.

We have made use of the existing emergency plans. We believe that certainly there are no significant impediments and the development of the plans will not be a problem.

We've addressed all the open items from the February draft SER, the non-seismic items.

And all the confirmatory items have been completed or the one final one is in the works.

And again, final permit conditions and COL action items are under consideration by the Staff. You'll see those in the final SER.

And with that, I would open to other questions.

CHAIRMAN POWERS: March time frame for the final is -- that's what I had on my original agenda for that. So it represents some sort of a delay.

MR. GRANT: That schedule is a delay that was identified most -- well, the schedule values, the dates, was most recently identified to us mid-August, I believe. 16th if I recall correctly was the date of the letter that provided that schedule.

We had some discussions with the Staff a little bit earlier on that. So it is a change. Yes, sir.

MR. MUNDY: Eddie, let me go back to at least one question posed by the board that we didn't have an answer for, and that has to do with the confusion expressed around how we arrived at our population projects.

MR. GRANT: Yes. Good.

MR. MUNDY: Let me turn this over to Bill

Maher. I think he has some more recent information.

MR. MAHER: Bill Maher, Exelon.

The question was rationale and why a population decreased when common sense would lead you to believe, and I'm paraphrasing here, some urbanization that typically happens in agricultural lands.

In table 2.1-2, which is the population projections for the zero to 10 mile range, there does show a population decrease in all sectors. And the rationale is for that population decrease is in a footnote to that particular table. It goes into a little bit more detail in the environmental report and the social and economic section where we deal with zero to 10 mile social/economic impacts.

The rationale provided there is due to the lowering manufacturing activity within that areas and migration out of agricultural areas.

The following table, the footnote to that particular table which discusses some of the Illinois state rationales for their projected increases or decreases deal with fertility rates, mortality rates and migrations out of those areas.

The following table 2.1-3 deals with population projections in the zero to 50 mile range out to a certain time frame within the area of the application. If you look at the sector qualifications of those population projects, in areas or in sectors where there are population centers you do see population increases which would reflect a certain in those population centers.

In sectors or areas where there are no population centers, you see population either staying static, relatively static or a slight decrease or slight increase with the time frame for the permit.

CHAIRMAN POWERS: As I understand what you did was you took the projections for 2010 and 2020 from Illinois state and then said whatever trend that they came up with for 40 years ahead continued for the next 40 years.

MR. GRANT: I believe that's correct. I'm not sure.

MR. MAHER: That's correct. And that is a typical methodology that is used within environmental reports, within licensuring also.

MR. GRANT: The only thing I wasn't sure about there in your statement was the 2010/2020 projections. My recollection was the 2000 and 2010 numbers were used to do the projections. But, I may have to go back.

MR. MAHER: Well, the footnote says 2010/2020.

MR. GRANT: Does it?

MR. MAHER: Yes.

MR. GRANT: That's why I don't base things on my recollection.

CHAIRMAN POWERS: I mean while I'm seeing here is saying, yes, I mean we're dealing with small numbers so it's a trivial point actually. But why wouldn't you just say okay, well it fell to this level at 2020, just leave it static?

MR. GRANT: That would have been conservative it sounds in this particular area. But I believe the guidance asked for projections, and those were our best projections.

CHAIRMAN POWERS: I mean, does somebody come with these ideas based on I did it for 1910 to 1950 and it worked? So doing it from 2005 to 2060 it ought to work, too?

MR. MAHER: And I'm speaking more in the environmental area. When the population projections would -- this is a standard methodology that's used for judging social/economic impacts in the environmental area.

I would anticipate, however, as part of

going to COL that we would reverify those population projections and make sure that we fall within the envelope.

CHAIRMAN POWERS: Yes, I understand that. But I'm just wondering, you know somebody says it's a standard methodology. I just want to treat these things up. It's not what I would have offhand done. On these particular numbers, I mean there's nothing wrong with it because I'm not going to argue with you over 83 versus 78. And for the increasing areas you did just -- I mean, you were consistent. And so I can't fault you, I just wondered why.

MR. GRANT: We typically don't go into the details and the history of the development and methodology unless we have a concern with the methodology, which we did not have in this area.

CHAIRMAN POWERS: Okay.

MR. MUNDY: One other question posed was around the snow load computations. I don't know if we have a response mow or not, but we're looking into it. So if we don't -- okay. So later this morning or this afternoon we'd like to try and make a comment on that and address your question.

CHAIRMAN POWERS: That would be appreciated because I just didn't follow the argument.

MR. MUNDY: Okay.

MR. GRANT: Maybe the closure on that is for us to take a look at the discussion that is in the application and see if we can clarify it a bit.

CHAIRMAN POWERS: Well, I suspect we'll get into it with the Staff. There'll be time to revisit this topic.

Any other questions for the speakers?

MR. HINZE: If I may, please. Have you considered global warming in your predictions of 100 year drought, etcetera?

MR. GRANT: Not specifically. What we believe there is that generally global warming is a discussion of the average changes. And when we're establishing site characteristics we tend to look at the extremes. If we take the temperatures, for example, the average temperatures in the Clinton area run between 20 degrees and 90 degrees, or thereabouts. I don't have the exact numbers, but something like that. Whereas, when we're looking at the ultimate heat sink design we use a zero exceedance number, the maximums. And those run between about minus 36 degrees and 117 degrees. So we do not see that the minor variations within the average numbers are going to have a significant impact on the extremes.

We would point out, however, that there are two opportunities to look at that in the future. One of those when the COL application comes in. And if we have seen something change in that time frame, then we would address that in the application.

The second opportunity is as an operating plant almost every plant has something called a condition report, a problem report, a concerns report of some type where if something is identified to be beyond the extremes that is identified in the site safety analysis report or the final safety analysis report, then that would be documented and evaluated. So that would be the second opportunity. If we're 40 years into the life of the plant and we find that we've got higher temperatures than we thought we would see, then that would be documented and evaluated.

CHAIRMAN POWERS: 1990 seemed to be a particularly bad year.

MR. GRANT: That's certainly possible. As I get older I can't really remember that far back. But it could have been.

CHAIRMAN POWERS: Yes.

MEMBER KRESS: Are the plans for at least two more plants on the site?

MR. GRANT: It depends on the design.

Some of the designs that we looked at were a single plant. But on the other end of that spectrum the PBMR design that we looked at had eight modules. So anywhere in between. I think it was a single AP1000 -- no, I'm sorry. A single ESBWR, 2 AP1000s, 3 high temperature gas reactors, 8 PBMR modules; you know a wide variety. Three ACR 700s, if I recall.

MS. KRAY: Right. In the plant parameter envelope it acknowledged how many we were assuming because in some cases, depending on heat loads or whatever, that made the difference.

MR. GRANT: Right.

MS. KRAY: But you know our interests since then has been I'd say refined to the ESBWR, in which case it would accommodate one, which I think is approximately 1550 Met Electric or two AP1000 which each individual I think are 1117.

MR. GRANT: So yes, one or two.

CHAIRMAN POWERS: Any other questions.

Well, thank you very much.

MR. GRANT: Thank you.

MS. KRAY: Thank you all.

CHAIRMAN POWERS: And we will recess until 10:15.

(Whereupon, at 9:47 a.m. off the record

until 10:16 a.m.)

CHAIRMAN POWERS: Let's come back into session.

We're going to move to the Staff's discussion of the non-seismic aspects of the Clinton early site permit. And our first speaker is John Segala.

MR. SEGALA: Okay. Thank you for having me here.

If you'll turn to the next slide. I'm John Segala, the lead project manager for the Exelon early site permit safety review. We will brief to the Subcommittee on the Exelon early site permit application and the status of the NRC's Staff's review. And we'll provide support to the Subcommittee's review and subsequent interim letter, and hopefully answer some of the Subcommittee's questions.

Next slide, please.

I will be touching on the schedule milestones. Some key features of the ESP application, key review areas, open items, permit conditions, SSE action items and some DSER conclusions.

Next slide, please.

For the completed milestones, Exelon

provided their application in September of 2003. We issued RAIs in July 27, 2004. We also issued some evaluation time estimate RAIs in December of 2004. And the applicant responded in January of 2005. However, that was not in time for us to factor that into the draft safety evaluation report. So many of the open items in Chapter 13 on emergency planning were nothing more than placeholders for us to review the response to those RAIs.

The draft safety evaluation report was issued in February of 2005. And the Applicant has provided two letters responding to our open items on April 4th of 2005 and April 26, 2005.

We issued the supplemental draft safety evaluation report on August 26th and we provided an advance copy to the ACRS. The supplemental draft safety evaluation report is not yet publicly available. It is in the process of a 14 day proprietary review period which ends on September 9th.

Next slide.

The remaining milestones is we have a full Committee meeting tomorrow. We're requesting an interim letter by September 28th. The Staff is scheduled to provide the final SER to ACRS. This will be an advanced copy in February 8, 2006 and issue the final SER on February 17, 2006.

CHAIRMAN POWERS: Now let me understand just a little bit what we're going to do here. You're going to come to us, the Committee is going to be familiar with this draft SER which does not reflect the responses from the Staff? I mean from the licensee.

MR. SEGALA: Yes. Today's meeting we issued our draft and what's happened here is that normally for the other two ESPs we issued our draft and then immediately had a meeting. In this case because we wanted to combine the meeting for the supplemental draft and the draft together in one meeting, there's been some time lag between now and the issuance of the draft. So we've had time to interact with the Applicant to resolve those open items.

So we're in the process right now of putting together our final safety evaluation report for the rest of the document, except for the supplemental, which is section 2.5.

CHAIRMAN POWERS: What I'm struggling with is, and maybe it's okay, but if we write an interim letter that speaks to things, you've got a lot of open items that you don't have any more. I mean, I'm not sure this is serving anybody's use here.

MR. SEGALA: I'm not sure I fully understand. I mean, typically the letters that you provide point out shortcomings or things that we've missed.

CHAIRMAN POWERS: Yes.

MR. SEGALA: So I would think that would be applicable regardless.

CHAIRMAN POWERS: Okay.

MR. SEGALA: And we could still factor that in to our final safety evaluation report if needed. Okay?

CHAIRMAN POWERS: A general summary of what our letter to submit.

MR. SEGALA: And again, I guess Exelon had touched on the full Committee meeting in March of 2006. And then a possible final letter in March 30th of 2006 so that we could issue our NUREG in May 1st.

And then we have a mandatory hearing and a Commission decision.

MEMBER KRESS: Who reviews the environmental impact statement? Does your people do that, too?

MR. SEGALA: We have two groups. We have the safety review which is done in my organization.

And then we have also an environmental group who has another project manager like me who is in charge of doing the review. And we have contractors from PNNL that are doing the actual review of the environmental report and writing the environmental impact statement.

MEMBER KRESS: Are these reviews more or less separate. You do one thing and they do the other?

MR. SEGALA: They're on separate schedules. We do have some common people on both. So you will have like for instance the hydrology review was done by PNNL, but they also did work on the environmental impact statement. So there is some consistency there between the two reports.

Well, I did want to mention that the issuance of the final SER on February 17th is contingent on us resolving all the open items with regard to the supplemental DSER by the end of October.

We have eight lead reviewers for the technical review of the safety side. We have Brad Harvey with meteorology. Goutam Bagchi on hydrology with support from PNNL. Kaz Cample on site hazards. Cliff Munson and Tom Cheng on geology/seismology and geotechnical with support from the U.S. Geologic Survey and BNL. Jay Lee looked at a demograph, geography and radiological dose consequence analysis. Bob Moody looked at emergency planning with consultation from FEMA. Pal Prescott reviewed quality assurance. And All Tardiff looked at physical security.

Goutam Bagchi and his contractor were unable to attend today because of a tsunami conference in Asia. So if we get into details on those, I'll have to get back to you.

CHAIRMAN POWERS: And we have 21 items in this hydrology area.

MR. SEGALA: Yes, sir.

CHAIRMAN POWERS: And it's the area that, quite frankly, just confuses me to death.

MR. SEGALA: Yes.

MEMBER SIEBER: We might have a tsunami.

CHAIRMAN POWERS: Tsunamis don't confuse me. I don't worry about them into Mexico. We very seldom have tsunamis. If we have a tsunami that effects New Mexico, it's going to effect other things a lot worse.

MEMBER KRESS: We have them in Tennessee. It rains a lot and it all comes down at one down, and we're getting some tsunamis.

MR. SEGALA: I'd also like to say that Jay

Lee and Kax Cample also were unable to attend today.

I'd like to point out that we did a lot of independent evaluations and calculations to verify what the Applicant had done. And that was accomplished through the Staff and their contracts.

Next slide, please.

I'll try to go through some of these quickly because I know that Exelon touched on a lot of this.

The ESP site is approximately 700 feet south of the existing Clinton Power Station.

The ESP Applicant is Exelon Generation Company and AmerGen owns the CPS, the Clinton Power Station and the early site permit sites. And as Exelon had pointed out, that they seek authorization for limited work and have proposed or submitted a site redress plan.

Exelon's requesting approval for a total core thermal power rating between 2400 and 6800 megawatts thermal. They're proposing either a single reactor or multiple reactors or modules of the same reactor type.

CHAIRMAN POWERS: When you look at the early site permit does the lower bound make any difference at all?

MR. SEGALA: In terms of the power rating?

CHAIRMAN POWERS: Right. I mean does it effect things or is it just all the upper bound?

MR. SEGALA: I would think it's mostly the upper bound, but I don't know for sure.

Exelon has chosen to follow the plant parameters approach, which Exelon had already spoke about. They looked at the ABWR, AP1000, ESPWR, ACR 700, the pebble bed modular reactor an the GTMHR as well as IRIS.

CHAIRMAN POWERS: Because of the speculative nature of the plant parameter envelope when you do your review do you keep track of which one of those parameters are really salient? I mean, I find a list that says oh gosh, if this particular plant parameter changes, you need to look at this section, this section and this section?

MR. SEGALA: Well, going from the DSER to the final SER we put together a list of what we call bounding plant parameters.

CHAIRMAN POWERS: Yes.

MR. SEGALA: An we're still in the process of putting that together for the Clinton site. But we call out those plant parameters that were crucial to the Staff's safety review, and those will be called out in the SER as well as become part of the actual permit itself.

MEMBER KRESS: Do those parameters include a CDF and LRF?

MR. SEGALA: No.

MEMBER KRESS: They're not part of it?

CHAIRMAN POWERS: Nobody cares about CDF and LRF for a piece of property in the middle of Illinois flat lands.

MEMBER KRESS: Good question.

MR. SEGALA: And again, the Staff's review of the plant parameter envelope was more to look at whether they are reasonable. And we took a similar approach for design certification where we look at the site parameters to make sure that they were reasonable for the design.

Next slide, please.

CHAIRMAN POWERS: And there's nothing particularly exceptional in the plant parameters that Exelon chose. I mean, they look kind of nominal to me.

MR. SEGALA: Yes. So we sort of look at them and see if they look reasonable.

CHAIRMAN POWERS: As Exelon pointed out, the original Clinton Power Station was designed for two identical units and construction of the second unit was halted. The existing switchyard will be expanded to accommodate the output from the new facility.

The normal heat sink will be compromised of either a mechanical or a natural draft cooling towers. And the ultimate heat sink if needed, will be comprised of a mechanical draft cooling tower.

And Exelon is seeking a 20 ESP term.

