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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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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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ABWR SUBCOMMITTEE

OPEN SESSION

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TUESDAY

NOVEMBER 30, 2010

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Said Abdel-Khalik, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

SAID ABDEL-KHALIK, Chairman

JOHN W. STETKAR, Member-at-Large

DENNIS C. BLEY, Member

JOY REMPE, Member

JOHN D. SIEBER, Member

NRC STAFF PRESENT:

WAYNE BIEGANOUSKY, NRO/DSER/RGS1

LAUREL BAUER, NRO/DSER/RGS1

TEKIA GOVAN, NRO/DNRL/NGE

BRAD HARVEY, NRO/DSER/RSAC

JAY LEE, NRO/DSER/RSAC

ADRIAN MUNIZ, NRO/DNRL/DDLO/NG

GEORGE WUNDER, NRO/DNRL/DDLO/NG

MAITRI BANERJEE, Designated Federal Official

ALSO PRESENT:

BOB BAILEY, Exponent Failure Analysis Associates

RICHARD BENSE, STPNOC

COLEY CHAPPELL, STPNOC

RALPH GRAHAM, PBS&J

SCOTT HEAD, STPNOC

ROBERT W. HOOKS, Sargent & Lundy

PAUL JENSEN, PBS&J

CHARLES KINCAID, PNNL

RAJIV PRASAD, PNNL

BILL STILLWELL, STPNOC

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P R O C E E D I N G S

Time: 8:30 a.m.

CHAIRMAN ABDEL-KHALIK: The meeting will now come to order.

This is a meeting of the ABWR Subcommittee of the Advisory Committee on Reactor Safeguards. I am Said Abdel-Khalik, Chairman of the Subcommittee.

ACRS members in attendance today are: Dennis Bley, Jack Sieber, and Joy Rempe. John Stetkar will join us at a later time during this meeting.

Ms. Maitri Banerjee is the Designated Federal Official for this meeting.

This year we have been briefed several times by STPNOC and the NRC staff regarding the South Texas Project combined license application and the corresponding safety evaluation reports with open items prepared by the staff for all chapters except Chapter 2.

The full Committee was briefed in July and wrote an interim letter to the Chairman. In today's meeting we are scheduled to discuss Chapters 2 and 15.

Chapter 2 will be presented to us for

the first time, and the staff safety evaluation, we understand, has open items that are not yet resolved.

Chapter 15 was presented to us before, and the staff will discuss how they have resolved the open items in their safety evaluation.

The staff and the applicant may also discuss follow-up action items from previous ABWR Subcommittee meetings.

Contrary to the Federal Register Notice that announced this meeting, Chapter 7 has been postponed to a later meeting. I expect today's discussion to be centered around the technical issues in the application and the SER.

The rules for participation in today's meeting were announced in the Federal Register on October 29, 2010, for an open/closed meeting. Parts of this meeting may need to be closed to the public to protect information proprietary to the applicant or other parties. I am asking the NRC staff and the applicant to identify the need for closing the meeting before we enter in such discussion, and to verify that only people with the required clearance and need to know are present.

We have a telephone bridge line for the public and stakeholders to hear the deliberations. That line will not carry any signal from this end during the closed portion of the meeting.

At this time, if there is anyone on the bridge line, please identify yourself.

MR. HEDGE: This is Joe ~~R. Hedge~~ Litehiser and Jim ~~Rooney~~Marrone with Bechtel in San Francisco.

MR. CASHELL: This is Steve Cashell and Scott Bennett from STP in Bay City, Texas.

CHAIRMAN ABDEL-KHALIK: Is there anyone else?

MR. SMITH: This is Rob Smith with MACTEC ~~MAGTEC~~ Engineering in Charlotte.

MR. HOWARD: And Dan Howard with Fluor ~~Flory and Greenwald~~, South Carolina.

CHAIRMAN ABDEL-KHALIK: Thank you, gentlemen.

At this time, to minimize disturbance, the line will be kept muted until the last 15 minutes of the meeting. At that time, we will provide an opportunity for any member of the public attending the meeting in person or through the bridge line to make a statement or provide comments.

As the meeting is being transcribed, I request the participants in this meeting use the microphones located throughout the room when addressing the Subcommittee. Participants should first identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

We will now proceed with the meeting, and I call on Mr. George Wunder to begin the presentation.

MR. WUNDER: Thank you, Mr. Chairman. I believe that you have covered accurately any introductory points that I would have made.

I have only to introduce members of the DNRL staff. The Chapter 2 presentation will be led by Tekia Govan, and she will introduce the members of the technical staff at the appropriate time. Chapter 15 will be presented by Mr. Adrian Muniz.

CHAIRMAN ABDEL-KHALIK: Scott?

MR. HEAD: Thank you. Appreciate this opportunity to brief the ACRS again. With respect to the day, we understand that we will have a break after our introductory presentations, and then we will do the action items following that. We are prepared to support that.

Here is our agenda today: A little more detailed discussion of items of interest that we are going to be discussing today. The main coolant reservoir embankment breach, we believe, is obviously a topic that we would like to present; the wave generation during the MCR breach, and the probable maximum storm surge.

As you had noted, the NRC staff still has open items associated with these, but we have done a significant amount of work in these areas, and we felt that it was important to brief the ACRS on those efforts. So that is what we are planning to do today.

Here are the action items we are attempting to also address today, if we have the time to get to them.

Attendees: Chapter 2, as you know, has an extensive amount of material to cover, and we have asked a number of individuals from around the country to join us today as either involved directly in the presentation, such as Mr. Paul

Jensen and Randy Graham with respect to MCR breach, and Bob Bailey with respect to the storm surge.

Other people are here to answer potentially any other questions that might come out of a Chapter 2 discussion.

Okay. We felt we would put this slide back in. We have used it in a couple of presentations, but it does show the main cooling reservoir, and it will be a topic of discussion today, and noting again the large site, the size of the main cooling reservoir, the infrastructures in place for the South Texas 3 and 4, because of -- opposite Unit 1 and 2 existing there.

Chapter 2 deals with population, and we do have a low population density in the area, and the last point there, the strong community support.

Here is another picture, just to give again a water perspective for the site. The water down there at the bottom is the ultimate heat sink for Units 1 and 2, and like I say, another picture of the reservoir from a lower angle.

Overhead shot showing where 3 and 4 is going to be located. The yellow line at the top is 521 and, if we get into the discussions on the MCR breach, that more or less formed a boundary for our calculations that were performed. And it is important to note that the Gulf of Mexico is to the bottom of this picture to the south, and most of our discussions will be regarding the north embankment, and they are in close proximity to 3 and 4.

Finally, this last picture is just a little closer shot of the north embankment showing 1 and 2 and the ultimate heat sink, and also it shows the current excavation plan. I would note, you see a couple of sharp straight lines with shadows. That is the crane walls that we are going to be building to -- It is important to the construction of Units 3 and 4, and we expect to start clearing the ground area to start preparing to build those here in the very near future. So we are making progress in that area.

Any questions for me on this introduction? Okay, I am going to turn it over to Dick then to go through our more detailed presentation.

MR. BENSE: My name is Dick Bense. I am the licensing engineer responsible for coordinating Chapter 2, which required input from a very large number of people.

Initially, I would like to go over the topics that are covered in Chapter 2. Essentially, what Chapter 2 does is to compares the site characteristics and acceptance criteria in the DCD to what actually exists at the STP site. We will cover geography and demography; nearby industrial, transportation, and military facilities; meteorology; hydrology engineering; geology, seismology, and geotechnical engineering.

The second section of Chapter 2 is the requirements for site acceptability. We look at design basis events and severe accidents, and the remainder of Chapter 2 in our COL application is essentially COL information items. There are 42 COL information items that are requested. All of that information is supplied as supplemental materials in Section 2.3S, 2.4A, and 2.5S.

The principle purpose of Chapter 2 is to verify that the site design characteristics specified in the ABWR DCD are satisfied. All of those ABWR site characteristics are satisfied except for the maximum flood level. The DCD limit is one foot below grade. Our limit is six foot above grade. We will talk a lot about that later. The principle reason for that is the MCR breach.

Precipitation: It rains just a little more in Texas than the DCD anticipated. We exceed those limits by a very small amount. We will be discussing that.

Ambient design temperatures: The maximum wet bulb, both the coincident and non-coincident temperatures. We exceeded the limits specified in the ABWR DCD. There is no significant impact on the design as a result of that.

The last item is the soil properties for minimum shear wave velocity. The DCD established a limit that shear wave velocity would be greater than 1,000 feet per second. We have several layers of soil that exceed that limit, and as a result of that, we will be doing seismic structure interaction calculations which will be discussed at another time in response to Sections 3.7 and 3.8.

On Section 2.2, the requirements for ABWR site acceptability, our conclusion in our application was that the site is acceptable because all of the design characteristics fall within the envelope of the ABWR, except where were noted and justified.

In addition, for external events the Reg. Guide 1.206 requires that these events have a probability of less than 10^{-7} for potential consequences exceeding 10 CFR Part 100, and we do that.

In Section 2.2.2 we talk about severe accidents. We do a site specific analysis for the consequences of severe accidents. One departure that we did take is the DCD, based that analysis on an outdated code, the CRAC2 code. Our departure was that we performed this analysis using the ACCS2 code.

One of the items covered in Chapter 2 is potential hazards from nearby industrial transportation and military facilities. Our analysis as outlined in Chapter 2 indicated that we met those limits for all of the external hazards except for the aircraft hazard exceeded the site limit by a very -- or the DCD limit by a very small amount.

We discussed in the last meeting in the discussions of Chapter 2. We brought up the RAI where we resolved that issue, and I think that issue has been satisfactory. We won't be discussing that, unless requested.

CHAIRMAN ABDEL-KHALIK: I think Mr. Stetkar raised this issue, and he was interested in seeing how these probabilities came about. So he will join us after the break, and maybe if there are additional questions, he will bring them up.

MR. BENSE: It was covered extensively in the response to a request for additional information.

CHAIRMAN ABDEL-KHALIK: I understand that.

MR. BENSE: I believe that satisfied it.

The big part of Chapter 2 is the COL information item. As I said earlier, all of the COL information item is addressed as supplemental material in Sections 2.3S, .4S and .5S. COL information included items like non-seismic site characteristics, seismic site characteristics, location information, activities in the designated exclusion area, population data, information about adjacent industrial, military and transportation facilities, potential accident situations in the site vicinities and how they would be addressed, impact hazards such as aviation which we discussed a minute ago, local meteorology, on-site meteorological monitoring program, short term dispersion estimates, average atmospheric dispersion estimates, hydrologic features, historic flooding and potential flooding, design basis flooding and flood protection, safety related system structures and components in the water supply and their impact by ice, flooding or blockage, the hydrologic design of the MCR in the channels for the cooling, channel diversion of the STP site, flooding protection requirements, natural events that could limit the cooling water supply, surface water and the ability to disperse, dilute or concentrate accidental releases, flood protection measures, site physiology, geomorphology, lithology and tectonics, geological, seismological and geotechnical data, site specific geologic data, properties and stability of site specific soils, site conditions and geologic features, the type, quality and extent purpose of field explorations, the number and type of laboratory tests related to the soil, engineering classification and descriptions of soil and supporting foundations, excavation and backfilling requirements, analysis to groundwater, liquefaction potential, dynamic soil properties and shear modulus, minimum static bearing capacity and site specific evaluation of the dynamic and lateral earth pressures, static and dynamic stability in the foundation and rebound and settlement, instrumentation and monitoring programs for the performance of safety related foundations, information on static and dynamic stability, embankments and dams that impound water required for safe operation, although that is not applicable to the STP, and site acceptability for severe accidents.

All that information is provided as supplemental material. And with that, we go into the area that we identified earlier as items of interest. We selected these based on a review of previous transcripts and NRC open items in the SER.

The principle item that we would like to discuss is the main cooling reservoir embankment breach. As I stated earlier, the embankment breach is the event that determines what our design basis flood level is and why we have that departure.

The ~~breach~~ embankment is 12.4 miles long. It surrounds a 7,000 acre reservoir which is used for cooling for -- will be for all four units. The minimum embankment elevation is 65 feet. The normal maximum operating level of the MSL is 49 feet, and the toe embankment is approximately 29 feet above sea level at the north end, which is the area where the breach has occurred.

As shown in the -- To give you some perspective on what would be involved in the breach, we have a cross-sectional -- typical cross-sectional diagram to show that the embankment is roughly 320 feet in diameter, and for perspective we used this for another analysis.

We also show superimposed on top of our embankment a typical hurricane levee that would be in Texas City to give you some perspective of the different size. On this diagram we also show the maximum pool elevation. The normal operating maximum level is 49 feet. For the breach analysis we use a higher level of 50.8 feet, and storm surges there which we will talk about in another item.

On the MCR embankment breach, we believe that it is an improbable event, and the reason is the mechanisms that would typically cause an MCR embankment breach overtopping was deliberately designed out of the -- by having more than a 15-foot freeboard. Normal operating level is 55 foot. The minimum height of the embankment is over 65 feet. That essentially eliminates failure due to overtopping.

We believe that seismic induced failure is not plausible based on design and the low potential for seismic activity in the site vicinity.

MEMBER BLEY: No chance that seismic activity, even with your 15 foot, could lead to overtopping? Did you look at that?

MR. HEAD: Yes. We analyzed that at the maximum postulated, and the 15 feet gives us the freeboard we need.

MEMBER BLEY: For any waves that might be generated from that? Okay.

MR. BENSE: A significant feature -- We showed you a picture earlier that shows the 12.4 mile length of the embankment. There is only a very, very small section of that embankment where a failure would impact the safety related areas for Units 3 and 4, and failure in other locations would not have a significant impact on the site itself.

We believe that piping caused by uncontrolled water level build-up within the embankment is improbable due to the engineered design features. There are features which would enable us to detect piping relatively early in the process.

The embankment is also subject to operating requirements, maintenance and inspection requirements that have been ongoing since the constructions of Unit 1 and 2, and these activities, these maintenance and inspection activities, would enable us to identify events that could cause failure.

Even though we considered a highly implausible event, in order to analyze this event we selected piping as the mechanism that could cause the MCR embankment to fail. We went through possible ways -- things that could cause that failure.

MR. HEAD: Explain piping.

MR. BENSE: Piping is a mechanism where water starts to essentially pipe or tunnel through the embankment, which would cause a failure. There are mechanisms built into the embankment. There is a sand barrier inside the embankment. There are piezometers and essentially channels which would enable us to detect piping that occurred, and those piezometers and things are inspected as a regular program, as part of Units 1 and 2 maintenance program.

CHAIRMAN ABDEL-KHALIK: So what sort of inspection requirements are currently in place to address that?

MR. HEAD: Right now we have engineers who drive around the reservoir on a daily basis, six days of the week. There are other monthly inspections of different areas, and there is a staff on 1 and 2 that is -- you know, that is their responsibility, is to ensure that different aspects in the health of the reservoir are maintained.

CHAIRMAN ABDEL-KHALIK: But how would you detect piping, currently?

MR. HEAD: Well, boils, sand boils would be a logical way that you would see that. We have, in fact, seen sand boils on the south side of the reservoir a number of years ago, and once you see those, then you take action to reenforce the area or, if there were some activity going on and you cease that activity.

So it is something that will reveal itself and give us what we believe plenty of time to react. Like I say, we have, in fact, had occasion to do that. So the engineers that are involved with this are, like I say, experienced with over 20 years of monitoring of the reservoir on a daily basis. We can expand on that, if you would like us to.

CHAIRMAN ABDEL-KHALIK: No, that is fine. Okay.

MR. BENSE: For the analysis of the MCR embankment breach to determine the worst case breach, we determined there are three factors that affect the severity. To begin with, the location of the breach: As I said a few minutes ago, the embankment is 12.4 miles long. There is only a very small, maybe one or two percent of that perimeter, where a breach would affect the site.

The other factors that affect the severity of the flooding due to the breach is the size of the breach and the speed at which the breach develops.

The breach width and the speed were predicted using ~~during~~ several different methods. All the analysis assumed that the breach occurs at the two possible worst locations, which are on either side of the main cooling water lines that run between sites 3 and 4 and the embankment.

In order to determine the size and the speed of the breach, we relied heavily on the Dam Safety Office of the U.S. Bureau of Reclamation. they have analysis of dam breach failures. they provide a number of empirical equations.

We determined the breach width using Froehlich's equation, which gave the worst case development of the breach width, and the other set of equations, the MacDonald Landgridge equations -- when we used those equations, we got a more rapid breach. So we combined both the largest breach and a different set of empirical equations that gave us a faster breach, and we believe that that ensures that we got the most severe possible analysis.

Then we confirmed that our analysis and assumptions were conservative by doing an independent confirmatory analysis using a National Weather Service BREACH model program which is used for the analysis of dam failures.

The results of these analyses indicate that the peak water level following the MCR breach was 38.8 feet above main sea level, which occurred at the Unit 4 ultimate heat sink structure, and it occurred from a breach that was just west of the main cooling water tunnels.

Because the worst case breach flood level was 38.8 feet, we conservatively established the design basis flood level ~~s~~at 40 feet above main sea level, and the estimated duration of the flood water above the site grade at the plant site, which is 34 feet, is the water level inundates the site for approximately 20 hours.

CHAIRMAN ABDEL-KHALIK: Now if you had

used the results of the NWS BREACH model, how would these numbers change?