The next slide I think Exelon covered, so I'm not going to get too much into it. We have the same, the power block for the early site permit and area for the normal heat sink, and the area for the ultimate heat sink, cooling towers. And this is where the Unit 2 switchyard would be expanded. And this is the approximate location of the new structure and the ultimate heat sink.

MEMBER KRESS: When one specifies the limit on the ESP, like 20 years, what is the thing that limits? Is it population projections or I mean why not 40 years? What difference would the SER have in it if it were 40 instead of 20?

MR. SEGALA: Well, the requirements for how long an ESP can go is written in Part 52. They can propose either a 10 or a 20 year --

MEMBER KRESS: Oh, that's specified in the--

MR. SEGALA: Yes, in Part 52. Now, as to the exact reasoning of how we came up with 20 years in Part 52, I could find out for you. But I don't know offhand.

MEMBER KRESS: The only thing I could think of would be changing the environmental population and --

CHAIRMAN POWERS: But in fact if you look in the detail, whereas it last for 20 years, it actually has a lifetime that just goes on forever. I mean, it doesn't really disappear.

MR. SEGALA: I think there's a process where they can ask for --

CHAIRMAN POWERS: And it can be extended. But even if you don't, it's kind of there for a long time, isn't it? It's less official but it's still there for -- I mean, it just doesn't seem to die.

MR. SEGALA: Next slide. This slide is sort of a visual of Exelon provided a slide of all the elevations.

CHAIRMAN POWERS: Is it a slide you requested.

MR. SEGALA: What's that?

CHAIRMAN POWERS: This is a slide you requested from Exelon?

MR. SEGALA: No. This is a slide that our contractor, PNNL. And I liked it because it helped me understand.

CHAIRMAN POWERS: I like it, too.

MR. SEGALA: The only problem is this maximum flood I have the old number on there. The number is 715.5, which Exelon had pointed out, which would be above the top there. But it sort of gives a depiction of -- it's not to scale, but it's pretty close to where the creekbed is. And this is the ultimate heat sink with the submerged dam and the intake to the ultimate heat sink for the Clinton Power Station. And this is the early site permit grade.

So it just gives you an overview of how all the different elevations. 690 is the normal pool level.

So, I just thought that was a good visual.

MR. HINZE: John, where would the proposed excavation bottom on this diagram?

MR. SEGALA: In terms of putting the power block?

MR. HINZE: The excavation for the power block, right.

MR. SEGALA: I believe I don't have those slides in front of me. I don't know if Exelon would--

MR. HINZE: What's the scale on this?

MR. SEGALA: It's not to scale.

MR. HINZE: Oh, okay.

MR. SEGALA: This drawing is not to scale.

MR. HINZE: All right.

CHAIRMAN POWERS: Well, what we know is that the bottom penetrates through the 35 level or penetrates through the 700 level -- I'm sorry.

MR. SEGALA: I think it goes down 140 feet, yes.

MR. HINZE: 140 feet I read, is that right?

MR. SEGALA: Yes, I think it's 140 feet and then they may go a little bit below that for evening out or regrading.

MR. HINZE: So where would that occur on this diagram then?

CHAIRMAN POWERS: Down below the bottom of the creekbed.

MR. SEGALA: I think it would be 140 below this.

MR. HINZE: Okay.

MR. SEGALA: Where exactly that would be--

MR. HINZE: It would be below the whole diagram?

CHAIRMAN POWERS: Somewhere.

MR. SEGALA: Yes. And I think that was a bounding value. So that would be the lowest it would be depending on what design was used.

MR. GRANT: If I might, Eddie Grant with Exelon.

The 140 foot is, I believe, the PBMR design. Most of the other designs are much less.

MR. HINZE: Maybe we're getting ahead of the game here, but you also discussed removing some of the potential zones of liquefaction if I understand correctly.

MR. GRANT: Correct.

MR. HINZE: But would that take you even below this 140 or does that --

MR. GRANT: No, sir. If you recall again, as you indicated that's this afternoon's discussion, but the proposed permit condition is that we would be required to remove the upper 60 feet.

MR. HINZE: Sixty feet? Right. Okay. Sixty/140. Okay. I understand now.

MR. SEGALA: As Exelon had pointed out there, seeking a major features option in Part 52 the

Staff's using supplement to the NUREG-0654 to perform their review. As indicated in the other ESP meeting industry has a concern with the degree of finality with the major features option. And the Staff believes that we can grant finality as to the overall description, but we'll need to address the implementation details at the COL.

One of the open items in Chapter 13 is regarding major features H, which is on the emergency facilities and equipment.

Regarding the OSC and the TSC details, the Staff didn't believe that the Applicant provided sufficient information in order to approve this major features option. So the Staff is going to not approving major features H for Exelon.

CHAIRMAN POWERS: You're going to have --

MR. SEGALA: This was also true for North Anna as we took the same approach.

CHAIRMAN POWERS: You're going to have to remind me. Major features H?

MR. SEGALA: It's for the facilities and the equipment as to --

CHAIRMAN POWERS: Oh, okay.

MR. SEGALA: The key review areas I'm not going to read through all of them. The seismology and geology will be discussed in the afternoon session.

This is an overview of the open items in what areas they fell into. There were 33 open items in the draft safety evaluation report and 7 open items in the supplemental draft safety evaluation report. And Exelon as pointed out, the number of open items are not necessarily indicative of the significance of the issues.

Resolution of all the open items will be discussed in the final safety evaluation report.

MR. HINZE: John, I don't know whether I'm ahead or behind the curve, but I looked at the list of open items that I was given and it didn't include the seismology and geology. Do you have a list for us of the open items or are we supposed to extract them from the verbiage?

MR. SEGALA: I'll be presenting those open items in the afternoon session.

MR. HINZE: Okay. Could we have those before the presentation by the Exelon Company.

MR. SEGALA: Sure.

MR. HINZE: If that would be possible, I would appreciate it.

MR. SEGALA: We could hand those out right after I finish talking.

MR. HINZE: That would be very kind. Thank you. Very helpful.

MR. SEGALA: All the open items in the DSER resolved except for the 7 supplemental draft safety evaluation report open items. And there's one hydrology open item that we've come to the conclusion that there's adequate water in the ultimate heat sink, but we're working out what the appropriate site characteristic value is for the maximum ice thickness.

The list of open items, as you pointed out, are provided as background. I wasn't planning to discuss all the open items today unless there were specific ones you wanted me to touch on.

As Exelon pointed out, there are five confirmatory items and the one that remains open is regarding the Staff verifying that the SAR markups provided in RAI and open item responses get reflected in the application.

Next slide, please.

In the combination of the draft safety evaluation report and the supplemental draft safety evaluation report there are a total of 15 proposed permit conditions and 17 proposed COL action items. Like we did for North Anna when we went from the draft safety evaluation report to the final safety evaluation report we developed a list of criteria for permanent conditions and COL action items, which we didn't have for the draft reports. And so we're currently going through that exercise right now to make sure that we apply the new criteria to the draft safety evaluation report items. And like North Anna, we expect that the number of permit conditions are going to go down and the number of COL action items will increase.

And the list of permanent conditions and COL action items that are in the draft report are also provided in that attachment.

To recap the three circumstances under which we use permit conditions is when the Staff's evaluation rests on an assumption that it's practical to support only after the ESP issuance or a site physical attribute that exists that is not acceptable for design of the system structures and components important to safety and the Staff's evaluation depends on a future act.

And for the COL action items it's a list of work that needs to be looked at the COL stage. We're using similar approach that we use for design certification. And those COL action items will be listed as an attachment to the permit itself.

Next slide, please.

For those sections of the draft safety evaluation report that had no open items, I'm listing here the conclusions that were drawn from those sections because those will be the same conclusions that will be in the final safety evaluation report.

Potential hazards associated with nearby transportation routes, industrial and military facilities pose no undue risk to the facility that might be constructed on the site.

Next slide, please.

The proposed site is acceptable for construction for constructing a plant falling within the plant parameter envelope with respect to the radiological effluent release, dose consequences from normal operation.

Site characteristics are such that an adequate security plan and measures can be developed. And the focus there was looking at if there was appropriate standoff distance.

In summary, as I said before, all open items are resolved except for the 7 seismic open items and the one hydrology open item on the maximum ice thickness.

CHAIRMAN POWERS: Let me talk about that

ice thickness. I read their analysis of the ice thickness as they were following a prescription. Is it the prescription that you object to?

MR. SEGALA: The Staff, you know, through RAIs and open items has looked at initially when we did our calculation and they did their calculation, we got drastically different results. And we went back and figured out what the differences were.

There was a difference in the -- I'm trying to remember. There was the ice thickness estimation equation. The Applicant used a U.S. ACE standard and the Staff used an Assur's equation from 1956. The Staff went back and looked at that and found that the approach the Applicant was using, that equation was the industry-wide accepted value or equation to be used. So we've since gone back and redid our calculation using that.

The other difference that we found was the method for estimating the maximum accumulative freezing degree days. We used a fixed date and the Applicant used an estimated freeze-up onset date. The Staff is still in the opinion that we should be using a fixed date of December 1st.

So now that we know the differences and we've done the calculations, the Staff has a calculated maximum thickness that's a little bit thicker than the Applicant's. And we still need to have further discussions to get to an appropriate site characteristic value.

MEMBER KRESS: What does this ice thickness impact? The intake to the --

MR. SEGALA: We look at the ice thickness. It effects the design of the intake structure. It needs to be able to handle that. It also effects the excess capacity in the ultimate heat sink. The Staff looked at a scenario --

MEMBER KRESS: That's the ICD part of it?

MR. SEGALA: And I think they looked at a scenario where the dam breaks and there's ice on top of the water. The level goes down and the ice sticks in the ultimate heat sink in that dam. And they look at that scenario and is there excess capacity in the ultimate heat sink to be able to provide makeup to the ultimate heat sink for the ESP site.

And so we've gone through those calculations. Even assuming the Staff's thicker ice, and we've concluded that there is excess capacity in the ultimate heat sink. And what we're wrestling with now is, you know, what's the appropriate way to calculate what the thickness is and what the appropriate site characteristics should be that we include in the permit itself.

CHAIRMAN POWERS: Well let me ask you about these standards. You have a 56 equation that you were using and then you find that there's a more modern. What is the technical basis for these? Is there sufficient technical basis to have any confidence in these standards?

MR. SEGALA: I don't know the answer to that. And I don't have my expert here today to touch on that. But that's something I could --

CHAIRMAN POWERS: Well, it's just interesting for us to know.

I'm not sure which category it falls in, but as I indicated in the presentation by the previous speaker, I did not follow the arguments concerning the amount of snow load that they had to count.

MR. SEGALA: Okay.

CHAIRMAN POWERS: And what I especially don't follow is how this application is being treated that differs from what happens in Vicksburg, Mississippi as far as snow load. They, too, got what seemed to be an unreasonable number. And you told them to live with it.

MR. SEGALA: Okay.

CHAIRMAN POWERS: Can you explain what all transpired here.

MR. SEGALA: This is Brad Harvey. He did the meteorology review.

MR. HARVEY: Hi. This is Brad Harvey with the Staff.

The standard Reg. Guide 1.70, which is the former contents for the final safety analysis report discusses providing 100 year snow pack plus a 48 hour probable maximum precipitation as data to be included in the SAR. And there was some point of confusion on basically both the Staff and the Applicants as to how do you combine those numbers.

And what you see here is a sequence of thoughts evolving in the Staff and the order which the Applicant came in and the Staff dealt with them. Started with North Anna, then Clinton and then Grand Gulf, which is not the order the ACRS is reviewing these applications.

So what you saw in Grand Gulf is really the final thought process that the Staff has come with. And subsequent to writing the DSER the Staff has come across a 1975 branch technical position which discusses the use of the 100 year snow pack in defining the normal live load for roofs. And then the combination of 100 year snow pack plus the 48 hour probable maximum precipitation for the extreme life loads for roofs.

And so basically what the wording in this area for the Clinton SER is going to look at bit different than what you see in the DSER in that we're going to call out two different climate site characteristics; one being a 100 year return snow load and the second being the 48 hour winter probable maximum precipitation.

CHAIRMAN POWERS: Okay. That's good. How do I get from 110 pounds per square foot to 85 and then back to 40?

MR. HARVEY: Okay. Well, the 40 will not end up showing in the final SER. The way that number came is I believe they took the 100 year snow pack, which is around 30 pounds, and they added what they considered the worst case snowfall historically, which they extrapolated, assumed the monthly maximum reported snowfall in the site, and added that to the snow pack. That's how I believe they came up with the 40 pounds. But like I said, that value will not show up in the final SER.

MEMBER SHACK: What number will show up?

MR. HARVEY: There will be two numbers.

One will be the 100 year snow pack, which will be 24.4 pounds per square foot. And then the 48 hour probable maximum winter precipitation with 16.6 inches of water.

So the idea is is that the COL applicant can take those two values and depending on the shape and design of his roof, argue that for instance the 16.6 inches of water on top of the snow pack would not stay on the roof because of the design of the roof. But now we start getting into design issues and so part of the exercise the Staff went through here was trying to separate site characteristics from design issues. So these are values that the designer needs to look at the COL stage and say my roof is designed to hold that load or it's not because it's not physically possible for that load to stay on top of the roof. Either because it's sloped, it's a dome containment, etcetera, etcetera.

CHAIRMAN POWERS: It shall forever remain a mystery how we go from 110 pounds. H ow much is 16.6 inches of water? I can figure that real quickly here.

MR. HARVEY: Well, that's where the 100, so it's got to be 60 to 70 pounds per square foot. The problems with maximum with the precipitation is really a theoretical type number as opposed to an actual number, which is why it's two or three times higher than what has been historically observed in this site.

CHAIRMAN POWERS: Yes. Water is about roughly 64 pounds a cubic foot. So it gets you up close to 110. I now understand. Okay.

And you've separated the two and they're just site characteristic, and we no longer add them. That's somebody's else job to do?

MR. HARVEY: That's the design engineer to look at that.

CHAIRMAN POWERS: Okay. And the folks in Mississippi still got to wrestle with their 22 inches of snow plus 22 inches of maximum precipitation; they happened to be the same thing? But they need to wrestle with it?

MR. HARVEY: They need to wrestle with it. And, again, they will do that at the design phase.

CHAIRMAN POWERS: Okay. Okay. Well, as long as we've got you here, I think, Bill, you want to repose your question about global warming or even more importantly, just weather cycles?

MR. HINZE: Yes. How have they been factored in or have they been?

MR. HARVEY: Generally the extreme climatic site characteristics that are presented in the application as well as in the SER are based on historical data that has typically been extrapolated out to 100 year recurrence intervals. So depending on the length of that historic data, depending on the parameters that's being measured, and you come up with statistical methodology for doing that.

MR. HINZE: Sure. But no climatic model to predict into the future are being used in these at all?

MR. HARVEY: That is correct. Not at this point in time. I think in the future that might change, but we basically are using values that, for instance, the American Society of Civil Engineers uses for building loading, wind loads as well as roof loads and the ASHRAE, which is American Society of Heating and Air Conditioning Engineers. They publish data to be used for extreme.

MR. HINZE: Is anyone contacting NCAR on any of these topics in terms of climatic models for the next 40/50 years?

MR. HARVEY: I suspect that that is probably a work in process. I know that the Federal Government has organized a group that is looking at climate change, are in the process of doing that. Which is one reason why the SER is worded -- discusses very briefly climate change. And if in the future the methodology for coming up with the design loads changes to reflect potential global warming climate change, that the regulations allows the Staff to go up and change the site characteristics to reflect the new methodology, evolving methodology.