MR. BENSE: We will get to that in a minute. We did an analysis to show the flood levels and the duration at any particular levels, and this figure, which appeared in the response to RAI 02040414, shows the flood level. The flood levels are shown on the right, and the breach flow is shown on the left, and the duration is shown. You show that the peak flood level is a very short duration event, which will be important in a minute.

Then another item is, by using the two empirical equations and coming up with a worst case breach size and the fastest breach speed, we got results which we think exaggerated the size of the breach and the depth.

So we have a comparison of the results we have using the method that we based our 38.8 foot breach analysis, which is shown in the blue; and we compared it to the results that we would achieve using the National Weather Service BREACH model. As you can see, the BREACH model shows a much slower breach and a lower flood level, and that convinced us that the analysis approach that we used was, in fact, very conservative.

CHAIRMAN ABDEL-KHALIK: Now the point at which the slope changes -- is that the point where the maximum breach size is reached?

MR. BENSE: Yes. If you look on the lefthand column, the discharge rate is shown on there.

MR. HEAD: Before we go on, I would like to introduce Paul Jensen, who was responsible for the analysis that we have done here, and I would ask, is there anything else that we should note with respect to this with the analysis?

MR. JENSEN: I would just at this point -- just maybe perhaps note that the time -- This is a very -- The assumption -- not really the assumption -- the calculation of a maximum width and a very short time to achieve that maximum width was done to be conservative.

Just as background just as to why this was done, the staff asked a very key question: If this is going to happen very quickly and there is still water in the reservoir, could not the width have gotten wider?

So this separate BREACH analysis shown in red is done just to assure that we were on the conservative side. With that model -- and I should point out that my colleague, Randy Graham, was intimately involved in that model and can give you more information on that aspect of it. But it basically shows that, if you look at the mechanistic process of a breach forming, starting out slow as the hole through the levee is small, and progressing larger and then slowing down as the water level drops in the reservoir, you get a much slower process.

Your question as to what the peak flood elevation would be: We haven't done that analysis. It would be considerably less than the 38.8 feet, though.

CHAIRMAN ABDEL-KHALIK: Now what -- I mean, the BREACH model sort of just gradually reaches the peak discharge rate, and I assume at the point of the peak, that is where you reach the maximum breach size in both cases, approximately.

MR. JENSEN: Approximately.

CHAIRMAN ABDEL-KHALIK: So how does the maximum breach size compare in both cases?

MR. JENSEN: Randy, do you want to take that question?

MR. GRAHAM: Okay. I guess I was asked to provide a little background before I speak.

I have done close to 50 dam break analyses over my career. The first 26 were when I was with the Omaha District, Corps of Engineers. They were starting a program for the contingency plan for emergencies with the Dam Safety. So I did their 26 dams within that District, the six largest on the main stem of the Missouri River. That was 80 million acre-feet.

Since that time, I have done quite a few more, notably the Tampa Bay Regional Reservoir. That is making news recently, but not the dam break portion. I did that. I did the Corps dams back in the early Eighties using the dam break model. The Tampa Bay Regional Reservoir, I used the FLDWAV model, both by the national Weather Service .

Then most recently, I have done the 12 South Florida Water Management District's Herbert Hoover Dike dam analysis using the MIKE-2 model, MIKE FLOOD, due to the terrain and such, and then

14 altogether for that district. So that is kind of my background and history. I have also done dam forensics, dam/ferry forensics while with the Omaha District, Long Lake Dam being the most notable. So that is kind of my background.

The question, I think you said, did the breach peak discharge occur with the peak width? Was that your question?

CHAIRMAN ABDEL-KHALIK: Well, at blue curve, it does.

MR. GRAHAM: For which one?

CHAIRMAN ABDEL-KHALIK: For the blue curve, I assume.

MR. GRAHAM: Yes, it does, flood wave. That set the width and the time, and when it hit that, it did. The peak did occur at that time. So when it reached its maximum width.

CHAIRMAN ABDEL-KHALIK: So what was the breach size at that point?

MR. GRAHAM: That was 380 feet bottom width.

CHAIRMAN ABDEL-KHALIK: And for the red line?

MR. GRAHAM: For the red line, I believe it was 442, if I remember correctly, at the time of the peak. It expanded wider. We ran -- I ran it for 30 hours, and it continued to increase over the 30 hours, but it wasn't a linear increase. It expanded more quickly up through the first six -- well, five hours, roughly, and then -- because it is a physical based model, and it was looking at velocities and such.

So the FLDWAV model is a linear. It expands linearly, so that from zero to 1.7 hours, which was our time to peak, it would increase at a constant rate. That is the way the model works.

The BREACH model considers the various aspects, the soil and internal components. So it will breach very slowly during the piping part, but once it gets to a certain opening so it's got some efficiencies to it, it starts to expand much more rapidly, to then, once the head starts falling and the reservoir's tail water starts increasing such that you lose that energy head and velocities slow down --

CHAIRMAN ABDEL-KHALIK: I am just sort of trying to sort of get to the point that this empirical Froehlich model gets a conservative breach with. Based on what you told me, the breach width for the Froehlich, the maximum breach width, was 380 feet.

MR. GRAHAM: That is correct.

CHAIRMAN ABDEL-KHALIK: Whereas, the other model, which is presumably an unconservative, the maximum breach width is 442 feet. So can you sort of reconcile these two statements?

MR. GRAHAM: Froehlich was -- That is based on forensics and developing empirical equations for the widths. So looking at the height and the volume and considering those, and on experience from other dam barriers, the one closest to this in volume being the Teton, the 380 would be what that equation would predict as a breach bottom line.

That would occur in 1.7 hours. The 440 feet occurs in 6.25 hours, a much longer time, much more time to develop. So in essence, you develop to the 380 at a much rapid rate than you did the 440.

CHAIRMAN ABDEL-KHALIK: But these things are independent, presumably. The Froehlich model is focused on determining the breach width.

MR. GRAHAM: Right.

CHAIRMAN ABDEL-KHALIK: And when you say this is a conservative model, I would have assumed that it would predict the maximum breach width amongst all possible models, and yet what you are telling ms doesn't jibe with that.

MEMBER BLEY: Maybe you could tell us what you mean by conservative.

MR. GRAHAM: Well, the conservative part would be the peak discharge.

MEMBER BLEY: The peak discharge flow?

MR. GRAHAM: Flow. That is what your main concern is, flow and timing. That is what your response -- how quickly you can react and how much water you have to deal with.

MEMBER BLEY: So it is wider with more head above it at the time it gets --

MR. GRAHAM: Yes, because it develops so much quicker, at a much more rapid rate, it had less tail water and more head, and through the opening size, produced a higher peak.

MEMBER BLEY: You said you did a number of forensic events. Any of those on dams that you actually did the calculations on ahead of time?

MR. GRAHAM: Ahead of time? No.

MEMBER BLEY: Okay. For the ones that you have investigated, what kind of models were used, and how well did they match up with what really happened?

MR. GRAHAM: Well, you fit the model to the -- because you have the -- On Long Lake, for example, that was a 10 percent slope going downstream, but it hit critical at a few outcroppings of flows going down. So we had a pretty good idea of what the peak discharge was fairly close to the dam and then --

MEMBER BLEY: I didn't ask my question right.

MR. GRAHAM: Okay.

MEMBER BLEY: Were there calculations done ahead of time for the dams that you actually -- had actually failed, and so you compared those predictions? I understand you fit a model to it afterward that worked very well.

MR. GRAHAM: No, no. These were not Corps dams. So we had done a calculation before. Our interest and why we were doing it is the Corps -- Federal property. So perhaps they might be brought into law suits; so let's investigate and see. That is why we did it.

CHAIRMAN ABDEL-KHALIK: On Slide 28, presumably the areas under these two curves eventually will be the same if you go long enough. So how far beyond the point when you get essentially zero flow from the blue line do you continue to get flow from the red line?

MR. GRAHAM: I don't believe the red line -- We went 30 hours, and the red line -- Is it down to zero flow?

CHAIRMAN ABDEL-KHALIK: Right.

MR. GRAHAM: No, it hadn't gone to zero flow. We are down to, you know, the thousands of CFS as opposed to 82,000 or 130,000, but no, we haven't gone to zero.

MR. JENSEN: The primary interest was in the peak levels.

CHAIRMAN ABDEL-KHALIK: Yes, I understand.

MR. JENSEN: So once we passed the peak, we didn't try to go further.

CHAIRMAN ABDEL-KHALIK: So the total duration is not of concern?

MR. JENSEN: That is correct.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. HEAD: The time that we came up with before it gets to the flood level at 34 feet is 20 hours. If that were 30 hours with the breach, well, obviously, is the plant going to be reacting to all four units? And as I mentioned before, I firmly believe we will know this is coming. It won't just happen. So the reaction to all four units will have to be the same. The time was really not of much interest to us at this point.

CHAIRMAN ABDEL-KHALIK: Beyond 20 hours.

MR. HEAD: Right.

CHAIRMAN ABDEL-KHALIK: Thank you. Go ahead.

MR. BENSE: The next item is actually an action item. It is the -- During the MCR breach embankment, the flood level is maximus 38 feet. A question from the staff and from the ACRS committee was the contribution from the wind-wave contribution: What impact does that have on the maximum flood level?

The concern was, does it increase the flood level above 40 feet? We initially responded to the staff's question on the same subject in RAI 03.04.02-211, and our initial response was that we didn't think it was something we needed to evaluate, because of the short duration of the maximum flood level.

We didn't have a concern that a wind in a certain direction, constant speed, would have a significant increase. However, as a result of the staff's question, we did do that analysis, and we assumed a two-year peak 50 mile and hour wind where the wind direction flowed in the same direction as the water leaving the embankment.

We used the Coastal Engineering Manual method for calculating the wave height, and we came to the conclusion that, theoretically, it is possible that at the peak, if we got the worst case wind-wave run-up, it could increase the level by 3.1 feet.

So the worst case flood level that we got was at the Unit 4 ultimate heat sink where the maximum flood level was 38.8 feet for a very short duration. If we add on the 3.1 feet, which we would get from intermittent wave run-up, which we don't really consider plausible, we would get a maximum level of 41.9 feet, which exceeds the design basis flood level.

Well, the most important building of the ultimate heat sink in the reactor service water pumphouses are both watertight up to the 50 foot level. So that is not a concern. The other power block buildings are watertight up to the 41 foot level.

The design basis flood, the calculations for flood loading are 40 feet. However, the buildings are watertight up to 41 feet. We believe, if we got these intermittent waves that increased it above that level, there could be some leakage into the building, but it wouldn't be a flood concern. It would primarily be a housekeeping concern, and we didn't consider it a significant issue.

CHAIRMAN ABDEL-KHALIK: Now does this 3.1 foot number depend on the total time of the flood that you assume to be 20 hours?

MR. BENSE: We assumed that the flood level stayed at ~~stated~~ the 38.8 feet for some duration.

CHAIRMAN ABDEL-KHALIK: Which is?

MR. BENSE: I am not sure. It is less

than an hour.

MR. JENSEN: Very much less than an hour.

CHAIRMAN ABDEL-KHALIK: Very much less than an hour.

MR. HEAD: We assumed it was there long enough to set up the wave.

MR. JENSEN: Which is being overly conservative.

MR. BENSE: We did the calculations assuming the level stayed at ~~stated~~ the ~~this~~ 38.8 feet, and there is the duration.

CHAIRMAN ABDEL-KHALIK: Okay, thank you.

MR. BENSE: And as a result of that, we don't think that wave run-up will be a significant issue. With that, we are ready to move on to the next event. I'm sorry, I skipped a slide.

CHAIRMAN ABDEL-KHALIK: I guess we will hear from the staff as to the assessability of this analysis. Thank you.

MR. BENSE: There were two issues, the maximum water level that occurred during the flood with the wave run-up. That was the ACRS question. The staff's question was the impact on hydrodynamic loading from this wave run-up.

The peak flood level is 38.8 feet. The building is designed for a hydrostatic force, a continuous force up to 40 feet. We also include on the hydrodynamic loading on the building a drag force of 44 pounds per square foot due to the flood water level, which is applicable to the entire portion of the structure above grade.

Also in the analysis, we include an impact due to 500 pound floating debris traveling at the discharge rate of 4.72 feet per second, and in that we add the wind generated wave forces equivalent to 3.1 feet above the 38. 8 foot flood level, and all of that is described in detail in our response to a previous RAI.

CHAIRMAN ABDEL-KHALIK: Now this hydrodynamic drag force is applied only up to the 40 foot elevation or does it apply to the entire?

MR. BENSE: I believe it is up to the 40 foot level.

MR. HEAD: Bob, do you know?

MR. BAILEY: I would have to go and double-check whether it is 40 or 44.

CHAIRMAN ABDEL-KHALIK: We are talking about 44 pounds per square foot, whether that applies only up to the 40 foot flood level or goes beyond that.

MR. BAILEY: I believe it is to 40 feet, but I would have to go double-check, which I can do perhaps at the break and make that clear. I am Bob Hooks with Sargent Lundy, building design director for the nuclear island at STP 3 and 4.

CHAIRMAN ABDEL-KHALIK: Perhaps you could let us know after the break. That would be great. Thank you.

MR. BENSE: Are there any other questions on wind-wave contribution to hydrodynamic loading?

The next event item that we thought would be of interest to the Committee was the probable maximum storm surge, and this became an interesting issue because of the wide variation between the results of different computer models used to calculate the probable maximum storm surge.

The science supporting this is evolving very rapidly. In a chronological order in our original application, we did a storm surge analysis using the SURGE model, which calculated the probable maximum storm surge from a probable maximum hurricane at the coast, and we used the HEC-RAS model to move the effect of that level inland to 15 miles inland where the STP site is.

In conjunction with that, we used the 2007 version of SLOSH, the Sea-Lake Over Land Surges with Hurricanes model. That was the best available model at the time, and that model only analyzed up to a category 5 hurricane. For a probably maximum hurricane, we had to extrapolate the results of the SLOSH model to predict the maximum storm surge at the probable maximum hurricane condition.

We had some interesting discussions with the staff on this subject. They questioned us extensively about the method for extrapolation that we used. The staff did their own confirmatory analysis using a much newer version of the SLOSH model, which resulted in a higher storm surge than we had predicted.

At that point, STP went back and looked at the -- The Reg Guide requirement is that you use current best practices. We went back and examined the current best practices, and we came to the conclusion that the ADCIRC, the Advanced Circulation model, which is currently used by the Army Corps of Engineers and FEMA and the Navy, provided the current best practices in the area.

We did additional modeling using that. We will talk all about them in a minute. However, our point has been that GDC-2 require that we demonstrate that the site is adequately protected from the storm surge, and the design basis flood is 40 feet.

All of the models, and all of the analysis we used, predict the maximum storm surge would be less than 40 feet. So we believe, no matter which model we use, we have demonstrated that we are adequately protected.

This table shows the results of the different models. Our initial surge in HEC-RAS model, we predicted a level of approximately 20 feet at the Gulf Coast. Using the HEC-RAS model, we brought that level inland, and we predicted a level of 24.29 feet, which was less than the site grade at the power block, which is 34 feet.

On the early version of SLOSH that we

used in our initial application submittal -- you know, the results are there. I won't read them -- we got 26 feet at the coast and 31.1 feet.

When the staff challenged us on the method we used to extrapolate on this early version of SLOSH from the Category 5 hurricane to the probable maximum hurricane, they used a much newer version of SLOSH, the 2010 model, and they concluded that the maximum storm surge would be approximately 36 feet, and if you include wave run-up, it would be 38.5, approximately 39 to 40 feet.

At the same time, we got the same version of the SLOSH model. We inputted all our assumptions, our conservative assumptions, and we came to essentially a very similar conclusion that the staff came to on what the maximum surge would be.

Our perception was that this was an excessively high level and overly conservative. That is when we examined the various evolving nature of the science, and as a result of events on the Gulf Coast, there is a lot of interest by the Army Corps of Engineers, FEMA, a number of universities, and we concluded that the Army

Corps of Engineers and FEMA were using the ADCIRC model.

So we went back, and we redid these analyses using the ADCIRC model, and I will talk about why we think that model provides more accurate results in a minute, and we came to some conclusions on our initial run that the peak surge at the site, including wave run-up, would be 26.5 feet, which is well below the 34 foot site grade.

We discussed that with the staff. It turns out that we didn't use precisely the same assumptions that were used for the SLOSH model. We went back and we did a sensitivity study, redid the analysis using the most conservative assumptions.

The model results are very sensitive to things like the exact point where the hurricane hits the coast, the direction of the storm, the size of the eye of the hurricane, how fast it is moving forward. So we did a sensitivity analysis to ensure that we were looking at the most conservative results, and on the last response that we docketed showing the results of our ADCIRC model, we concluded that the peak surge was 29.3 feet, which is still well below the site grade at the power block at 34 feet. Yes, sir?

MEMBER BLEY: You said you are going to tell us why you like the ADCIRC model, but can you in any reasonably straightforward way identify what the key differences are that lead to these very different results?

MR. HEAD: I am going to turn it over to Bob Bailey at this point.

MEMBER BLEY: I am assuming that, for all of them, you had it hit the Coast at the exact same place, since you said that is a key parameter.