MR. HINZE: Well, it looks like they're doing a better job predicting climate in the next decades than they are predicting weather for the next day.

CHAIRMAN POWERS: Well, what I find interesting is that we do see trends that show multiple cycles, some of which are converging. And reenforcing at this period of time associated with the band around the Gulf of Mexico. And it has consequences to the north and the south. I mean, there are entire journals devoted to this stuff and individuals with differing opinions. But all opinions seem to be that the weather in the last 50 years is somewhat milder than the weather that they are anticipating in the next 50 years. The reasons for it differ.

MR. HINZE: Yes. Well, in the ACNW we're

worried about 10,000 or --

CHAIRMAN POWERS: Yes. I know you guys are really out in the middle of nowhere.

MR. HINZE: This is a no never mind.

CHAIRMAN POWERS: You guys are in the imponderables. But fortunately no matter what prognostication made, there's no one to claim you're wrong or prove you wrong. They can claim you're wrong, but they can't prove it.

MR. HINZE: Yes.

CHAIRMAN POWERS: Here we have some chance of finding out who is wrong.

MR. HARVEY: It does seem reasonable, though, as to what the climate models can show us.

CHAIRMAN POWERS: Well, we've asked in the Staff previous communication with them to address that, and they think they don't have the responsibility.

Please continue.

MR. SEGALA: I only have the last item left. Was we're looking forward to receiving your interim letter and open for comments.

CHAIRMAN POWERS: Well, I'm left a little bit uncertain what to comment on in this area. Because I don't know what's resolved and what's not resolved. I guess everything is resolved, save what one little ice thing.

MR. SEGALA: Yes.

CHAIRMAN POWERS: And so everybody's in life?

MR. SEGALA: Yes.

CHAIRMAN POWERS: And so to if we don't have anything unusual about this application, and in this area there's not much.

MR. SEGALA: We'll be coming to you, you know you'll receive the final SER which will have the full explanation of how we resolved all the open items. And we'll come before you again for the final and we can discuss those items as well at that time.

CHAIRMAN POWERS: Yes. Members have any questions they'd like to pose in this area?

MR. HINZE: Well, one of those that I was rather interested in was the 2.418, the potential impact of the construction on the piezometric surface and piezometric levels. What lead to your concerns in the first place and how were they resolved?

MR. SEGALA: Okay. Again, I don't have my expert here, but I have some notes which I may be able to -- the Staff felt that the Applicant did not bound the possible indirect impact of an overall drop in lake pool elevation caused by additional consumptive use, water associated the ESP facility which might alter the piezometric surface of the ESP facility. The Staff wasn't clear of construction down to the plant parameter envelope embedment death. It could be performed without dewatering systems that could possibly reverse the piezometric radiant for the existing Clinton Power Station unit. So the Staff asked the Applicant to provide the potential impact of future construction for the ESP facility on the piezometric gradient for the ESP site.

The Applicant stated that there will be no scenario where the liquid radioactive effluent could be released about the ambient ground water table, including the scenario where the effluent holding facility could be flooded raising the release point above the ambient ground water table.

The Staff agreed that under these circumstances release of liquid radioactive effluent to ambient ground water can be precluded. And the Staff is proposing a permanent condition to ensure that the hydraulic radiant will always point inwards into the rad waste holding and storage facility from the ambient ground water during construction and operation of the ESP facility, including the time during which recovery of ground water occurs to near its PD water elevation.

So the permit condition will be put on the permit that at COL they'll have to show that the gradient always points inwards.

MR. HINZE: So the excavation to 140 feet below grade will be associated with the watering. But then what you're talking about here is the final piezometric gradient, right?

MR. SEGALA: Yes.

MR. HINZE: Is what I said appropriate?

MR. SEGALA: I believe so, yes.

MR. HINZE: Okay. Thank you.

CHAIRMAN POWERS: I'd like to just ask a question of clarification on COL 3.1-1 which states "Verify the calculated radiological doses to members for the public when radioactive gaseous and liquid effluents for the ESP facility are bounded by the radiological doses in the SER for the ESP application."

What are you looking for here? You just comparing one number to another number?

MR. SEGALA: I think is, you know, we've done a dose calculation looking at the source term and the chi over Qs. And I believe that this is to verify when the COL comes in that the Staff's calculation is still bounded when they come in at a COL.

CHAIRMAN POWERS: In the application when they get to this stage, they're going to end up using a Gaussian plume model and they're going to calculate the chi over Qs. But they go through and discuss why the Gaussian plume might be perturbed on the lake there on both sides of the plant. And in fact, they'd look at that and think about Gaussian plumeness here?

MR. SEGALA: Brad, do you have any insights on that?

MR. HARVEY: Brad Harvey with the Staff again.

There's is a potential that the difference in surface roughness over the water will impact the plume as compared to surface roughness over land. And the model is, I wouldn't consider it really refined enough to start making the differential differences in the surface roughness from one area to another. As a matter of fact, if you look at the amount of water that's in the site vicinity in terms of surface area, maybe 20 percent on an average if you look around the site.

And so what's happening is that if you have wind coming up to your release point, that the wind strives to the characteristics that it sees in the underlying surface and then once you -- and not the piece of wind, you may have your release. And the wind characteristics may change down wind as the plume disperses again because of the changing in the surface characteristics as the effluent travels down wind.

So it's really a hodgepodge of different things happening depending on where and when the wind has been and where it's going. And there's really not a homogeneous surface cover in that site, but a combination of trees, buildings, water surface and flat grassland. So I think in all-in-all, it starts to too much average out in the long run.

CHAIRMAN POWERS: In the Applicant comes back and says well I don't know what to do about this but my suspicion is that I'm conservative ignoring this effect, you guys agree with him?

MR. HARVEY: Conservative, but I don't think it has a major impact given the overall uncertainty of what's being done here.

I believe the regional dispersion is based on miles that were -- empirical data was capped out in Kansas in the middle of a corn field. So --

CHAIRMAN POWERS: Well, there's a rather famous comparison between Gaussian plume and what happened up on the Idaho National Laboratory in which there is essentially no comparison between reality and the Gaussian plume.

MR. HARVEY: Yes. It's a 30 year old process. But, again, I think it's a fairly conservative 30 year old model that we've been using.

CHAIRMAN POWERS: Well, members have any other questions they'd like to pose to the speaker?

Thank you very much.

MR. GRANT: Dr. Powers, if I might jump in with a couple of responses on questions that we weren't able to answer during our presentation.

CHAIRMAN POWERS: Please. Please.

MR. GRANT: One item you asked about was the distances to the cities.

CHAIRMAN POWERS: Right.

MR. GRANT: And we have looked into that and identified that those are distances to the city centers, the population centers.

CHAIRMAN POWERS: So now begs the question is how far is it now from the city center to the city limits and whatnot. I don't want anything to three significant digits. A mile?

MR. GRANT: That depends certainly on the city. For DeWitt, which is only 200 people, I mean there's probably less than a half of a mile distance. But when you talk about Springfield, for instance --

CHAIRMAN POWERS: I'm only interested in cities over 25,000 population.

MR. GRANT: All right.

MEMBER SIEBER: And you only got two.

CHAIRMAN POWERS: Yes, I got two left.

MR. GRANT: You get out to Springfield and Bloomington, those types of cities, then you're -- can somebody help me with the geographic distances? But my guess would be somewhere on the order of five to ten miles from center to the edge.

CHAIRMAN POWERS: Okay. Fine. Thank you.

MR. GRANT: One other item here just recently I believe I mentioned to you that the 140 foot depth with a PBMR value, and I've been told that it's the other gas reactor, it's the GTMHR. Yes. That is that deep. And the others, of course, are even closer to ground surface.

One last thing I'd like to comment on is I think I heard some confusion early in the Staff's discussion about the responses to the RAIs being reflected in the DSER. And I'd like to clarify, if I could, that the only thing that I understand did not get reflected in the DSER was one late letter on emergency planning. That the rest of the responses occurred in the September to October time frame of last year, and those are reflected in the February DSER.

MR. SEGALA: That is a true statement. It was just the evacuation time estimate response that--

MR. GRANT: That did not get reflected?

MR. SEGALA: -- that did not come in late.

CHAIRMAN POWERS: Okay. So we're much more complete?

MR. SEGALA: Yes.

CHAIRMAN POWERS: Good. If there are no questions, we will recess until 1:00 and then approach the rather simply and easy topic of seismic.

MR. SEGALA: Thank you.

(Whereupon, at 11:07 a.m. the meeting was adjourned, to reconvene this same day at 1:00 p.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

1:07 p.m.

CHAIRMAN POWERS: Let's come back into session.

The afternoon session we're going to focus on the seismic issues associated with this site.

And just to alert people, I am fairly confused on the approach taken. I think I've got myself wrapped around the axle plowing through all the factual information and not understanding quite what the philosophical approach is. So to the extent that you can help me cut through the thicket of factual information, you can safely assume I understand glaciation and things like that, and even some of the geological terms. But I'm a little lost on the overall approach. That would help a lot.

And I guess we're starting with Dr. Anderson.

MR. MUNDY: Yes, if I may, let me introduce. Because I think we have the right group of people here to help.

CHAIRMAN POWERS: Sure. And this is Tom Mundy, correct?

MR. MUNDY: Yes, it is. Tom Mundy from Exelon.

To help all of you in your understanding of what we presented in our application.

Starting at the back of the table there with the microphones to the left is Katherine Hanson. She is with Geomatrix. She was the lead on our application for the seismic source characterization and the basic geology work.

Next is Dr. Robert Kennedy, consultant to Exelon on the performance-based methodology.

Next to him is Dr. Allin Cornel, a member of the Seismic Board of Review and his area of review was seismic criteria and PSHA methodology.

And then finally Dr. Robert Youngs. He's also with Geomatrix. He was responsible for the ground motion and the probabilistic hazards analysis presented in our application.

Appearing up here on the panel and our speakers for this afternoon, Dr. Don Anderson will do the geotechnical and geology information and the overview of that material followed by Dr. Carl Stepp, who is also our Chairman of the Seismic Board of Review. He will do the seismology related information in our presentation.

With that, as far as our agenda on slide 2, we will start with the geotechnical geology information, an overview. We'll go into the seismology and talk about some of the site specific information. Discuss the evaluation methodology that we presented in our application and the results that we obtained from that methodology. And then briefly touch upon the open issues that are in the draft supplement to the SER.

With that, I'd like to turn it over to Don Anderson to pick up with the investigative approach.

DR. ANDERSON: Thank you.

Again, my name is Don Anderson. I'm a geotechnical engineer with CH2M Hill. I was the task lead for the geology geotechnical work that was done on the Exelon ESP site.

Over the next several slides, I think 7, I'll try to give a brief overview of what we did, and then at the end make some conclusions on why we feel the site is suitable for the development of another power generating unit.

So, we started off with the existing Clinton Power Station site. It's located, as you saw, about 700 feet from -- or the Exelon ESP site is located 700 feet from the Clinton site to the southwest.

The ground surface between the Clinton

site and the ESP site with relative with that.

Clinton Lake was about 800 to the north, down about 35 feet. So those are general conditions.

Clinton site had a large amount of geotechnical geology information developed during the preparation of the PSER or FSER. And so that existing database for the general area, just being so close to the Exelon site, we had a complete description of regional geology, and we wouldn't expect that to change much within that short distance.

As part of the work done at the Clinton site, they did a lot of site geology work. They did explorations. So a lot of drilling and sampling work, geophysical, refraction, uphole/downhole work. In the drilling and sampling at this Clinton site, the CPS site, the collective soil samples, rock samples and performed a large number of laboratory tests on it. So all that work dated from back in the mid-1970s when the work was done for the Clinton site. What we were doing is moving 700 to the southwest and saying, well we think this condition 700 feet to the southwest looks pretty similar from the ground surface. And we expect conditions to be very similar, but we need to go through an evaluation to find out how those conditions are at this new site.

So that was the primarily purpose of the ESP work done for Exelon. It was to determine the suitability of the new footprint.

We also because 25 or 30 years had elapsed between the work that was done on the Clinton site and today, there was some data that we wanted to -- methods had changed over the last 30 to 40 years and specifically in some of the dynamic testing methods. And so we wanted to collected some new dynamic information to just confirm that we had the correct data for doing site characterization.

CHAIRMAN POWERS: Now let me ask you a question on just reading the document. When you go through this description of, particularly the site geology, it will episodically come down and include a paragraph by saying "additional details can be found in the FSAR." And I would read that I said, well I didn't know I didn't needed -- I don't know what I'm not missing by not looking at the FSER. I mean, the descriptions seemed to be adequate to me for the site permit.

DR. ANDERSON: What did you miss?

CHAIRMAN POWERS: What am I missing by not looking at the FSAR?

DR. ANDERSON: You probably missed about

200 pages of reading and minute details of --

CHAIRMAN POWERS: That's ten percent of what I've got. So, I mean, it's a minor perturbation.

DR. ANDERSON: Okay. And we could have presented that. It was available.

What's in the FSAR is when you look at regional and site changes, very detailed descriptions of all the stratigraphy of the site, the origin of the site; just a lot of characterization information for the general region as well as the local site. And we said rather than burden the reader with --

CHAIRMAN POWERS: Well, that wasn't your motivation. I don't believe that was your motivation.

DR. ANDERSON: No, well part of it was because I would have had to write all of that, too.

CHAIRMAN POWERS: Now that was the reason.

DR. ANDERSON: Very fair, though. It was time saving on my part. And we thought, well, the person that is interested in that additional information would be able to --

CHAIRMAN POWERS: Well, I guess what I'm asking you is I'm not missing anything salient by not going back to that SFAR?

DR. ANDERSON: As a geotechnical engineer I would say no you're not missing anything.

Now a geologist could argue with me on that, because --

CHAIRMAN POWERS: We'll let him do that on his time, okay?

DR. ANDERSON: Okay. Next slide.

Okay. We did review the geology of the area and then concluded the general regional geology that was presented in the FSAR or the USAR, as well as we looked more recently at some of the geological hazards that might exist in the area.

So our concerns are what is the formations that exist, how did they get there and that helps us understand the uniformity of the site.

We're still concerned about geologic hazards. And by geological hazards that could be faults, tectonic faults or non-tectonic faults.

And it could be karst terrain. Certainly in the southeast U.S. you have the sink holes and you don't want to have power blocks over sink holes. And mining and landslides, all those sort of things.

So we looked at the geology, regional geology in the USAR and made sure that there hadn't been any significant developments over the last 30 years.

We also went to the State of Illinois

records to see if any geologic hazards had been identified in the site specific area. And the conclusion was the general geology hasn't changed. We wouldn't expect it to. And the site hazards remain unchanged and there's no particular site hazards that are -- to put the plant, existing plant or a new plant in any type of jeopardy.

Now the little inset here, just to give some idea. You mentioned the glacial actions. There's been at least three that have gone over the site, and you can see this green area. Here's our site right there. The green area is the last glaciation, that was in Wisconsin. One of the earlier glaciations came down through here and then some portions even south.

What those glaciations do from a geotechnical standpoint is they load the soil. They deposit soils there, but they also load the soil. By loading the soil it does a couple of beneficial things. One is it makes the soils hard and stiff, so it gives it good things like bearing capacity, limits the amount of settlement that occurs. So from a foundation standpoint those are desirable.

It also takes out some of the variations that occurs. With all this weight it makes the soil more uniform. And so that's one of the things that we'll show here as a look at the soil pool file.