MR. BAILEY: Buy way of introduction, my name is Bob Bailey. I am senior managing engineer with Exponent Failure Analysis Associates, and our firm was retained by STP to assist with this confirmatory analysis, as discussed by Dick Bense.

The key difference here and why we think you are seeing the magnitude of difference between the two largely has to do with the mapping of the topography, along with the friction factors, and also terrain features, specifically natural and manmade features.

You will see here in a moment, we will progress forward with some slides to demonstrate that. But those combinations, along with, as he commented earlier, there were some earlier runs where the pressure differential, for example, between the barometric pressure in the center of the storm or the peripheral pressure. That is a key input for all these models.

MEMBER BLEY: That should be the same, though.

MR. BAILEY: It was, without final analysis there. IN the earlier ones, we were a little bit lower than what was done with SLOSH, but we corrected for that, and it makes some difference.

Also, another interesting thing is what they call the boundary layer wind profile or the wind model which, of course, is your forcing function, which is creating the wave. SLOSH uses a different one than what ADCIRC uses, and it tends to be a bit more of a conservative value it will generate. So that accounts for some difference.

MEMBER BLEY: Conservative doesn't

help me here. Something in terms of the physical phenomena you are talking about.

MR. BAILEY: Yeah. It will create a magnitude that is greater than what we believe now over the years as we have observed and measured and gathered more data to accurately represent that boundary layer. So it is generate at a certain height a mean value that is higher than what ADCIRC would generate using what is called the Holland model.

MEMBER BLEY: And what physical reality tells us one model is better than the other?

MR. BAILEY: In large part, the wealth of data that is being collected over the past 10 years with aircraft reconnaissance drop signs, Doppler. Mobile Dopplers are being deployed as approaching landfall, etcetera.

MEMBER BLEY: Actual measurements.

MR. BAILEY: Absolutely. Absolutely, and we are getting a much better capture. In fact, there is even another evolution of wind models coming out called Willoughby that is probably going to supplant the Holland model that is current used in ADCIRC.

So you know, you have enough of these differences that individually any one may make a two or three foot difference, but when you start adding it up, it makes a difference.

You said that one of the main differences is the mapping of the topography and the associated friction factors.

MR. BAILEY: That is correct.

CHAIRMAN ABDEL-KHALIK: Does the SLOSH model allow better input of topography data?

MR. BAILEY: It will allow it, if you want to provide such input, but a little bit of a challenge here is this grid. It is a polar grid with four-sided or quadrilateral elements, whereas ADCIRC is a triangular finite element mesh, and to transfer from one or the other is a challenge.

I mean, you can do it, but it is difficult, and we just -- We want to stick with the much finer mesh, which you will see here in a moment. We actually have a figure for it.

CHAIRMAN ABDEL-KHALIK: Well, just to get to the question as to, you know, the reason for the differences in terms of physical differences.

MR. BAILEY: It makes a big difference, as you will see in a moment. Again, it is one thing if I have a relatively uniform, gradually sloping flood plain or a grassy area that doesn't change much , but in this particular case of the STP site, as you notice in some of the other pictures that were being shown, you've got quite a varying array of both natural and manmade features in and around the site that significantly affect the wave energy and the surge as it is coming inland and how it attenuates that wave and how it dissipates that energy. It makes a big difference at this particular site than, say, other coastal areas along the Gulf or Atlantic Coast.

MEMBER BLEY: Let me restate what I think I heard. What I think I heard is it is a lot easier to put in more detailed topography into ADCIRC than it would be into SURGE unless you did an awful lot of extra work, and you think that is a key factor.

MR. BAILEY: Absolutely.

CHAIRMAN ABDEL-KHALIK: It is a lot easier, because the data are available.

MR. BAILEY: Yes.

CHAIRMAN ABDEL-KHALIK: In the format that you need it for a finite element.

MR. BAILEY: That is correct. We had the good fortune in this particular case. The state of Texas is currently -- FEMA Region 6 is going through a complete remapping of the FIRM maps that they are creating for that up and down the coast.

As with all areas of the United States, which all 50 states are subject to flooding, but it is a sensitive issue. When you reissue those maps, it goes out for public comment, and there is a lot of vested interests that speak up in meetings just like this one to discuss the impact of those revised maps.

Given that sensitivity, FEMA Region 6 went to great lengths to create a new topographic mapping along the Gulf Coast, and using ADCIRC along with it; and we have the opportunity for FEMA Region 6 they granted us permission to use that grid just for this particular analysis.

It hasn't been officially released yet, because you have to wait public comment. But we were very fortunate, because there is a level of resolution here that far exceeds what you see in those grids. We are talking millions of cells.

CHAIRMAN ABDEL-KHALIK: Now somewhere I read that this data is not being released to NRC, because it has not been verified yet.

MR. BAILEY: Actually, no, you can request that model if you like the grid, and I'm sure they would do that. But it is just that we can't use it for any other analysis right now for other commercial interests, frankly.

CHAIRMAN ABDEL-KHALIK: I guess my question is: Given the fact that the data has not been verified yet, how do we know that this difference is real?

MR. BAILEY; No, it has been verified. Oh, the model has undergone considerable analysis looking over a range of different storms that have impacted specifically the Texas coast dating back to Hurricane Carla in '61, Celia in '70, Allen, Alicia and, more recently, Ike and Rita. Ike, in particular, was very useful because of the data that was collected with it, and that exercise has already been conducted on FEMA's behalf.

CHAIRMAN ABDEL-KHALIK: So the

uncertainty is not in the data for the topography. Is it in the application of the model?

MR. HEAD: By uncertainty, do you mean why hasn't it been released?

CHAIRMAN ABDEL-KHALIK: I am sort of keying in on the word verifying the model.

MR. BAILEY: It is not the model verification. When you say differences, do you mean between what we are getting with ADCIRC and some of the earlier runs with SLOSH?

CHAIRMAN ABDEL-KHALIK: Correct, or the more recent runs with SLOSH.

MR. BAILEY: Or the more recent ones? Okay. Again, the difference there is, frankly, model input and also the design of the model in terms of the assumptions made or the models used. I mentioned the wind profile as one; more importantly, the topography and features, meaning geographic, levees that exist, roadways, intercoastal canals, even right down to the mapping of the barrier islands.

With the ADCIRC model and the mesh we used, it is much finer, and it has been validated. It has already gone through extensive analysis on behalf of FEMA in getting that mesh to where, you know, we were getting what we think -- numbers were very consistent, which was actually observed by historical events, including tidal measurements and intercoastal measurements, flood levels.

CHAIRMAN ABDEL-KHALIK: Will the model itself be submitted to staff for staff evaluation?

MR. BAILEY: Certainly, all input files, if requested.

MR. HEAD: We are still working with the staff on that.

CHAIRMAN ABDEL-KHALIK: I mean, given the large difference in what is being predicted by these two models, presumably that are modeling the same physical phenomena --

MR. BAILEY: Yes. I want to be a little careful, because even the creators of SLOSH will tell you, it was designed as a tool to assist emergency managers in real time -- emergency managers -- with the focus largely being right at the coast. You start pushing further inland. These issues regarding topographic relief, terrain types -- the SLOSH model has a far fewer number of friction factors for it, once you start pushing the water inland; whereas, SLOSH has a much broader range that are calculated dynamically as water moves inward and we get higher depths.

For that reason, even the creators of SLOSH will tell you, be careful relying on the numbers if I am, say, 10, 15, 20 miles inland. There can be much greater variance than what you might otherwise expect right at the coast.

CHAIRMAN ABDEL-KHALIK: But if that were the case, one would expect that the predicted maximum surge at the coast to be roughly the same by both models.

MR. BAILEY: Well, again it depends on the cross-section profile as you are approaching an island. Though, that said, when you look at the output that we were getting, even though it is not shown here, the difference was less. I mean, it wasn't near the same magnitude as what we were getting at the site.

MR. HEAD: So the Gulf Coast value, the not-docketed value, which we have not docketed, was relatively close to the SLOSH?

MR. BAILEY: Yes. I mean, it was

approximately 24 feet.

CHAIRMAN ABDEL-KHALIK: Well, I am much more interested in the third entry on the second column, which is not evaluated, the NRC confirmatory analysis. The third row.

MR. BENSE: The staff didn't provide those results to us. They only provided the storm surges --

CHAIRMAN ABDEL-KHALIK: Because depending on where that is, you may have the same kind of variability, whether you do the comparison at the Gulf Coast or you do it inland, and if that is the case, then topography is not really the driving parameter for these main differences.

MR. BAILEY: Well, without seeing that number, I can't respond to that.

CHAIRMAN ABDEL-KHALIK: Yes, sir?

MEMBER SIEBER: Do buildings and structures have any impact at all on the local surge heights?

MR. BAILEY: In other words, right at the coast?

MEMBER SIEBER: Yes.