MR. HINZE: While you have that up there, could we keep that up there for a moment if I might please? A couple of questions.

I notice that the bedrock contour map that you show in one of these reports shows a valley, a bedrock valley extending to the west/northwest. Is that part of the Mohomet River Valley system? Is that a tributary to it?

DR. ANDERSON: I am going to have call on one of our geological experts. My interest was right at the site and there is a slight -- of that on the site. But the Mahomet River bedrock valley is?

MS. HANSON: My name is Katherine Hanson. I am the consultant with Exelon on the geology.

I would have to check on that. There is a major system, a drainage system there. And I believe that it is --

MR. HINZE: Well, you can see it right there on the map.

MS. HANSON: Part of that drainage system. But I can't answer that question directly right now.

MR. HINZE: It's interesting because it may be part of a large drainage system going down towards the Mississippi, the ancestorial Mississippi.

Another question while you have this slide up, you talk about the compaction from Wisconsin. We're very close to the edge of the Wisconsin.

DR. ANDERSON: Yes.

MR. HINZE: Have you done any real calculations, any quantitative calculations on this? I mean, I've walked over a lot of glaciers in my life and there's quite a nose on that. So the question is how thick was the Wisconsin glaciation at that point, and what would be its quantitative impact upon the clays and lasustrian materials?

DR. ANDERSON: I can't tell you how thick it was, but it wasn't very thick.

MR. HINZE: That's right.

DR. ANDERSON: What I can tell you is from the geotechnical work we've done, we do test in the laboratory, consolidation tests. And those consolidation tests can be used to determine what is the pressure that it's seen at its maximum in the past. And then we compare that to the current pressure, and that is the over consolidation ratio. It's not highly over consolidated in the Wisconsin layer. And that indicates to me as a geotechnical engineer that it didn't have a large amount of ice over the top.

MR. HINZE: Right. So there's a lot more compression that's going to be possible there? Is that something?

DR. ANDERSON: That's a good point in that upper 50 foot layer where the Wisconsin is. But as we're going to discuss a result mentioned later, we're going to take that layer out for some reasons. And so the actual in site construction, and I think Eddie you may have mentioned that this morning, that we've got an upper 50 foot layer that's going to be removed and replaced with an engineering fill.

MR. HINZE: It would be interesting to calculate how much real pressure there was on there, because we used to think the glaciers were very thick and that's not the prevailing wisdom.

DR. ANDERSON: No. And I agree completely. I went through just a quick chat the other night just not realizing that this question would come up. And I'd say oh that's not really that much ice would be taken to create that.

MR. HINZE: Right. Thank you.

DR. ANDERSON: As I said, we started with a large database of geotechnical information at the Clinton site. And just to give you an idea of that database, all the bullets there that you see are soil borings. There are 76 of them. Twelve of them went down to bedrock. And what those shows is there is a thickness of soil that's somewhere in the neighborhood of 250 to 300 feet in thickness. And then you get into rock. And so these, there's various boreholes. Some go down to 100 feet, some do enter the rock at 300 feet. And there is I think a borehole that was done to 500 feet or thereabouts below the ground surface.

The actual ESP site is going to be, I think, right in this area. And then the footprint for the CPS site is there. So they abut next to each other.

The key is that with the footprint down in this area, we have some more explorations that were done during the CPS study that extend beyond the ESP footprint. So all that information was available at the time that we were doing our planning for the ESP site. We had boreholes all around it. And we said well with that existing information and with the information about the geological processes that went into forming the soil at the site, then this is what we're going to do in the way of exploration. We're going to fill in some gaps just to confirm what they saw during the CPS and to confirm that there's no unusual conditions within the footprint.

So the explorations for the Exelon footprint were fairly limited. The red dotted area shows the size of that footprint. The types of explorations that we did there, we did drilling and sampling at four locations. The purpose of the drilling and sampling was to collect soil samples for both classification and for laboratory testing.

Two of those borings extended 315 feet or thereabouts into the rock at the base of the soil profile. The other two extended down to about 100 feet. So that information was to confirm data that had already been collected at the CPS site.

We also conducted cone penetrometer soundings at four locations. And you've probably heard in previous presentations, maybe at Grand Gulf cone penetrometers pushing a rod into the soil. You have a load cell on the end of the rod, it gives you an indication of resistance of penetration which then we can look at and see how the stratigraphy is varying as far as we can push the rod. We can also correlate that information and do engineering soil properties, which could be valuable for some of our analysis.

With the cone penetrometer we also

performed some seismic cone tests. Seismic cone tests are, instead of pushing this load cell into the ground, we pushed a geophone velocity transient stream into the ground and performed basically a down hole seismic test which gave us the sure way velocity of the soil.

Those cone penetrometers we were only able to push about 50 to 80 feet into the ground. That was pushing with about a 25 ton truck. It was hard enough that we ran out of pushing capability. And that's probably when we got to the top of or through the Wisconsin layer, which is probably likely over consolidated into the Illinois layer that appears to be more heavily over consolidated.

Other tests. Nope, I've got more tell.

MEMBER SIEBER: And bedrock is 300 feet, roughly?

DR. ANDERSON: Bedrock is 287 feet, standard feet close enough. And we went probably 20 feet to 30 feet into the bedrock.

MEMBER SIEBER: Yes.

DR. ANDERSON: And I'll show a soil profile and describe the characteristics. Yes.

MEMBER SIEBER: Okay. I can't read this.

DR. ANDERSON: Okay.

MEMBER SIEBER: My eyes aren't good enough.

DR. ANDERSON: Well, we apologize for that.

Other tests that we did at the site, as I said, we did drilling and sampling. We installed some ground water monitoring wells, piezometers to see where the water table is at the site. So 800 feet from the lake.

We also did a deep shear wave compression wave velocity profile using a PS suspension logging tool. This is a procedure that wasn't available back when they did the CPS site. It's a fairly new tool that the Japanese developed 15 years ago. Somewhat similar to the old Schlumberger borehole logging tools. But it gives a very good measurement of sheer and compressional wave velocity in the rock and the soil that went from approximately 315 feet below the ground surface up to the ground surface. And we got velocity values about every foot and a half in that range.

MEMBER SIEBER: And you're able to pick out these various strata?

DR. ANDERSON: Yes. And we'll show that later how in previous days back in the CPS studies, they used up hole and down hole procedures. Got a very average profile compression in sheer waves.

MEMBER SIEBER: Right.

DR. ANDERSON: And this time we'll see very detailed variation.

MEMBER SIEBER: You can actually see the boundaries?

DR. ANDERSON: Yes.

MEMBER SIEBER: Okay.

DR. ANDERSON: Just the stratification interlayering that occurs.

MR. HINZE: Did you do any shale hole reflection work?

DR. ANDERSON: We did no shale reflection work.

MR. HINZE: Why not?

DR. ANDERSON: Because we didn't feel that it would help us -- it would tell us where some of the tops of the hard layers were, but we felt that we had quite a bit of data from the existing CPS site to tell us where those different major horizons were and then with the cone penetrometer and the drilling and sampling we felt that that would give us a good indication of where the different soil layers were.

MR. HINZE: The Staff has raised concerned about a lack of drilling. I thought perhaps you might think about doing some seismic reflection to fill in the gaps?

DR. ANDERSON: It's certainly a consideration. WE have been discussing the need for additional characterization in the material. And one way of doing it would be with some type of refraction procedure.

MR. HINZE: While I'm asking a question about seismic reflection, in the previous site characterization studies were there any seismic reflection studies made of the -- sediments?

DR. ANDERSON: There were reflection refraction surveys done in the original site survey. And I think you can see the top of the rock. I don't think you can --

MR. HINZE: Top of the bedrock? The bedrock surface or the --

DR. ANDERSON: Well, you can see the rock at roughly 300 feet, 250 to 300 feet below the ground surface. So you'd pick up major soil layers. You see where the rock is. You don't see anything below the rock.

MR. HINZE: This is an area, that you well know, is in the LaSalle Anticline area and I imagine there are some faults in the nearby vicinity. I wondered if the previous work had shown any of that and if not, certainly technology has improved vastly in this area.

DR. ANDERSON: Vastly, that's right.

MR. HINZE: Even in the last decade. And I'm wondering if any thought was given to if it hasn't been done, to doing some reflection work to really determine whether there are some structures not only folds, but faults in the bedrock?

DR. ANDERSON: I guess from the ESP standpoint we felt that with the available information and the explorations we had enough to justify or determine whether the site was suitable. Now, in terms of the geology studies, Katherine any thoughts on that?

MS. HANSON: Well, our approach was to evaluate to look for sort of secondary evidence for strong ground shaking in the site vicinity, too, see if there was any evidence for recency or activity.

MR. HINZE: Guarternary.

MS. HANSON: Guarternary. So that was our general approach was that the structures had been fairly well mapped and were well known from some of the state surveys and mapping. And so we used the published --

MR. HINZE: But that wouldn't give you the detail of your site unless they've got a lot more detail in that area than they have in most areas.

MS. HANSON: Yes. But the LaSalle, the structures I think are about 16, sort of 20 miles to the east are some of the closet folds --

MR. HINZE: Where's the nearest fold and fault that one could ascribe to the LaSalle Anticline and associated monoclines?

MS. HANSON: I can double check on that. I believe it's about 16 miles to the east.

MR. HINZE: Is that because we have information shows that they aren't there or that's the nearest place that we have information on them?

MS. HANSON: That's based on the published mapping from the state.

MR. HINZE: Okay. Thank you.

DR. ANDERSON: Just a side note looking at my notes. The one thing in looking over the CPS data what we did include is they have done a good job in the characterization of the site with the exception maybe of some of the seismic dynamic methods they used good techniques that haven't changed a lot since during the drilling and sampling was done back in the

1970s. The laboratory testing was old ASTM methods, and those haven't changed a lot over the last 35 years in the non-seismic areas.

We're going to be looking at this cross section, CC I think in the next slide. And that goes through the footprint of the ESP site and into the CPS site. So here's the ESP footprint and it's picking up two of the boreholes that we drilled for the ESP. One went down to bedrock. And then the P21, P18, P22 are boreholes that were drilled as part of the CPS site.

So the soil conditions what we learned was much of what was recorded in the CPS. There's an upper layer of Loess that's recent with load silt material. And then there's a soil to clay, clay silt layer in the Wisconsin period, and that has been overridden, not a lot but it's strengths in the consolidation characteristics it's still pretty good material. A deep thickness of Illinoisan till, so one of the earlier glaciation. There's a less -- period in between and then this pre-Illinoisan and some people refer to it as a Kansan till. By in large, the properties throughout the soil layer are soil to clay, clay tills with occasional gravels, sand layers.

Rock is located down at 280 feet, 287 feet at the ESP footprint location. Over at the CPS footprint is 250 feet. So there's about a 30 to 40 foot gradual decrease in the layer, the top of the rock layer probably caused by erosion sometime in the past. The rock is primarily shale, has some limestone in it. Very good rock as far as we were concerned. When we got back the rock ore they had we'll refer to as high RQD values. That means you get a nice intact section of rock. It's got high strengths, 15,000 psi or more. Shear wave velocities were 4,000 feet per second or thereabouts.

CHAIRMAN POWERS: I have a technical question about this particular -- it has nothing to do with your application, but a curiosity to me.

You have this glacial outwash located in a couple of places. And you've drawn it in, but your boreholes are through the middle of it. How do you know where it ends?

DR. ANDERSON: Like for example --

CHAIRMAN POWERS: Yes. The little ellipse there.

DR. ANDERSON: That's probably the best way of putting it.

MR. HINZE: That's what the seismic reflection could do for you.

CHAIRMAN POWERS: Yes, but he doesn't have a seismic reflection here.

MR. HINZE: Right. Right. But that's what it could --

CHAIRMAN POWERS: All you know is that two drill holes went through a gravel area?

DR. ANDERSON: Yes. Yes.

CHAIRMAN POWERS: Okay.

MR. HINZE: While we're chatting about that, is that glacial outwash such that that could be subject to liquefaction?

DR. ANDERSON: In shallower depths, yes. Typically we see what fashion occurring in the upper 75 feet of material or so. After that it gets pretty deep. And this gets back to the discussion or comment that we made earlier. We're going to take out the upper 50 feet, which comes down to I think right in this -- down to 736 less 50, so it's somewheres right in this very region. The reason for that was that as we did our explorations we found a few areas that had softer materials and so it would be prone to settlement. Some of that material from the ground water elevation, which is around minus 30 to minus 60 has some sand layers. And that sand layers we found when we did -- and that's basically what they found back in the CPS study as well. So what the CPS they did is they evacuated down I think 55 feet and then they actually built back up 30 feet to get to the foundation level of their power block unit.

MEMBER SIEBER: I guess you could also put piling in there, right?

DR. ANDERSON: That's another alternative.

MEMBER SIEBER: Frankie piles or something like that.

DR. ANDERSON: Yes, or improve the ground by densification processes.

MEMBER SIEBER: Yes. That's pretty tough.

DR. ANDERSON: Yes. It would have to be at the bottom of the excavation to do that.

MEMBER SIEBER: Yes.

DR. ANDERSON: But other key things here. Overall the layering was very uniform from my perspective just considering the distances here and other exaggerations and scales, but we're talking about 4,000 foot difference. And almost pancake like in layering.

MEMBER SIEBER: How thick is the lens? I would call that a lens?

DR. ANDERSON: Yes. I think it's ten feet or thereabouts.

The materials, again if you have clay and silts -- sort of non-identifiable. It's just the size -- sands and sometimes gravels.

Water table, I said before, is located about 30 feet below the ground surface. And that occurs at about 35 feet or the average ground surface. We had some parched water which is the water infiltrates and hits a clay layer and perches on that. And so we have some water up close to the surface. But the permanent ground water elevation is around 30 feet below the ground surface.

What they found when they did the excavations at the site is infiltration water into the excavation was very low. And, again, it reflects these very rarely silty clays, clay to silt materials.

As part of the work that we did on the ESP site, we did data comparisons between the results of laboratory tests and that we collected at the ESP site to the data that had been published in the USAR for the Clinton site. And all that information is presented in the ESP.

By and large, if you look at the layer, the ranges and properties, classification properties, the strength properties they're very similar. And so what we were able to do was by looking at the engineering properties at Clinton versus the engineering properties at the Exelon ESP site, we're able to say it looks the same, behaves the same when we do laboratory tests. And so it's reasonable to -- and we expect it to be the same just from the geological processes. And so we can say that with confidence that the materials that you find at the Exelon site are consistent with the materials that you find at the site on the Clinton site.

By and large, though, those materials are fairly stiff, the clays and the silts. And that's evidence by over consolidation of the clay materials, the strengths of the tests when we did strength tests were higher than what you'd see with just a soil that hadn't been overridden.

MR. HINZE: Can I interrupt you again, Doctor, and just for a second if I might.

We see a lot of variation in the sheer wave velocities here, of course. And we get some pretty low velocities down around 1800 something like that in a couple of zones. Are those zones that you can trace over the site? Can you do stratigraphic work on those? And if so, what are they caused by and are they of any concern to us?

DR. ANDERSON: It's a question. So we're talking here --

MR. HINZE: Well, I'm talking about down in the main -- the Illinoisan I think that probably is.

DR. ANDERSON: Yes, there's one right here.

MR. HINZE: One there and one above, right.

DR. ANDERSON: And I think those are -- you can go back to look at the soil profiles. And they are related to the lacustrine or the finer grain layers there.

Let me just go back for maybe the benefit of some others with shear wave velocity versus depth. And I said we did two types of velocity measurements at the ESP site, one is the suspension. And that was every foot and a half we made a measurements. That's what all these little dots are. And up at the ground surface we did the sheer wave velocity using the cone procedures. They just went down in this vicinity, right here on the surface.

Also shown here in black is the velocity values that used in the work they've done for the CPS site. And so that was using some older procedures, explosive sources, up-hole down-hole procedures.

Now once again, you know you see fairly

good -- you know, the average data goes through -- you know, all these little points here. And what we're saying is that we've got some high layers here down at 100 feet. There was probably a little gravel there that the velocity -- logging tool picked up. And this is the layer we were concerned about. There is a soft layer. And in fact when we had our board review to look at our data, they were concerned about how we modeled this or how Bob Youngs has modeled in this site response study.

This is still 1500 feet per second shear wave velocity. And so relative to many conditions it's still a fairly stiff -- these values here or the red values there are around 2,000 feet per second, which is getting into soft rock or west coast we call it rock. There's another low layer here that's down to about 1200 feet per second.

If you modeled these, and this is where the debate. Because if you model those they become a base isolator and they actually -- and this was -- we used averaging as we went through some of these layers.

MR. HINZE: Now do you find them consistent through the area?

DR. ANDERSON: On the CPS study, the

original study, they didn't pick up those layers.

MR. HINZE: Okay.

DR. ANDERSON: When we did it, we just did a single deep PS logging method, suspension logging method. We were able to pick them up. They seemed to be correlated to a couple of the soil layers. The soil layers had been picked up in different layers but we didn't have velocities at those different -- or the spacial and locations.

MR. HINZE: Do you have holes available so that you could check this?

DR. ANDERSON: No. The holes are backfilled.

MR. HINZE: Okay. All right.

DR. ANDERSON: Lab data, another key element of the program was some of our laboratory testing that was done. And this is the dynamic testing. Over the last 25/30 years one of the test procedures that has really advanced is dynamic testing methods. And the procedure we used on samples from the ESP site is using this torsional shear procedure. The tests were conducted at the University of Texas by Ken Stokee. And what those tests provide is an indication of how the stiffness of the soil changes with level of displacement or sheering strength. And so we have got set of what are referred to as modulus ratio versus shearing stream values. And also got material damping versus shearing stream.

This information goes into site response studies that Bob Youngs conducted.

What we did is we compared those laboratory results to the EPRI curves that were generated back in the early 1990s. There's a set of curves for modulus ratio and damping ratio. And overall the comparisons were quite good. And as a result of that we opted in the site response analyses to use the EPRI curves for doing our site response analysis.

CHAIRMAN POWERS: It says that in the text. Is there a plot or something that I can look at that I missed?

DR. ANDERSON: Yes, there is a plot in appendix B, the plot you never went to figure was.

CHAIRMAN POWERS: Because I looked, and --

DR. ANDERSON: Yes. We were going to show it and we said well it's too much detail.

CHAIRMAN POWERS: And I'm not sure I knew what I was looking at.

DR. ANDERSON: 4.2-6 in appendix B. Yes. Two through six in appendix B.

CHAIRMAN POWERS: Well, I have to look when we get a chance.

DR. ANDERSON: Yes. But it was encouraging again from my standpoint as a geotechnical engineer to see how well the lab data compared to these generic EPRI curves.

Well, in conclusion from the geotechnical studies, our original objective was to conclude or to determine whether the site was suitable for development of a power block structure. And what we concluded was that the properties that we measured for the ESP site was very similar to the properties that were obtained the CPS site.

We also updated some dynamic information. There when they updated the shear weight velocity measurements they tended or they were fairly similar to the average velocities that were measured at the CPS site. And then when we updated the dynamic soil properties, those properties were consistent with the EPRI curves.

And so what we concluded there is we didn't have anything particularly unusual at the site. And certainly nothing different than what had occurred at the CPS site. What that allowed us to do is look forward and say well given these conditions, we've got a stiff site. If we go in with a power block unit similar to what we have at the CPS site, we should expect similar settling characteristics. And those settlement values were very small, they were less then predicted. So that was a real good sign.

The CPS site had high bearing capacities. And so that's good because it means the foundation won't undergo a bearing capacity failure.

So overall from a development of a power block unit it looked like the design could be accomplished with no significant concerns.

From a construction standpoint we knew we had constructed a -- down to elevation line is 55 feet. At the Clinton CPS site without having significant difficulties with excavation slope stability or dewatering issues. And so based on the similarity of properties between the two locations, it is fair to say that we would expect similar ability to have an efficient construction at the Exelon ESP site.

So in summary, it was the conclusion of the people that worked on this was that this site was suitable for future development.

And that concludes my presentation.

MR. HINZE: Are we going to discuss open items now or are we going to come back to that? I understood there was an open item related to geotechnical, and I'm just wondering how you handle that and where that stands at this time?

DR. ANDERSON: If I may suggest we handle it later.

MR. HINZE: Okay.

DR. ANDERSON: For questions and answers.

MR. HINZE: Good show.

DR. ANDERSON: Other questions for me or Carl Stepp will --

DR. STEPP: Well, good afternoon. My name is Carl Stepp, as you heard earlier. And I'm going to summarize in the next dozen or so viewgraphs the work performed for the Clinton ESP site leading to the development of the ground motion earthquake for the site.

First of all, I'd like to just briefly describe the purpose of the evaluation and the regulations that we satisfied during the evaluations, and the regulatory guidance that we used and followed to satisfy the regulation.

The purpose of this work was to compile and update, evaluate new data that has been developed since the mid-1980s when the EPRI SOG seismic source characterizations for the central and eastern United

States were completed. Reg. Guide 165 provides guidance that starting with those evaluations is the proper place to develop a new seismic design characterizations for sites in the central and eastern United States. And we adopted that approach.

We in the process evaluated any changes in the site region seismotectonic environment. And I will describe some changes that we identified that impacted the PHSA and the seismic design for the site.

And finally, we determined the SSE ground motion for this ESP site following the guidelines in 165.

The regulations that are pertinent here and that we followed in this development is the 10 CFR Part 100.23. That was issued in early 1997, effective January 1997. And it replaced the old deterministic regulation Appendix A to Part 100, updating the approaches to modern technologies in particular. It requires now the use of probabilistic hazard analysis or sensitivities analyses to address uncertainties in the entire data set that goes into determining the SSE ground motion. That's a critically important development which we have followed and attempted to update in this evaluation, and you will hear more about that later.

Regulatory Guide 1.165 we followed, essentially in total. I will point out where we departed from that guide in later viewgraphs. That guide implements the new regulation, 100 Part 23. And we also implemented the guidance in the standard review plan Rev 3 section 2.5.2 Rev 3 updating that with some new information that's been developed in NUREG-6728. And I will mention that later as well.

CHAIRMAN POWERS: Let me just clarify for a point for philosophical.

You're required to address uncertainties and it's using either a probabilistic seismic hazard analyses or a sensitivity analyses. Well, the two aren't the same or even similar are they?

DR. STEPP: Not necessarily. But the regulation does permit one to do either. The guidance, however, it gives in 165 gives strong guidance to follow a probabilistic hazard approach.

CHAIRMAN POWERS: And the uncertainties that it's asking you to address are really parametric uncertainties, aren't they?

DR. STEPP: They characterized in the regulation as data uncertainties. And I would say they are a combination of parametric uncertainties and variability and epistemic uncertainties in knowledge base. All of these get factored into the PSHA methodology that we follow.

CHAIRMAN POWERS: Well, when I look at the world of seismologists, which is actually a surprising a small community, if you ask me, you find a consensus group and then you always find this one guy that's the wildman out there and views the world somewhat orthogonal to the rest. I mean, how do you factor in the fact that he might be right?

DR. STEPP: This is a very significant point, and I will ask Allin Cornel to comment on this I think also. But this is a very significant point and it has been a troublesome point in the past in making seismic hazard evaluations using subjective interpretations as inputs.

In regulation an expert has to be given equal weight. And we have attempted to develop mechanisms by which we could devise weights to give expert, but we've not been successful in implementing those in regulation. And so the way we approach this is a rather complicated process approach in which we very carefully select the experts that performed the evaluations on the recommendations of the scientific community. And then we go through a process of giving the experts a certain amount of grounding in subjective probability assessments. We give them a lot of guidance as to what their roles and responsibilities are as evaluators. And we hold series of workshops that are designed to: (1) Give the experts the state of current scientific knowledge about the particular elements of their evaluation that are being addressed in a workshop and to give them an opportunity, them the experts, an opportunity to interact with each other in the discussion of the competing hypothesis, parameters, models and so on that they will be evaluating.

By this process we have been, I would say, reasonably successful in eliminating really egregious departures or outliers in the evaluations.

And perhaps, Allin, you would like to amplify?

DR. CORNEL: I'm Allin Cornel, a consultant to Exelon.

I think Carl has given a very good general summary of this process.

I think it's fair to say the probabilistic seismic hazard analysis has gone as far or farther than many fields of science in which we have lack of 100 percent consensus on multiple hypothesis and models and parametric values. And the process that

Carl discusses has been applied in a variety of major studies. And I think the primary factor that avoids the single orthogonal expert, to use your term, is in fact to make sure this becomes some kind of interactive process among the experts to make sure that there are not what we often find is basically misunderstandings, simple misunderstandings among themselves as to how my model compares with your model to make sure that kind of exercise is open and at the table and as opposed to a questionnaire which you put a weight on a model.

So we try to make that sort of interactive process that Carl discusses. And this was done very extensively, particularly in the EPRI project, EPRI SOG project in the mid-'80s.

CHAIRMAN POWERS: To be sure seismic expert elicitations that I'm familiar with, one where there was a substantial orthogonality of opinion rested heavily on a misinterpretation. But I hasten to point out the British study of expert panels which found that if you had to bet on panels prognosticating the future, you always bet on the wildman. You're about 60 percent chance of being right if you always bet on the most extreme opinion and something less than 30 percent right if you bet on the consensus opinion.

Be that as it may, let's continue.

MR. HINZE: Well I think there's a good example of your orthogonal in the New Madrid area. We all know who I'm talking about, an expert who I think has very great concerns about the use of PSHA. And I'm talking about Kriznesky. Because there are differences of opinion, among strong PHSAers feel that you should do both PHSA and a deterministic. Do you have any comment on that, Carl?

DR. STEPP: Well, yes. Again, I might ask Allin to reenforce here and expand on what I have to say.

This, of course, has come up from the very beginning of our attempts to apply PHSA in the manner that we now apply. And the real situation is that a deterministic evaluation is just one realization of an uncertain range of interpretations. And so we actually perform the PHSA evaluations in an effort to capture that full uncertainty that is required by Part 100.23.

MR. HINZE: It gives different results?

DR. STEPP: It gives different results because it properly weights interpretations across the broad range of uncertainty.

Allin?

DR. CORNEL: Yes, that's well stated. I think the fact that you may have differences of opinions about critical paramatrics, mean return time of New Madrid events is the first order issue. How do you deal with that is what you're addressing.

And I know when the considerations were given to modifying Part 100 in which PSHA was recommended and the concern about the deterministic method that was brought forward was its failure to put all of these cards on the table, including the orthogonal ones, and that's when the notion of well maybe you could use something which is not probabilistic but at least you do a sensitivity study. So you would at least have to do multiple so called deterministic analyses. And once you start working in that manner, the question comes up well what do you do with all of these multiple deterministic analyses when you have them all laid out in front of you. And that's why I believe the primary weight in 1165 is that you ultimately go through the kinds of exercises Carl had identified to weight these alternatives and opposed to taking the worse case of the many worse cases.

DR. STEPP: Okay. I will proceed then to the next slide to give you a brief overview of the regional tectonic and geologic setting. It's primarily the tectonic setting of the area.

What this slide shows a series of basis and archs in the continental stable platform. These are basically what are referred to as epiorogenic features. They're very broad scale features that are formed in the otherwise stable tectonic continental interior.

Prominent among these are the Illinois Basin, and I'll point out where the site is located. It's in this area. And as Professor Hinze pointed out, it's very near the LaSalle Monocline, which cuts down through the middle of the Illinois Basin here. These contours are structural contours on a limestone horizon. I believe it's a lower or emission limestone.

The prominent basis, Michigan Basin, the Illinois Basin. And these are generally separated by archs which end in domes. Just an example of these, the Kankakee Arch over here, the Cincinnati Arch and the Nashville Dome. And here's the prominent Ozark Dome over in this area. These are all structural features that form in the late paleozoic more than 200 million years ago. And they've been effectively unchanged since this by any internal tectonic activity within the stable continental regions.

There are many faults in the area, prominently in this area south of the Illinois Basin and basically throughout. And that faults are in some instances associated with small earthquakes. But the point that I would make strongly here is there are no internal, known internal tectonic forces operating in this region. Basically a passive continental region that is responding to stresses plate balance.

The exception here is the Mississippi Embayment which is imprinted on this table of continental fabric, tectonic fabric in the Mesozoic time. And it arguably remains active now if you take earthquakes as a measure of activity, it's been very active in historic times in the upper Mississippi Embayment.

So this is the tectonic environment of the site region.

Go onto the next one.

Starting with the regional seismicity, the earthquake catalog. I'll first show in this slide the catalog that was developed by EPRI for the EPRI SOG study back in the mid '80s. It expands the time period from the earliest earthquake in 1777 to 1985.

This slide shows relatively few seismicity through this stable platform region. It does show concentrations of earthquakes within 200 miles of the site in the Wabash Valley area. And it shows prominently this active zone known as New Madrid seismic zone in the upper Mississippi Embayment just beyond 200 miles of the site at its closest reach. And this, of course, is a famous well-known earthquake zone for three large earthquakes that occurred in 1811 and '12 and it remains an area of active ongoing earthquake activity.

MEMBER SIEBER: Where's the Wabash Valley again?

DR. STEPP: It's up to the northeast in this region.

MEMBER SIEBER: Okay.

MR. HINZE: Carl, some of us have talked about another seismic zone that occurs within your envelope there, within your ellipse, and that's the Beloit Zone near the junction of Wisconsin and Illinois. The Beloit earthquake is prominent in that.

I notice in the National Seismic Hazard Mapping Project of the U.S. Geological Survey that they still show an ellipse type of affair up in that area and west of Chicago. I'm wondering what basis you dismissed that as a seismic zone to be considered, particularly because it's within a relatively short distance of the site.

DR. STEPP: Okay. I'll comment and then I'll ask Katherine to help me out with some of the details of the faulting in the area.

I think that area that you're referring is probably in the area of the Sandwich fault zone in the Plume River. And it's really the point I was making earlier, this platform has numerous faults in it and we have seen some localization of earthquakes associated with those faults in Ohio there at the Sandwich fault zone. And I'm sure there are others that we could identify as well.

But the characteristics of these faults are pretty consistently the same. You know, they formed in the mid-Paleozoic. They show no evidence of displacing horizons above Paleozoic. And they basically are passively responding in the most prominent interpretation or the dominant interpretations they're responding to stress fill at the plate boundary, and occasionally there are small earthquakes associated with it. But they are not considered to be active in the sense of having local ongoing sources of tectonic stress or strain deformation as for example a member of the San Andreas fault system would have. So I think this distinction is critically important.

And from a hazard assessment point of view what has typically been done by the experts is to group these faults which have similar characteristics and behaviors into a single larger source zone. And the flexibility of the evaluation process allows one to then cluster earthquakes within the source zone or to replicate the historic pattern of earthquakes or to smooth the earthquakes in the source zone depending on the interpretations of the experts.