MR. BAILEY: Yeah. I mean, any kind

of obstruction, you know, a manmade, is going to affect it. And in fact, the Matagorda levee in this case, which is right at -- I mean, the Matagorda Bay, which you have barrier island right there, had a big impact on surge, magnitude of the surge we were generating through ADCIRC, and we maintain that that simply wasn't being captured by SLOSH near as accurately.

MEMBER SIEBER: That would slow down the surge. Right?

MR. BAILEY: Oh, absolutely.

MEMBER SIEBER: On the other hand, a surge coming in with a building or a structure right there, would that not intensify the surge?

MR. BAILEY: If it redirects and accelerates locally, yes. Right, yes.

MEMBER SIEBER: Yes, right. Did you take that into account?

MR. BAILEY: The model captured that effect. Yes.

MEMBER SIEBER: So you did model the actual physical buildings?

MR. BAILEY: to the extent you had such development. I mean, that is a largely unpopulated -- This isn't Galveston Island.

Nonetheless, what we -- But what you are capturing, in the absence of such development, also is friction factor. That comes into play. That is taking that into account.

MEMBER SIEBER: Right.

MS. GOVAN: Chairman, Tekia Govan, Project Manager. I just wanted to note that your interest in the confirmatory analysis with SLOSH will be discussed as part of the staff's presentation coming up.

CHAIRMAN ABDEL-KHALIK: Good. Thank you.

MR. HEAD: And I wanted to note at the right moment that, as I mentioned earlier, this is obviously an open item, and we are still working with the staff on it. This response was only provided last week. So, clearly, you know, we are sharing it with you with the premise that the staff has not --

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. BENSE: To get back, on Slide Number 35, I will skip right to bullet Number 4, which is related to the discussion we just had. The digital elevation maps based on LIDAR data used with ADCIRC had a grid resolution of 50 meters by 50 meters. The grid resolution on the SLOSH model we used had a resolution of approximately 300 by 500 meters. So there was a much finer grid used with the SLOSH, which resulted in the identification.

CHAIRMAN ABDEL-KHALIK: I just want to make sure we are not chasing the wrong thing. If the differences are the same at the coastline as they are inland, then maybe topography is not the main reason for the differences.

MR. BENSE: As I said, the SURGE model, which the staff finds acceptable to use, also has a lower value at the coast.

CHAIRMAN ABDEL-KHALIK: Yes, I understand.

MR. BENSE: This shows the results of our probable maximum hurricane. It is just provided to show the assumptions in the storm tracker that were used in the probable maximum hurricane. This slide is presented to show essentially the grid resolution and the details that are picked up in the map, the grid map.

MR. HEAD: Bob, could you just comment on grid resolution?

MR. BAILEY: Sure. That particular

figure there -- it is almost deceiving if you didn't have the opportunity to further zoom in, but if you go close enough, you begin to see the actual grid elements, triangular elements. I mean, I mean you have to get real close.

You are looking at, just that picture alone, over a million triangular elements that are being mapped across those surfaces. Okay? The entire ADCIRC model that we executed for this analysis had over 6 million elements when you include the Gulf of Mexico and portions of the Atlantic Basin, but we were mapping the storm -- the probable maximum hurricane.

CHAIRMAN ABDEL-KHALIK: What is the scale on this picture?

MR. BAILEY: Probably on that order -- I don't have that exact number from that figure. It is on that order.

CHAIRMAN ABDEL-KHALIK: Could you find that during the break?

MR. BAILEY: But we could get that for you. Sure.

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. BAILEY: And just to point out a couple of things here, of course, the MCR is very prominent. I think everyone kind of gets orientated when they see it, but notice in the lower right there, it looks like the shape of a boat. You know, if you just first glance, you might ask yourself, well, what is that? That is the Matagorda levee.

The City of Matagorda in the 1940s experienced a hurricane, one of many over the history of that small community, that basically wiped it out. After that event, they built a levee around the community. And sure enough, Hurricane Carla showed up in 1961, and it protected it. It worked, and it is very prominent. It is 15 foot, approximately 15 foot tall levee, and you will actually see an analysis that we run, literally the attenuation -- the blocking, if you will, the redirection of the storm surge as the storm passes the site.

It plays a very important role, along with other features as well that are captured there that, again, if you were to look at a similar grid with SLOSH which we presented during our NRC audit -- you know, just kind of toggle back and forth, it becomes very evident. You begin to fully appreciate the level of effort that went into creating this model. This takes time.

CHAIRMAN ABDEL-KHALIK: Has that particular storm been analyzed using the ADCIRC model?

MR. BAILEY: Carla?

CHAIRMAN ABDEL-KHALIK: Right.

MR. BAILEY: Yes.

CHAIRMAN ABDEL-KHALIK: And the data were consistent with the observations that were made?

MR. BAILEY: Very favorable comparison, absolutely.

MEMBER BLEY: I have to ask. Was it used to model or was that part of the development of this model such that it was fit --

MR. BAILEY: No, you don't -- That is not how they do it. The grid you see is based on largely LIDAR data, and I mean the grid is what it is. We don't play with the grid to make it work. That is not the way it works, and again --

CHAIRMAN ABDEL-KHALIK: But it takes more than just a grid. I mean, are there any knobs in the model that were adjusted so that that particular event --

MR. BAILEY: No.

CHAIRMAN ABDEL-KHALIK: -- is correctly modeled?

MR. BAILEY: Not at all.

MEMBER SIEBER: I presume the depth of the water has some bearing on what the surge is?

MR. BAILEY: Yes. In fact, in the analysis we did it where we had a high tide plus 10 percent exceedance, I believe, plus a long term sea level rise. So we were actually adding some, I think, almost five feet, 4.9 feet, to the initial mean sea level, which further adds.

Of course, the same thing was done in SLOSH as well. They did take that into account and added it, too, and so on. That wasn't -- I mean, it was done in both models.

MEMBER SIEBER Great. Thank you.

MR. BENSE: The last slide in the discussion of the probable maximum storm surge level is a results slide provided by the ADCIRC model and a representation, as you can see in the upper center. You can see the outline of the main cooling reservoir, and the area above it, gray, indicating that the storm surge doesn't hit the area north of the reservoir.

MR. HEAD: And the path of the storm is the black line, and you can see in there the Barrier Islands, the effect that barrier islands have with respect to attenuating in the particular case.

CHAIRMAN ABDEL-KHALIK: I am trying to understand. What is the gray region then?

MR. BENSE: The gray is dry.

CHAIRMAN ABDEL-KHALIK: Dry?

MR. BENSE: No storm surge.

MR. BAILEY: And that is the extent of our mapping of the grid. You know, we don't go all the way to Amarillo with it. We stop within so many miles. That is the extent of our grid, and it is dry. The gray means dry.

You will notice the reservoir is shown as dry, if you will, meaning we never overtop it. By contrast, in this run notice the Matagorda levee is overtopped. It is inundated.

MEMBER SIEBER: I am surprised that the cooling pool is not overtopped.

MR. HEAD: It is just a hot 65.

MR. BAILEY: And if it were, you would have water. I mean, it would actually start mapping surge over it, including wave.

CHAIRMAN ABDEL-KHALIK: Presumably, this graph is sort of a time composite.

MR. BAILEY: Yes, and this is at peak. You are seeing the peak value. In fact, you are right. If you were to see the sequence as the storm is approaching -- and we presented this to the Committee.

MEMBER BLEY: But this isn't.

MR. BAILEY: This is the max, a snapshot. That is correct. There is a sequence to these, and actually, it is real interesting. If you follow the sequence time step, literally seeing the surge with the wave approaching, inundating, pushing in, it really gives you an appreciation of what is happening, again just for interest.

CHAIRMAN ABDEL-KHALIK: And it is kind of hard to imagine that, given that, that you would have a sharp boundary between a region where you are in the red zone as far as the peak value and a gray zone where there is absolutely no flooding.

MR. BAILEY: Well, just to clarify, what you are seeing -- That is relative to mean sea level. So, say, we are talking some close to

30 feet. All that is saying is, if you get in that gray boundary, relative to mean sea level I am above that. I'm dry.

MEMBER BLEY: But just relative to Said's point, look right at the reservoir. The southern boundary is -- you know, it is flooded right up to it on the back side. So what is the base elevation on the south side compared to the north side?

MR. HEAD: It is quite a bit lower.

MEMBER BLEY: There is quite a hill right there. I didn't remember that. So on the back side, just the basic level of the land has helped you.

MR. HEAD: In fact, it is whatever that says it is.

MR. BAILEY: Well, and we had -- Again, the benefit -- The Audit Committee had some additional material presented. There is a cross-section we did where we cut through, and you can actually see that variation in the landfall by going from the coast all the way behind the reservoir and that surge level across it, which -- But keep in mind, what you are seeing here is relative to mean sea level, and my surge will reach a limit. I mean, you know, it will reach a new line, a new point.