So that's really the explanation I think in response to your question. It's a better process than the way we handled them --

MS. HANSON: Carol, I'd like to add a couple of things. We did consider and describe some of the recent small earthquakes, maybe 2, 3 4 earthquakes that have occurred up in northern Illinois along that structure, which is actually the northern part of the LaSalle Anticlinorium, some of those structures.

We started from a source characterization standpoint from the EPRI SOG models. And several of the expert teams identified some local sources up in that vicinity that would capture the slightly higher rates of seismicity that are occurring kind of localized along those structures. So we felt that from a seismic source characterization standpoint those models captured that.

MR. HINZE: The you would feel that the seismic hazard mapping project was ill-advised to have a peak acceleration focal point up there in the area? I guess that's what you're saying?

DR. YOUNGS: Perhaps I could answer that? This is Bob Youngs, a consultant to Exelon.

The National Hazard Mapping Project primarily used a smoothing process in which the earthquake rates were mapped based on the density of earthquakes in a local area as opposed to taking one very large zone and assuming a uniform rate. So if there is a concentration of, as you can see on this figure, there is a somewhat concentration of seismicity in upper Illinois and that would translate into a higher rate in upper Illinois compared to central Illinois. And so a seismic hazard map based on that approach would show a higher hazard in that location. So their map reflects primarily the observed pattern of earthquake density across the whole map.

The EPRI SOG interpretations that were

performed in the mid '80s also used or included the option for the expert teams to include spatially varying rates of activity. And so whether or not they actually drew a box around that particular source area, they still had the option of having a higher rate in northern Illinois compared to central Illinois based on the differences in the observed numbers of earthquakes. So their models do incorporate a similar concept implements slightly differently, but a similar concept to what has been applied by the National Hazard Mapping.

So I believe if we had conducted an analysis of the northern area we would also product a somewhat higher hazard than we would in central Illinois.

MR. HINZE: Well, while I'm asking, I notice that you treat central Illinois basin seismic area and then you treat central Illinois basin seismic zone. And those are all with small letters except for Illinois.

Can you tell me where this central? Can you draw on there the central Illinois basin zone?

DR. YOUNGS: I tried to burn Eddie's eyes out.

There are actually six versions of what

the central Illinois seismic zone looks like, because there were six EPRI teams that developed seismic source map. And so there are six general versions of what this zone looks like. But it basically encompasses the area north of -- this is the Wabash Valley and to the west is the st. Genevieve arm, which also had a source zone. So typically this concentration in southern Illinois north of the New Madrid zone had it's own source zone boundary. And then various zones were drawn up that encompassed this area of low seismicity, sometimes with a source zone up here and sometimes this was just part of a very large stable background region.

MR. HINZE: So Illinois basin is then used not as a tectonic term, but as simply a geographic term?

DR. YOUNGS: As a geographic term. And some of the --

MR. HINZE: I think that's the point that needs to be made very clear to the reader. Because when you see central Illinois basin seismic zone our usual procedure is to relate that to a tectonic feature. And you're sending this off into the Kankakee Arch and all the rest.

I would have liked to have seen, I think it would have helped me in my review of this, if I had had a map with that shown. I never did see that. And even if the boundaries have to be diffused, I think that would have been helpful.

DR. YOUNGS: Yes. I believe there are figures in appendix B which show the various interpretations of the experts.

MR. HINZE: I hope a figure hasn't slipped by me, but it probably has.

CHAIRMAN POWERS: The genre seems to be designed to make difficult finding figures and whatnot. Not your fault. I understand.

MR. HINZE: Okay.

DR. STEPP: Let's see, where was I? I think I was down to talking about central Illinois seismic zone. And generally this area is, as you see from this map, and was treated in the work as a region of relatively diffused low level earthquake activity with magnitudes in historic record less than mb 6, which the mb is the magnitude of measure we were using at that time. So what's really constitutes the known earthquake catalog in the mid-1980s.

Now for this project that catalog was updated using first the USGS catalog between 1985 and '95. And this CNSS is no longer a group. It was known as the -- I'm not sure I remember exactly. The National Seismic System. But it's really been replaced by the Advanced National Seismic System, also a part of the USGS. And so we have relied on USGS catalogs for the updating of the EPRI SOG catalog.

And what you see here is, the important point is that we are not seeing a change in the spacial pattern of earthquake activity. We still have relatively concentrated activity in the upper Mississippi Embayment. And we have additional earthquakes showing up in a diffused way generally within 200 miles of the site, perhaps a little more frequently in the Wabash Valley region.

We also updated the catalog to include Paleoearthquake. During the past 20 years or more there have been, I guess, a major contributions to our understanding of past earthquakes in this region and in the New Madrid zone have been studies that use the liquefaction features to interpret the occurrence of earthquakes in the prehistoric record where they were preserved to evaluate.

What this information has shown is repeated large earthquakes in the upper Mississippi Embayment, the New Madrid seismic zone. Large earthquakes in the Wabash Valley zone. This outlying of dotted area here shows general outline, the liquefaction features of that larger quake and identified a couple of earthquakes here near the site just referred to typically as the Springfield earthquake about 40 miles southwest of the site with a center like this liquefaction features. And there was associated with that apparently also a smaller earthquake in the same region in the magnitude 5 range.

MR. HINZE: How do we know that? How do we know that that's a different earthquake? What's the basis of that? You know, the test here goes from one to two and back to two and one, and so forth.

DR. STEPP: Yes.

MR. HINZE: There's some slippage here and I'm wondering is there one or are there two or what's the evidence that would indicae that there might be two?

MS. HANSON: In the vicinity of Springfield there's evidence for -- Paleoliquefaction features are formed at distinctly different times. So there's evidence that there was a feature that formed some classic dykes, liquified sands ejected up to a cap of silty material. And there's clear evidence from the soils and from dating that there was a second pulse or period of classic dyke formation.

MR. HINZE: Excuse me. I'm going to interrupt you for just a moment because I want to make certain I understand. The range of ages, you got have carbon 14, do not overlap?

MS. HANSON: In the case of the Springfield area they're interpreted by McNulty & Obermeier who did the mapping to suggest that there's a second pulse or a second period of time. All the features that they identified seemed to be localized in the Springfield area. And on that basis they've identified a potential energy center there at Springfield.

There is elsewhere throughout the southern part of the state they identified Paleoliquefaction features have been identified at numerous sites. Through radiocarbon dating they have identified and correlated features that they identify essentially a felt area for specific event. The large events in the Wabash Valley have gotten the most study. And there are clear indications from radiocarbon dating that you have events of different ages throughout southern Illinois.

In some cases there is overlap and you can't preclude that Paleoliquefaction you see at one site may be do to a more distant earthquake. And we've factored that into our analysis of a number of events and size of earthquakes based on interpretation of Paleoliquefaction data.

MR. HINZE: Let me ask you a question then as a follow-up to that. In terms of the work that you did on the study of the possible Paleoliquefaction features, you concentrated your studies in areas where the information was present, is that correct, because that's a legitimate zone for Paleoliquefaction? Could you tell us a little bit about your choice of that and how widely distributed the Henry is and if we have a lack of Henry, are we mapping out areas -- could we be failing to map them simply because we don't have the right kind of surficial zones?

DR. STEPP: We'll put up the next slide, which speaks to that.

MR. HINZE: Okay. I'm sorry.

MR. SEGALA: No, no, that's fine. I mean, we were coming to that.

MS. HANSON: I'll respond when the slide is up.

DR. STEPP: Well, you could go ahead.

MS. HANSON: We initially through the literature search, the work that had been prior to in the last 10/15 years had identified Paleoliquefaction fractures in the vicinity of Springfield. And that's indicated by this ellipse.

On this figure the green dots represent Paleoliquefaction features or sites. The size of the dot represents the relative size of the dyke or the feature at that location.

So in this case for the Springfield event there were -- the larger features were localized near Springfield but there were features that were identified out as far as sort of a radius of about 35 kilometers which they felt there were some dating at specific localities that suggested that this event occurred between 57000 and 66000 plus years.

There was also some indications at specific sites in that general area for a slightly younger event which looked like it had smaller features it was inferred to be at the threshold of developing Paleoliquefaction which would suggest it was like a magnitude 5 event. Based on the felt area for the Springfield or what they call the Springfield event, using empirical data from the liquefaction sites worldwide they can look at the general distance, they call it magnitude bound curves, which relates the distance from an inferred energy center to the more distant features and correlate that to magnitude. And on that basis they inferred a magnitude of about 6.2 to 6.8 for this particular earthquake.

They have since revised these curves and based on the newest curves the magnitude would be probably be pushed to that lower part of the estimate, more like a 6.3. That's just a recently published paper.

We started with the understanding that the work that had been done by McNulty & Obermeier and the mapping, the extent that their mapping is indicated by the green which is extending along drainages in this region. They had also done some work along the upper Sangamon River to the east of Clinton site. But their work was fairly limited to this portion southwest of the site.

We choose to do additional reconnaissance to essentially look for some more kinds of evidence for the presence or absence of Paleoliquefaction to the east and the north of the site. In particular our reconnaissance we focused along the LaSalle Anticlinorium structures trend through this general area. One of the features or one of the maps in our appendix 1 or attachment 1 to appendix B shows the location of the LaSalle Anticlinorium structures.

Your question about the Henry formation. The Henry formation is a glacial fluvial deposit. As the glaciers retreated the ice was covering this whole area. As the glaciers retreated the melt water would form and would be distributed forming along fluvial channels. And in those drainages the Henry formation is a silty sand or a sand deposit. These are the types of deposits that will liquify. They're the appropriate grain size. And the ideal environment to look for Paleoliquefaction in central and southern Illinois based on previous studies has been to look for these types of deposits along drainages where they're well exposed and where they're overlain by a cap of fine silty material. And this is very conducive to forming and preserving a record of Paleoliquefaction.

So we focused our study along the larger drainages, the upper part of Salt Creek to the north and east of the site. We did identify some liquefaction features in the vicinity of Farmer City. We did some additional reconnaissance along the upper Sangamon, too, because of where we had found these deposit and because of previous work that had done further to the southeast to define the extent of the larger events associated with Wabash Valley.

We also moved to the north and picked some of the larger drainages where we would have these types of deposits.

You're correct that in this type of environment, unlike New Madrid where there's more extensive uniform deposits that they have used to evaluate or look for evidence for Paleoliquefaction, it's a little bit more uneven. It's basically confined to these drainages, but there is sufficient drainages in the area comparable to where these features have been mapped in detail in Springfield area to make a reasonable assessment of the present or absence of comparable features in the site vicinity.

MR. HINZE: Are there more drainage areas with the Henry formation in that area to the north, west northwest?

MS. HANSON: There are some areas. One of the issues is also the time of year, the size of the drainage. We chose to go out in the late summer when the water levels were lowest so we'd have more extensive exposure. But this is pretty much along the larger drainages.

The smaller drainages, in fact, some of these drainages that were studied by Steve Obermeier and McNulty earlier they did after a particularly strong spring flooding event, these are smaller drainages and they are heavily vegetated and so there's only limited times that you can look at it.

There are some additional Henry formation along the Mackinaw River to the south. We felt that based on the work that we had conducted that we felt confident that we could say that the site vicinity if there was an event comparable in size or larger than the Springfield event, we would have seen evidence for it based on the reconnaissance we had conducted for this study.

We did reconnaissance along about 41 mile of streams and drainages in the area.

MR. HINZE: A final question while you have that up there, if I may. I believe that's McNulty & Obermeier's inferred location of the Springfield earthquake. What kind of an error envelope might we put on that? Because it is very much an inferred star. And how far could we move that?

MS. HANSON: I think that we addressed that there is uncertainty and various people would -- I mean some of the concerns about using Paleoliquefaction are that you see the features where there are susceptible deposits that may be related to more distant sources.

In the case of Springfield there is a fairly -- the pattern of the size and the distribution of the features was, you know, Steve Obermeier felt strongly that you see the largest features in the center and you see the smaller features. So the spacial patterns suggested that the energy center, that this was a legitimate interpretation.

For our characterization of the size and location of moderate size earthquakes that may occur in the Illinois basin or in this region, we did not assume that the Springfield event occurred at Springfield. We allow for the possibility of a moderate size event throughout the region. And we considered uncertainties in the magnitude and the number of possible Paleoearthquakes that could be inferred from not only the previous Paleoliquefaction studies but the work we had done.

MR. HINZE: But you used that for your characteristic high frequency earthquake, right?

DR. YOUNGS: This is Bob Youngs. I just wanted to amplify on that.

In terms of the probabilistic seismic hazard, the implication of the Springfield event was that wed needed to modify the maximum magnitudes for all source zones that encompass the site such that they would be large enough to include the possibility of the Springfield type event. So within the hazard analysis we assumed Springfield type earthquakes could occur anywhere in the site vicinity.

In terms of the frequency of earthquakes in the region, we compared the rate of earthquake activity that you calculate from the observed seismicity that was calculated as a part of the EPRI SOG analysis primarily from events in the magnitude 3 to 4 range. And if you extrapolate that out to the magnitude 6 range and compare it with ranges of estimates of earthquakes of the size of Springfield, the observed seismicity from the historical record would adequately represent the frequency of Paleo events in Springfield area. In other words, there would not be a -- in the case of New Madrid we have Paleo evidence that the events are more frequent than we would get by extrapolation of historical seismicity. That is not the case in central Illinois or has been found to be the case in, say, the Wabash Valley where a number of researchers have shown that if you extrapolate the observed seismicity rate of magnitude 5s and 4s out to magnitude 7s, the frequency of Paleo events is below that rate.

So the modern seismicity rate would adequately represent the frequency of Springfield type events in the region. The only thing that we needed to do to modify the EPRI SOG interpretation was to increase the maximum magnitudes for these sources so they would allow for Springfield events to occur.

MR. HINZE: And you used the 6.2 rather tan 6.8 because of this new --

DR. YOUNGS: No. The determination of the controlling of earthquake shapes was based on solely on the disaggregation of the hazard result. In other words, it was not tied to a particular structure or a particular event. They are representative of events like Springfield, but they are not representative of the Springfield event per se. The actual occurrence or location or size. so they determined solely by taking the relative frequencies of earthquakes that contribute to the hazard from the hazard model and then normalizing them according to the procedure in Appendix C. They are not specifically a Springfield event. They're of a type and, you know, the language we sort of loosely associated them, but that perhaps may have caused some confusion. But they are not specifically a Springfield events or distant events.

MR. HINZE: I think I become confused as

I read that as a result of that.

DR. STEPP: Perhaps it would be best to go back to the previous slide and I'll summarize I think what you've already heard mentioned here. But if I could just put it in context.

This really is the information that required the updating of the EPRI SOG seismic sources. And the updating was not in the source configuration but in the characterization of the rates of maximum magnitudes of earthquakes associated with those sources.

And the principal change are to the increase in magnitude for the central Illinois source. None of the EPRI sources anticipated -- I shouldn't say none of them. But in total they did not fully capture the larger earthquake in the central Illinois source that we observed in the Paleo records. So that was updated.

And the next and perhaps the most important but not necessarily so with regard to the Clinton site is the New Madrid seismic zone the liquefaction studies there show more frequent large earthquakes of the magnitude comparable to the 1811 and '12 sequence of three earthquakes that occurred in that zone. So that was updated. And these were then factored into the PSHA assessment for the Clinton site. So we conducted that PSHA with a fully updated characterization of those sources.

CHAIRMAN POWERS: I struggled to understand how you characterized the intensity of an earthquake that you'd have at the New Madrid site. Can you explain that a better to me?

DR. STEPP: Yes. I think I'll again ask Katherine to respond.

CHAIRMAN POWERS: The trouble that I promptly encountered was the citation of a Bokun and Hopper 2003 paper --

DR. STEPP: Yes.

CHAIRMAN POWERS: Which doesn't seem to exist?

DR. STEPP: I think it does exit, but I'm not sure.

MS. HANSON: The Bokun and Hopper paper was at the time we submitted the initial submittal in September was in press or it was in review. It has subsequently been published as a 2004 paper as part of one of the --

CHAIRMAN POWERS: I could find the 2004. I could not find anything in 2003.

MS. HANSON: Exactly. It was published

and the conclusions regarding the magnitude of the earthquakes changed. We subsequently in response to one of the RAIs considered that new information and reevaluated the magnitude distributions based on that paper as well as other new data.

CHAIRMAN POWERS: Now could you describe for the Subcommittee how you do the distributions?

DR. YOUNGS: How we assess them or how we use them?

CHAIRMAN POWERS: Yes.

DR. YOUNGS: Okay. Again, this is Bob Youngs from Geomatrix.

In terms of the assessment we looked at there are three basic groups that are doing interpretations of the size of the New Madrid sequence that occurred in 1811/1812. And we basically gave each of those sets of interpretations equal weight in developing our assessment of what the size of those events were.

The one group is Bokun and Hopper. One group is primarily led by Arch Johnston at CERI. And the third is Susan Hough and her coworkers. And each of these has basically done different and slightly different interpretations of what methods should be used to assess the size of those events. And as a result they come up with a range of magnitude estimates that vary by around magnitude, 7½ plus or minus, maybe a quarter of a magnitude in terms of the estimated size of those of earthquakes.

So in our analysis in the revised analysis which is presented in the response to the RAI we gave equal weight to each of their interpretations to determine the size of that sequence. So we now have a distribution with weights as to the possible sizes of New Madrid earthquakes that will occur in the future. And we run the seismic hazard analysis with each of those interpretations and then gave equal weight to the results of those interpretations that developed the estimate of the hazard.

CHAIRMAN POWERS: Are you claiming then that the maximum earthquake that can occur at the New Madrid site is that that was observed, whatever that may be, 1811/12?

DR. YOUNGS: In doing this analysis we use a model in terms of predicting or forecasting future earthquakes. We use a recurrence model of which I termed the characteristic earthquake model, which I am a coauthor of. And it involves putting a variability of plus or minus a quarter of a magnitude about our central estimate of what the size of the event would be.

So in terms of the largest possible event that we have in our seismic hazard model for New Madrid, it's a quarter magnitude larger than the estimates that we use for what we call the characteristic event, which would be our best estimate of what the characteristic event would be. So that considered just a variability in the size of future events about our estimates of the size of the past event.

The information that we have in terms of the sizes of the previous Paleo events, the ones that occurred in 900 and ones that occurred that 1450 are that they were, as best that could be told, of comparable size to the size of the New Madrid sequence. In other words, they were not a lot larger than New Madrid. Some of them may have been smaller and we factored that possibility into our various scenarios. But clearly the evidence suggests that at least two of the events in the previous sequences were of comparable size. And I think that the application of this model which has a plus or minus quarter variability would cover, you know, typical variations we might expect to see in future events.

MR. HINZE: While we're asking some

questions, one of the new pieces of data that have come along and I don't see it in this report, that doesn't mean it isn't it there, but that I haven't seen in the report is the report on the strain measurements, GPS measurements in the June *Nature* article, which are interesting, provocative and probably wrong. But these certainly are -- it's published in a very reputable journal.

DR. YOUNGS: Yes.

MR. HINZE: And even quoted in the *USA Today*, which I guess puts the -- how are you going to deal with that in this report and how much credence should it be put on in the review of the site suitability of the Clinton site?

DR. STEPP: Well, as you're fully aware, there's a lot going on to explain why there should be a large repeated major earthquake in the New Madrid seismic zone with no typical tectonic driving mechanism that we know of and no manifestation of those earthquakes.

MR. HINZE: Curiosity.

DR. STEPP: Yes. Well, the answer is that we really don't know. People have put out the strain measurements. They have put forward a hypotheses that tried to explain the earthquakes as a relaxation phenomena.

To speak to the specific article that you're referring to, I think I would ask Katherine --

MR. HINZE: Well, this is Arch Johnston and his group coming up --

DR. STEPP: Yes.

MR. HINZE: -- with 1.25 centimeters per year, which --

DR. STEPP: Yes.

MR. HINZE: -- on that kind of velocities. But it's published. This is new information.

MS. HANSON: There have been over the years various results based on geodetic data and earlier on there were some studies that suggested there was very little or high rates occurring across New Madrid and then very little measurable rates across the zone.

We have considered the longer term, the Paleoliquefaction record there. As Carl mentioned, there are people that have postulated mechanisms whereby you can sort of initiate this process of some kind of loading and relaxation and triggering repeated events. Those models which are models would suggest that we're in the cycle and that we'll continue.

I think at this point we would be hard

pressed not to relay or use the sort of longer term Paleoliquefaction record as a reliable or a best estimate.

I don't know if Carl has any other additional --

MR. HINZE: Well, excuse me. But I think the answer that Professor Johnston, who was a very credible researcher as we all know, is that this is a sign that we have episodic movement in the New Madrid region and that the former measurements which did not detect movement -- we're in period when there wasn't. You know, I'm having a hard time keeping a straight face. But nonetheless, these are some of the verbiage that's going around.

I really believe that it's incumbent upon your report to at least acknowledge the presence of these kinds of measurements and look at the implications of them.

MS. HANSON: I think that in seismic hazard source characterization this issue comes up for other faults in stable craton regions, the Meers fault and other faults in the United States have had evidence for repeated Holocene events and then a period as long as 100,000 years to the preceding event. So the issue of clustering of events and whether you're in a cycle where you're in the cluster or if you're now in the longer period, the quiescent period is something that we grapple with. But at this point I think we can definitely address those issues. We did try to summarize the information on geodetic information was available through the publication of our report.

DR. STEPP: The other comment on this, the evaluation of these kinds of information that we have done in this study, we used what is called the Level 2 SSHAC approach which Katherine and Bob and others involved in the formation and the evaluations and updating of the sources compiled all the new information. They consulted the people including Arch Johnston and others who are working in this area who are respected as having particular knowledge of importance in his evaluations. And the weights that you see on the interpretations really reflect that process of canvassing the state of knowledge.

So I think where we come down on this, at least, is the only really solid information that we can rely on fully for these repeated large earthquakes are the liquefaction studies. The geodetic measurements may hint of things, the various hypotheses that have been put forward make an array of assumptions to support the hypotheses. They may be of some value in explaining the seismicity, but we do not know what that value is at this point, very frankly.

MR. HINZE: But at the risk of stating the obvious, those measurements are now Paleoliquefaction is 6,000 years ago and we're worried about now.

I guess I would like to ask one more question and then I'll shutup for a while. My voice is going. But let me ask the question one of the things that has come along since the site was previously licensed is far-field triggering. Do you have any feel, Carl, for the impact of far-field triggering on our seismic risk assessment in the mid-continent region?

DR. STEPP: I do not. The information base that I'm aware of is associated with the earthquake in California, Mojave earthquake I believe it was called a number of years ago triggered earthquakes throughout the western part of Nevada and eastern part of California.

MR. HINZE: And on Yucca Mountain, too.

DR. STEPP: Yes. Yes. I didn't mention that, but yes.

I think that you're dealing with a very different crust in that region, in fact I know you are. It's a much softer, hotter crust in which the earthquake strain release of that magnitude can get transmitted to a very large region. And I would favor that as -- I mean, if that is correct I should say, my perception of that is correct, then that would argue against the likelihood that you would get this kind of triggering effect in these very stiff thick continental crustal environments in the east. That would be my conclusion.

MR. HINZE: Thank you.

DR. STEPP: Others may have a different point of view.

Okay. I think we are now at the determination of the SSE ground motion. The material I've gone through to now really i s describing to you in a very overview sort of way the studies that were done and the necessary updating of the seismic sources that we did to compute the hazard at the site.

We did update the seismic sources. We did redo the PSHA with the updated information. And we used that to develop the SSE ground motion, that is that being the PSHA results.

We believe the SSA ground motion complies fully with the intent of 10 CFR 100 Part 23. And we applied the regulatory guidance 1.165 with one variation. Instead of using the reference hazard approach, as is now contained in the guidance in 1.165 we elected to use the ASCE Standard 53-05 approach. This standard is a newly developed standard titled "Seismic Design Criteria For Structure Systems and Components in Nuclear Facilities." It is performance-based and we consider it to be a significant update in our approach to deriving SSE ground motion. That is consistent with the direction of risk-informed regulation of nuclear plants.

This is an industry consensus standard. And we believe in has in that context the credibility for and support for the application that we have used it for in this project.

The next series of slides shows some comparison of Reg. Guide 1.65 requirements and guidance with the application that we followed in the EGC SSE development.

First of all, with respect to the investigations that are required, they are the same. We did not depart in anyway from 1.165. We implemented those sections of the guidance fully.

With regard to the seismic source updates, similarly we implemented those sections of the guidance fully.

We applied a SSHAC level 2 assessment methodology to update the seismic source characterizations. That is not specifically called for in the regulatory guidance, but it is certainly consistent with the language in the regulatory guidance. So we characterized that as the same.

We did a PSHA, a full new PSHA for the site as required by the regulatory guidance.

The departure, as I pointed out, is with respect to determining the SSE ground motion, establishing the basis for determining the ground motion. We used the performance-based ASCE 43-05 approach rather than the relative hazard probability criterion, which is contained in 1.165

Next.

MR. HINZE: Excuse me.

DR. STEPP: Yes.

MR. HINZE: Where has this performance-based been used on any nuclear sites or hazardous sites? Has it been used previously?

DR. STEPP: I'll ask Bob Kennedy to respond. But performance-based in a similar contest is also being used at Yucca Mountain. I will just mention that, as you know.

Go ahead, Bob.

DR. KENNEDY: This is Bob Kennedy.

CHAIRMAN POWERS: And that's an endorsement for it?

DR. STEPP: I'm sorry?

CHAIRMAN POWERS: That's an endorsement for it?

DR. KENNEDY: This is Bob Kennedy, consultant to Exelon.

Basically the performance-based approach that's in ASCE 43-50 was originally developed in the early 1980s for use on Department of Energy facilities, originally in a report UCRL 15910 from Lawrence Livermore Labs followed up by, I believe it was in '84, with the DOE standard 1020. And then has been gradually gone through the DOE system for DOE facilities because of a wide variety of risk and a feeling that different kinds of complexes needed to be designed for different performance levels.

ASCE 43-05 was actually developed by the American Society of Civil Engineers at the request of the DOE to have an industry consensus standard to ultimately replace DOE standard 1020. It has in it five different quantitative performance levels in terms of annual frequency of unacceptable seismic risk and four different qualitative performance levels as to what constitutes a limit state for acceptable performance.

The category that has been selected here is the highest category in ASCE 43-05. It forces to state to a limit state of essentially elastic behavior at an annual frequency of exceedance of about one times ten to the minus five or better. Typically between .5 times ten to the minus five and one times ten to the minus five for staying on the onset of significant inelastic behavior.

Subsequent studies which were submitted to the NRC some time ago on this project and some studies that I'm not sure have yet been submitted to the NRC indicated that leads to core damage frequencies typically for central and eastern U.S. sites in the neighborhood of one to four times ten to the minus six.

The idea that DOE had for the performance-based criteria is there's a very wide of sites. Western sites have hazard curve slopes that are steep. Central and eastern sites have hazards curves that are fairly shallow. And they shouldn't be designed for the same annual frequency of exceedance of the ground motion. With a steep hazard curve you could design for a more frequent ground motion than with a shallow hazard curve to achieve the same performance goal.

But this whole idea also is being developed more and more into conventional design. The idea of performance goals, in fact it's the idea behind the IBC code is instead of designing for a 500 year earthquake, which is what conventional facilities used to be designed for, now you design for two-thirds of the 2500 year earthquake. That helps to account for this slope effect.

So it's been a gradually evolving area since the early '80s.

DR. STEPP: Thank you.

MEMBER KRESS: Has NRC staff reviewed this

DR. KENNEDY: I'm sorry.

MEMBER KRESS: Has the NRC Staff reviewed this procedure?

DR. KENNEDY: The NRC Staff has seen the procedure. This is one of the open issues between the Applicant and the NRC Staff. So I think we need to let the NRC Staff answer to the details.

Dr. Cornel reminded me. I may have been incorrect. 15910, I'm sorry I said early '80s. Actually started in 1985, UCRL 15910. And the first DOE standard 1020 came out in the early '90s. So I had my dates slightly wrong. I think that needs to be corrected.

DR. STEPP: Okay. Going on then with the comparisons of the methodology, we followed completely the Reg. Guide 1.165 guidance for de-aggregating the hazard and determining the controlling earthquakes for the site.

We followed generally the intent. We followed the intent, I will say, of the standard review plan in developing the site response analyses, but we updated the information in the standard review plan with NUREG/CR-6728 approach. And we used that approach which has not yet gotten into the standard review plan to develop the site response analyses.

Continuing with the comparison, I think we've discussed some of this already up to now. The reference probability is the annual probability level such that 50 percent of the set of the most modern seismic design currently operating plants has a median annual probability or annual medial probability of exceeding the SSE that is below this level. And it's set at 10 to the minus 5 or it is determined to be 10 to the minus 5 for a hazard response spectra levels of 5 to 10 Hz with 5 percent damping.

The performance-based approach, the SSCs will have a target mean annual frequency of 1E-5 per year for seismic induced onset of significant inelastic behavior.

This provides a significant margin against SSC failures that might lead to core damage. So there is a substantial margin of safety built in by keying this to the metric of inelastic -- onset of inelastic deformation.

Generally, as you just heard Dr. Kennedy say, this leads to seismically induced core damage frequencies that are significantly less than those for the existing population of well designed plants, or I should say for the population of plants that have PRAs or where PRAs have been performed.

MR. HINZE: What's wrong with a performance-based? It sounds good.

DR. STEPP: I say yes.

MR. HINZE: Is that a straight line? What's the major disadvantage? Everything has a disadvantage.

DR. STEPP: I don't know the details of any disadvantage. It seems to me that the performance-based approach is the next logical progression in steps to implement a fully risk-informed seismic design quote and a risk-informed regulation methodology. That's really the position that we are coming forward with. Others may wish to comment on this in more elaboration.

DR. KENNEDY: Bob Kennedy.

Basically the performance-based seismic design procedure requires you to make certain decisions. What is an acceptable annual frequency of unacceptable seismic performance, what constitutes unacceptable seismic performance, how much seismic margin exists in our existing codes and standards. Decisions have to be made on each of these aspects.

Now, in the ASCE committee which had, as I recall, approximately 30 members on that committee, those decisions were made.

As to what is wrong with it, I don't think there's anything wrong with it but I think it is something that the NRC Staff has only recently started to look at and legitimately they need to decide whether they are comfortable with the decisions that were made. And so I think it's a matter of gaining some comfort.

MR. HINZE: That's very helpful. Thank you.