MEMBER BLEY: Keeping that picture in mind, when you calculate the surge at the site, where are you calculating? Right on the southern edge of the pond, because much of the site is -- I forget the exact layout?

MR. HEAD: Our interest here was mainly the north side of the reservoir and the plant.

MEMBER BLEY: This stuff is on the north side?

MR. HEAD: Right.

MEMBER BLEY: So when you calculate 29.3 feet, that must be on the south edge of the site.

MR. BAILEY: Yes. It is wherever the boundary is of the reservoir that we -- the boundary of the site where we get a maximum value is what we record. Now it depends on the --

MEMBER BLEY: So it is that one just on the northeast edge of the reservoir, is the thing you have written on the table.

MR. BAILEY: That is correct.

MEMBER BLEY: The rest of the site is

not seen.

MR. BAILEY: That is correct.

MEMBER BLEY: With this one calculation, just to help me get a picture of this thing, are any of the locations where you are going to have the plant actually seeing any of this surge? It looks like there is no water going to reach most of the plant at all.

MR. HEAD: It doesn't reach the plant, and it also doesn't reach the north face of the reservoir, which was another area of interest that we will be speaking to in a second.

MEMBER BLEY; Even though just to the edge of the reservoir you got 30 feet or 40, depending on which model you believe, beyond that when you hit the actual buildings that you are going to construct, we are not seeing any water with a 30 foot surge, probably would with a 40 foot surge, if that were a real number. That helps me a little.

CHAIRMAN ABDEL-KHALIK: So just going back to a question raised, what is the exact elevation difference relative to sea level between the north and the reservoir and the south and the reservoir?

MR. BAILEY: I may have that.

CHAIRMAN ABDEL-KHALIK: It must be at least 34 feet if this picture is true.

MR. JENSEN: No. No. That is not water depth. That is elevation.

CHAIRMAN ABDEL-KHALIK: Yes, I understand, but I am trying to compare the completely dry spot relative to sea level with sort of a wet spot that has elevation that is roughly 30 feet on the south end of the reservoir.

MR. HEAD: So at that point the elevation of the main sea level for the ground is 30 feet. The surge has gotten to that point.

MR. JENSEN: But the ground elevation on the south base of the embankment is 20 to --

MR. HEAD: Is less than that.

MR. JENSEN: -- 23 feet, somewhere in that range. So it has water over it.

CHAIRMAN ABDEL-KHALIK: Twenty to 23 feet versus 30-34 feet on the other side.

MR. JENSEN: Twenty-nine on the north side, yes.

MR. HEAD: The water still has to get there, though.

CHAIRMAN ABDEL-KHALIK: Yes, I understand. I still find it hard to reconcile sort of a boundary between a gray zone and a red zone.

MEMBER BLEY: There is probably a yellow and green zone in between.

MR. BAILEY: Yes. I mean, if you were standing on that boundary with the surge and the waves lapping at your feet -- You know, back up further. Head toward Austin or San Antonio; moving further inland, higher elevation, you know, the surge just isn't reaching you. That is all that means. It is -- And again, if we were to step back in time as the storm -- you would see that boundary coming back toward the coast.

CHAIRMAN ABDEL-KHALIK: Yes.

MR. BAILEY: That is all.

MR. HEAD: I mean, each of the -- SLOSH would have the same -- a boundary also. It is just in a different place.

CHAIRMAN ABDEL-KHALIK: Right. Maybe it is just a matter of definition. These are all levels compared to sea level.

MR. BAILEY: That is correct.

CHAIRMAN ABDEL-KHALIK: So the reason

why you have a red zone on this graph right next to a gray zone, which is dry, is because, even though it is right adjacent to it, it is because that gray zone may have a higher elevation than the red zone, and that is why I am asking what is the elevation difference between the south side of the reservoir and the north side of the reservoir?

MEMBER BLEY: Is there a topographical map in Chapter 2 we could look at? I don't remember.

MR. HEAD: I am sure there is.

MEMBER BLEY: I would have thought there was, but I don't remember seeing one.

MR. JENSEN: We have that here.

CHAIRMAN ABDEL-KHALIK: Well, if you had that information, just after the break, just get it.

MR. BAILEY: Yes, we have it.

CHAIRMAN ABDEL-KHALIK: Okay. Thank you. Please proceed.

MR. BAILEY: As I mentioned, there is a cross-section that we have that is very clear, and it is. There is a difference. It is not the same.

MR. BENSE: The next item we thought was of interest was the concern that a probable maximum storm surge that exceeded the site grade could have an impact and cause a failure of the MCR embankment, and the staff asked us to consider simultaneous storm surge and the storm surge resulting in an MCR embankment.

In order to do that analysis, we assumed the worst case SLOSH results we got with the 39 to 40 foot storm level, and our model showed that even using this worst case SLOSH model, the flood level is above the 34 foot site grade for less than 80 minutes, and it is only at this peak level for a very short period of time, and that there were no wind waves and only a moderate current of the water flowing past.

We didn't take into account wind, because the direction of the wind required to impact the north face of the embankment would be the opposite direction of the wind required to get the storm surge that we are modeling. Right? As a result of that, we came to the conclusion that there was really no threat to the embankment.

We show the cross-section of the MCR

embankment. We show the peak surge level on the righthand side at 38.5 feet. You can see that peak height of the surge which only lasts a very short period of time, doesn't represent a significant threat to the embankment.

In order to emphasize this point, on using the same scale we have a cross-section of the typical Texas City levee and the storm surge that you would expect to see during a hurricane on these levels, which is substantially higher or a percentage higher, the height of the levee; and at these surges, that levee didn't fail.

So we didn't think -- Even if we have to assume the worst case SLOSH results, we don't think it represents a threat to the MCR embankment, and we have come to the conclusion that we have definitely satisfied GDC-2 because, no matter what model we use, we don't exceed the design basis flood level of 40 feet.

CHAIRMAN ABDEL-KHALIK: Now I guess you are getting into the specific action items at this point.

MR. HEAD: Let me just use this last one. You might ask why did we go through the ADCIRC effort? And we alluded to it earlier. As residents along the Gulf Coast for my entire life, we were -- we just weren't reconciled to the SLOSH results, just quite frankly, and we felt it was important to -- if other technology gave us different results, that we investigate that. So that is one point.

The other point was, we felt it was important to get a definitive answer, we believed, with respect to the north face. As you see here, we have demonstrated even with the higher flood level, we don't believe there is a threat to the north face, but we thought it was important to make a definitive statement regarding that.

So that is the two reasons that we embarked upon the ADCIRC effort. Quite frankly, we are very glad we did, because I think it has moved our process forward and, I believe, given us a result that we are quite comfortable with.

So if you were asking that why did we pursue the ADCIRC effort, that is it.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. HEAD: Do you want us to --

CHAIRMAN ABDEL-KHALIK: Well, let's take a break at this time, and then we will get the staff to make their presentation. Then we will get you back to address these open items.

MR. HEAD: And we are going to -- in the break, the hydro drag force for the buildings, if we can --

MR. HOOKS: I can answer that now, if you would like.

CHAIRMAN ABDEL-KHALIK: Yes, sir.

MR. HOOKS: The response to RAI 3.4.2-11 clearly shows that we carried the drag force up to the top of the wave. In other words, we took the conservative approach.

CHAIRMAN ABDEL-KHALIK: Rather than just the 40 foot level?

MR. HOOKS: Right. Not in the still water. We applied it to the still water plus the wave.

MR. HEAD: And then we will show you our slide that has the elevations on the south side of the reservoir.

CHAIRMAN ABDEL-KHALIK: Okay. Right. Thank you.

At this time, we will take a 12-minute break. We will get back at five after, and at that point the staff will make a presentation.

Then we will get back to the open items that STP will present. Thank you.

(Whereupon, the foregoing matter went off the record at 9:54 a.m. and went back on the record at 10:06 a.m.)

CHAIRMAN ABDEL-KHALIK: We are back in session. I believe STP would like to address the elevation question that was raised before the break.

MR. BENSE: Yes.

CHAIRMAN ABDEL-KHALIK: Please go ahead.

MR. BENSE: And Bob Bailey will show you figures that answer several of the questions you have. These figures are on the docket. They were included in our response to RAI 02.04.05-11.

CHAIRMAN ABDEL-KHALIK: Okay.

MR. BAILEY: What you are seeing here is the actual grid model. We are showing two section lines here. We will call it AA and BB, just to give you some sense of the change in elevation relative to the coast. If I come to the next slide here, here is an outline of the MCR. In the lower right is the Matagorda levee.

Again, here's those two section lines,

and we are showing within the model the actual elevations, and the negative just means -- believe it or not, it means up, positive; down, meaning we are going into the water. So that is all that means.