DR. STEPP: I would make just one other point that's critically important in that use of the performance-based approach does not in anyway impact the basic fundamental decision that the Commission made when it went from deterministic to probabilistic approaches that the existing population of plants are adequately safe, can be used as the basis for establishing designs of future plants.

CHAIRMAN POWERS: Well, we have to inject that the Commission also said they had an expectation that future plants would be safer.

DR. STEPP: Shall I go on to the next slide?

CHAIRMAN POWERS: Please.

DR. STEPP: Yes. This is the final viewgraph that I will show. I think we do have open items after this, but this is the final viewgraph in my presentation.

And what you see is the derived SSE design spectrum, both vertical and horizontal plotted against the Reg. Guide 1.60 standardized spectrum scaled to .3g at 33 Hz. And the essential points to make here I think is that the design spectra generally fall below the Reg. Guide spectra scale of 33 Hz in the frequency range below about 16 Hz here, the horizontal spectra actually begins to exceed the standardized spectra scale of .3g. At a level of about 20 Hz the vertical spectra begins to exceed. And the maximum exceedance is about 25 percent at 33 Hz.

Our view is that this is an equitable exceedance that is in the range where structures of system and components of nuclear plants do not -- are unlikely to be damaged. It's really in this range here where we -- where the Reg. Guide entered at .3g significantly exceeds the design response spectra. I should say the SSE ground motion spectra that the plant tests its maximum response.

Perhaps, Bob, you'd like to comment on this further?

DR. KENNEDY: Bob Kennedy again.

Generally a nuclear power plant's structure systems and components if you tried to say what is the natural frequency content of the input motion that is most potentially damaged to structure systems and components of nuclear power plants, I believe it's generally agreed that the dominant contributor to damage is spectral accelerations typically in the 5 to 10 Hz range. This being a fairly stiff structure, conventional facilities would be lower frequencies then that. But there's very little damage potential from spectral accelerations greater than about 10 Hz because it takes displacements to produce damage and the spectral displacement or spectric acceleration is divided by the quantity 2 pi frequency quantity squared. And so there's very little spectral displacements on these higher frequencies. This is, of course, the reason why in Reg. Guide 1.165 when the NRC developed their relative approach, they concentrated their relative approach on comparing spectric accelerations from the probabilistic hazard curves with existing plant SSEs by averaging the comparison in the 5 to 10 Hz range. The same thing applies here. These higher frequencies simply are not considered to be very damaging. I know the NRC Staff is doing internal studies on this issue because it is an open issue. All these central and eastern U.S. spectra are having high frequencies and there's a large study going on on the part of NEI being done by EPRI on this issue. And the NRC Staff is being kept aware of those studies.

So at this stage it's still an open issue, the high frequencies. But this level of exceedance at high frequencies, for instance, is much less than the level of exceedance that you might see on some other ESP applications. It is a small level of exceedance and it only occurs above 16 Hz.

DR. STEPP: That's my final viewgraph. Thank you.

CHAIRMAN POWERS: Any other questions for the speaker?

Thank you.

MR. GRANT: Eddie Grant with Exelon.

We did recently get the seismic supplement on the draft SER. It does contain seven open items. We're still looking at those seven open items and determining how we're going to respond to those. So we're not really prepared at this point to give you much information in those areas.

CHAIRMAN POWERS: That's fine.

MR. GRANT: I think that the Staff is going to discuss those further.

CHAIRMAN POWERS: I think our objective is more to understand why they're open than what the resolution is right now.

MR. GRANT: Okay.

CHAIRMAN POWERS: Unless you just had some particular insights you wanted to offer, that's fine.

MR. GRANT: Actually, we're kind of hoping to get some insights.

CHAIRMAN POWERS: Okay. Good.

Well, I thank you for a very deliberate effort to try to straighten this out for me. I can't congratulate for success. I'll still need to study this a letter more.

Any other questions? Seeing none, I will declare a recess for the next 15 minutes.

(Whereupon, at 3:10 p.m. off the record until 3:29 a.m.)

CHAIRMAN POWERS: Okay. Let's come back into session.

We'll turn to the Staff presentation in the seismic area. And, again, our speak is John Segala

MR. SEGALA: Yes. I'm John Segala, the lead project manager for the Exelon early site permit safety review.

If you want to go to the next slide.

We're today to provide an overview of the Staff's geology, seismology and geotechnical review, and specifically to discuss the open items that we issued in the supplemental draft safety evaluation report on August 26, 2005. Since the supplemental was recently issued, the Applicant hasn't had time to provide a response. Staff is prepared today to discuss the open items but not to get into possible resolutions of the items. And we plan to have a meeting later this month with the Applicant to go through all the open items in detail.

Dr. Cliff Munson is the lead reviewer for the seismology review. And Tom Cheng is the reviewer for the geotechnical review as well as his contractor, Carl Costantino.

We had two main open items on the performance-based approach that Exelon is proposing, open item 2.5.2-4 and open item 2.5.2-5. And I'm not going to get into the details of this slide. I think Exelon pretty much covered this in their presentation.

With regard to open item 2.5.2-5 down at the bottom of the slide, the Staff had questions regarding some of the assumptions used in the performance-based methodology. And I believe there's like five or six sub items that we asked the Applicant to --

CHAIRMAN POWERS: Can you go through those for four?

MR. SEGALA: Well, I can sort of read to them. The first one is justify the assumption of a linear hazard curve in logarithmic space and the appropriateness of solely using 10^{-4} to 10^{-5} interval to determining the amplitude ratio. That was the first one.

Justify why a B value of .4 was used and show the DF -- I think it's a design factor varies with different B values over the range of the amplitude ratios.

The next one was clarify the meaning of onset of significant inelastic deformation, specifically the words "onset" and "significant" with regards to the failure of system structures and components and core damage and the relationship of onset of significant inelastic deformation to essentially elastic behavior.

Justify the long term stability of the target performance goal 10^{-5} in comparison to the hazard based approach reference probability in Reg. Guide 1.165.

Since the target performance goal of 10^{-5} is based on seismic PRAs for current light water reactors justify the use of this value for advanced reactor designs which may differ from current light water reactors.

And the last one, since system structures and components for nuclear power plants are designed using the seismic criterion in the standard review plan, clarify how the design criteria in the ASCE Standard 43-05 are similar enough that systems structures and components design following the standard review plan would also achieve a 1 percent or lower probability of unacceptable performance.

So that's the assumptions that the Staff had questions on regarding the methodology.

With regard to open item 2.5.2-4 the Staff made some observations about that performance-based safe shutdown earthquake spectrum for the early site permit site is approximately equal to the mean 10^{-4} uniform hazard spectrum. The performance-based SSE of 10^{-4} may not adequately represent the seismic hazard from local earthquakes.

Next slide, please.

And sort of in conclusion to these items, the performance-based approach with a target of 10^{-5} annual performance goal may not be suitable for determining the safe shutdown earthquake for the Clinton early site permit site.

Next slide, please.

Other seismic open items 2.5.1-1. We discussed this earlier. I think when Exelon was giving their presentation. This is regard to the Bokun and Hopper preprint that was originally used by the Applicant to come up with the magnitudes for the New Madrid earthquakes. And when it went to press in 2004 the Staff -- they came out with higher magnitudes. So the Staff had the Applicant go back and redo that analysis.

CHAIRMAN POWERS: Now, as I look at those analyses, you know preprint to final published, I see things like everything got kicked up by about .4 on this moments scale that they were using. Yet when the Applicant spoke he talked about a quarter, .25 being the relative uncertainty here. Well, obviously, in the case of the Bokun Hopper they had a uncertainty of .4 between one publication and the other. So I mean, how do you look upon these kinds of uncertainties that the Applicant is ascribing to his earthquake magnitudes?

MR. MUNSON: This is Cliff Munson from the Staff.

The Applicant used, I believe, six different models to represent the New Madrid seismic zone. And each of these models have different moment magnitude values for each of the three different ruptures. And they range from the low sevens up to about 7.9, I believe was the highest one.

CHAIRMAN POWERS: Right.

MR. MUNSON: And they weight the middle range of magnitudes, which is 7.6, 7.8 and 7.5. They give the highest weight to that set of magnitudes.

So the staff, we evaluated that range of magnitudes to determine if it was an appropriate representation of what the current thought is on the New Madrid and those events during 1811/1812.

CHAIRMAN POWERS: Does the Staff do an independent seismic hazard analysis or do they just really weight the inputs that go into this?

MR. MUNSON: No. We have consultants with the U.S. Geological Survey. We have our geologic experts that look into the Applicant's characterization of the source.

CHAIRMAN POWERS: So it's really the inputs to the analysis that you look at?

MR. MUNSON: Right. Right.

CHAIRMAN POWERS: Yes. Good.

MR. SEGALA: Okay.

CHAIRMAN POWERS: You speak to the New Madrid. I mean, we've got other seismic sources here. And we have the treatment of the Springfield earthquake. Now you had no troubles with their analyses on those sources?

MR. MUNSON: This is Cliff Munson again.

That's one of our main open items with regard to the performance-based approach and the final safe shutdown earthquake ground motion spectrum is whether that adequately captures the Springfield earthquake based on the uncertainty and the magnitude, and also the location of where that event occurred. One of our concerns is whether the SSE adequately represents that potential hazard from that earthquake.

CHAIRMAN POWERS: Just as a point of curiosity to my mind, when we have a seismic source such as New Madrid that's been looked at more times than I'd care to think about, and it has a prescribed return frequency now of somewhere between every 200 and 800 years? Am I correct? And it's been, what, 200 years since the last major shift in that fault zone? Do we take the likelihood of having a major earthquake from that source in the next year as one over 500 as an average or do we do something different because of the relative well established frequency?

MR. MUNSON: I think we certainly factor in the uncertainties in those recurrence estimates which are based on Paleoliquefaction studies. And those recurrence intervals are mean values and definitely not exact estimates of recurrence for the New Madrid source zone.

So, I mean, that's one of the benefits of the PSHA, although the old deterministic method is that it captures this recurrence interval which was not previously part of the deterministic approach. So definitely that's one of the reasons why we updated in the late '90s using 1.165.

DR. YOUNGS: If I may, this is Bob Youngs.

CHAIRMAN POWERS: Yes.

DR. YOUNGS: I wanted to add an additional point of clarification.

In our application or model of the New Madrid seismic zone we used two types of recurrence models. One was we used a Poissionian model, which this has the rate of one over 500. And the second model is we apply what is called a renewal model which provides for time dependent probabilities which accounts for the elapsed times in the most recent event.

CHAIRMAN POWERS: That's really the question I was asking is if you look at that. And so you look at it both ways?

DR. YOUNGS: Yes, we looked at both of those and to see what difference.

CHAIRMAN POWERS: Sure.

DR. YOUNGS: It made some difference, some small difference.

CHAIRMAN POWERS: Well, I'm sure it does. But the question is whether it's smoke compared to your old law uncertainty or not?

DR. YOUNGS: I think the overall uncertainty of actually calculating the rate is probably larger than the effect of those models.

CHAIRMAN POWERS: It was just an item of curiosity to me. Thank you.

Let us continue.

MR. SEGALA: Okay. With respect to open item 2.5.2-1 the Staff is asking the Applicant to clarify and justify the EPRI ground motion attenuation study distance-conversion method. When the Staff read through the Applicant's description, it wasn't clear to them the process. So this question just asked for clarification.

CHAIRMAN POWERS: If the Applicant had done it in the hypothesized way instead of what is it, the joiner or something distance, does it make a huge amount of difference?

MR. MUNSON: For the sources that -- the most amount of difference, it would be for close in sources, sources very close to the site it would make a difference on what type of distance measurement you're using. But for most cases, say 20 kilometers and on out, it doesn't really have that much difference.

CHAIRMAN POWERS: I would think not. But

it's a question of spectra versus linear distance.

MR. MUNSON: Right.

MR. SEGALA: Next slide, please.

The next set of open items are related to the geotechnical review.

For open item 2.5.2-2 the Staff reviewed responses from the Applicant and found large variabilities in strength and stiffness of the soil as demonstrated by shear wave velocities and standard penetration test blow counts. So this open item is saying that the site response model does not adequately represent the variability of the soil properties.

CHAIRMAN POWERS: You're speaking of the soil properties below the foundation of the proposed plant?

MR. SEGALA: I believe this is the soil properties in the top 60 feet or so.

CHAIRMAN POWERS: But if he is going to remove the top 60 feet and place an engineering fill of --

MR. CHENG: This is Tom Cheng.

My understanding about it, the Applicant's intent is to try to remove the first top 60 feet of soil before they put a foundation there. That's the layer we're talking about here.

CHAIRMAN POWERS: I guess I'm struggling to know what the uncertainty is here.

MR. CHENG: Would you please repeat your question again, please?

CHAIRMAN POWERS: Well, I mean if your concern is the top 60 feet and the Applicant says he's going to take that out and put an engineering fill in is it that fill that you're worried about?

MR. CHENG: It's the original soil.

CHAIRMAN POWERS: But that's going to be gone.

MR. CHENG: Yes.

MR. MUNSON: I think when we originally wrote this open item we were -- I guess we overlooked that commitment to remove the top 50 feet. So I think, for example, this is probably one of the open items that will be easily --

CHAIRMAN POWERS: Yes, it's not going to be there anymore, is that correct? Am I missing something here? Okay. Okay. Fine.

MR. SEGALA: Open item 2.5.2-3 the Staff's questioning if the EPRI shear modulus and damping curves are appropriate for the site.

And for open item 2.5.2-4 this was just

another clarification point. The application states that at the COL stage they're going to determine whether additional drilling and sampling is needed. And the Staff is basically saying there's enough variability in soil properties within the ESP site to necessitate further exploration at the COL stage. And so we're just looking for some clarification words in the application.

CHAIRMAN POWERS: Is this again this top 60 feet or is this something deeper that I don't know about?

MR. MUNSON: Well, yes, let me speak to that. All of our regulatory guidance calls for additional soil borings, especially for critical structures such as the reactor building, aux building. And there was a statement in the application that basically said they would assess the need to do further borings at COL. And we viewed that as kind of a lukewarm commitment and we wanted to clarify that they would actually be doing several more borings as our regulatory guidance directs.

CHAIRMAN POWERS: Well, the regulatory guidance can direct it. Is it really necessary? I mean, I'm not sure what you're driving at. They seem to have made, both in their document and their oral presentation, quite a discussion of gee these things kind of look alike from the old site to the new site.

MR. MUNSON: Measurements of stability of the foundation static stability especially for critical structures, they need to know that in great detail. So they're going to need to do additional borings. And I think they would agree with this on that point.

CHAIRMAN POWERS: Okay.

MR. SEGALA: And that concludes my discussion. We're going to be working to resolve the open items and open for any additional questions.

CHAIRMAN POWERS: And your schedule is to attempt to have a final SER in late February?

MR. SEGALA: Yes. The initial, the early milestone is to have all these open items resolved by the end of October.

CHAIRMAN POWERS: October.

MR. SEGALA: We need that in order to meet the FSER date.

CHAIRMAN POWERS: Did you have any other questions for the speaker? You're happy and content? Why do I think you know more about this than you're telling me?

Well, I guess you're done.

MR. SEGALA: Yes.

CHAIRMAN POWERS: You're done. The Committee is not done yet.

MR. SEGALA: Thank you.

CHAIRMAN POWERS: I think we can go off the transcript record now.

(Whereupon, at 3:48 p.m. the meeting was concluded.)