Although this is shown in meters, typically the variation from the back side of the MCR versus toward the front is something on the order of 10 feet. I'm sorry, 11 feet. Again, it will vary on your cut a little bit and what node you are selecting, but I think what is more important to help you understand what is happening is if we actually look at that profile, the actual section.

Now just to give you some perspective here, the scale on the bottom on the x axis is in degrees. Roughly, that is on the order of thousand meters. So whereas the vertical scale --

MEMBER BLEY: The tick marks is 1,000 meters. Right?

MR. BAILEY: Not necessarily -- Well, it is the distances in degrees.

MEMBER BLEY: In degrees. Okay.

MR. BAILEY; Yes, it is hard to talk -

- You know, here I have a few meters height, and yet I am spanning thousands of meters across, but we are trying to get those somewhat in plot. But I think it makes the point here that -- See the difference?

MEMBER BLEY: Right.

MR. BAILEY: And that surge is coming right in here. So even though I have --

MEMBER BLEY: On the back side is where the bulk of the plant will be?

MR. BAILEY: That is correct. The plant will be on your left. The coast is over here on the right. The two little spikes -- that is the Matagorda levee.

Now in reality, if you stretch this out, it would look a true levee. I am just having to compress the scale to get it on the slide.

MR. HEAD: Here is the barrier.

MR. BAILEY: There is the barrier.

MR. HEAD: With the lines of the MCR embankment.

MR. BAILEY: The little troughs coming down are the intercoastal canals, and again if you stretched it out, it would look more like a true --

MEMBER BLEY: You said the scale is in feet. Right?

MR. BAILEY: It is in meters. Meters.

MEMBER BLEY: Meters? Okay.

CHAIRMAN ABDEL-KHALIK: Yes, but still, I mean in this case, if I were to compare the elevation at the point immediately to the right of the sharp gradient, which is at roughly three meters -- right? -- and the point right after is 10 meters; so the difference is seven meters, and that is 20-some-odd feet.

MR. BAILEY: No. No, it wasn't that. The difference was -- and it will vary.

CHAIRMAN ABDEL-KHALIK: Right. It depends on which direction you are at. Right.

MR. BAILEY: That is correct. No, your difference is three -- four meters, somewhere on that order, around four meters. I think the point to make, this is high ground.

MEMBER BLEY: Your other picture helped me. You are leaving copies of these for us?

MR. BENSE: These figures are shown in our response to RAI 2.3.4-11.

MR. BAILEY: And actually, this was during our -- We actually draw the surge line in there, too. It is submitted from this. You actually see it.

CHAIRMAN ABDEL-KHALIK: Still, without an elevation difference that is more than 20-25 feet, I still can't see how we can have a --

MEMBER BLEY: That is what I was thinking. That 30 feet is with respect to sea level. Right?

MR. BAILEY: Yes.

MR. BENSE: Yes.

MR. BAILEY: All elevations are relevant to mean sea level.

CHAIRMAN ABDEL-KHALIK: If you go back to Slide Number 38, please.

MR. BAILEY: Okay, let's go back there.

MEMBER BLEY: Here. Let me give you 38, and maybe you can show the --

MR. BAILEY: Here we go. Thank you.

CHAIRMAN ABDEL-KHALIK: The red region is sort of fuzzy, but it ranges from roughly 23 feet to roughly 30 feet. Right? And everything here is relative to sea level.

MR. BAILEY: Mean sea level.

CHAIRMAN ABDEL-KHALIK: Right. So if I have a region that is wetted up to a level of 30 feet, let's say, right next to a region that is dry, that tells me, if they are in immediate contact or in the immediate vicinity or immediate neighborhood of each other, the elevation difference between these two must be greater than 30 feet in order for this to happen.

MEMBER BLEY: That is what I thought, but if you go back to the other picture, the one you were just showing us with the cross-section, show us where the flood -- the 30 foot is on here. So right there.

So on one side we are only a little bit different, but --

MR. BAILEY: Below that black line. Another way to do it, if you went back to the other slide -- and this occurred to me, and it probably would help clarify it.

CHAIRMAN ABDEL-KHALIK: So zero here is not sea level on this graph?

MR. BAILEY: Yes, mean sea level.

MEMBER BLEY: Keep the other one up.

MS. BANERJEE: Go back to the other

one?

CHAIRMAN ABDEL-KHALIK: The elevation slide that he just showed, please.

MR. BAILEY: If I subtracted from these numbers the ground elevation, your scale would flip, and you would see blue over here close to zero, and it would start getting deeper. It would be a reverse. Maybe that would -- See what I am saying? If I subtracted the elevation from that?

MEMBER BLEY: I think it works better on the elevation picture you showed us.

MR. BAILEY: And that would give actual depth at that point.

MEMBER BLEY: Right.

MR. BAILEY: And as you approach that boundary, it is approaching zero.

CHAIRMAN ABDEL-KHALIK: All right. Thank you. At this time, we will move to the staff's presentation on Chapter 2.

MS. GOVAN: Okay. Good morning. My name is Tekia Govan, and I am the Project Manager for Chapter 2, Site Characteristics, the review that relates to the South Texas Project Nuclear Operating Company's COLA application for Units 3 and 4. Next slide, please.

The project lead for this application is George Wunder, and the technical staff comprises of three different branches in NRO, the Siting and Accident Consequence Branch with David Brown as the Acting Chief, the Hydrological Engineering Branch with Richard Raione as Chief, and the Geosciences and Geotechnical Engineering Branch with Christopher Cook as Chief. Next slide.

The staff's technical review for Chapter 2 was divided into five subsections that evaluated geography, demography, potential hazards within the site vicinity, specifically on nearby industrial, transportation, and military facilities, meteorology, hydrology and geology, seismology and geotechnical engineering.

All five sections cover the 42 COL information items that were previously described by Mr. Dick Bense from South Texas Project.

Our presentation today will focus on open items as they relate to hydrology, specifically the MCR embankment breach, probable maximum storm surge, groundwater and surface water levels, as well as in the area of geology, seismology and geotechnical engineering with topics including backfill and ITAAC settlement, as well as the shear wave velocity departure.

Rajiv Prasad and Charlie Kincaid from both NRC contractors from Pacific Northwest National Laboratory will lead the discussion in the area of hydrology. Hosung Ahn is the lead technical reviewer for this section.

At this time I would turn the presentation over to Mr. Rajiv Prasad who will discuss open items and items of interest as it relates to the area of hydrology.

MR. PRASAD: So this is an overview slide. We review floods that are described in FSAR Sections 2.4S.1 through .10, and specific items of interest here are described on this slide. Please treat this slide as a review slide.

The staff reviews various flooding mechanisms that might produce flooding hazards at the site, and they relate to local intense precipitation falling on the site, probable maximum floods in rivers and streams, at areas and embankment breaches that we have talked about this morning; storm surges, seiches, tsunamis.

We have talked about quite a bit of those except for tsunamis, channel diversions that might lead to flooding at the site also.

The specific items of interest for us have been the departure which is 5.0-1, states that both the local intense precipitation at the site and the flood elevation at the site exceed the respective DCD standard site design parameters.

The flood elevation which the applicant has described this morning is caused by the embankment breach of the Main Cooling Reservoir. It is set at 40 feet MSL that they have described this morning.

The site grade right at the nuclear island is about 34 to 36 feet MSL. So you have higher than the grade flood, and that is higher than the DCD parameter, which is one foot below grade. So they have to have this departure.

The local intense precipitation is also a departure, because the site is set to 19.8 inches in an hour, and the respective DCD design parameter is 19.4.

The staff in its review has identified four open items in Section 2.4 of the SER, and we will describe it in the following slides. The staff's review of the FSAR will be completed once these open items have been closed. Next slide, please.

This slide shows you the location of the site, major hydrologic features near the site, the MCR. The main cooling reservoir is one of the major hydrologic features that we can see.

On the east of the MCR, the Colorado River runs through to the south, and then we have Matagorda Bay and the Gulf of Mexico to the south of the site. MCR is a manmade cooling pond, and failure of this is supposed to generate the design basis flood elevation.

Let's move on to Section 2.4S.4 which describes potential dam failures, and staff has reviewed various dam breach scenarios here to determine the characteristics of the most severe dam breach flood that could occur at the site.

The staff has identified two specific items of interest which are being tracked by two open items that we have in the SER.

The first one deals with the main cooling reservoir embankment breach flood analysis that is related to the plausible breach widths and breach time. How does a breach occur, and how does a breach develop? The applicant has talked about these issues in their presentation.

Now the second open item deals with the choice of a specific parameter in one of the set-up models that they have used to describe or analyze this flood at the site.

Both of these open items have related RAIs issued to the applicant, and the staff's review would proceed once we receive the responses and complete our review. Next slide, please.

On this slide we describe the probable maximum surge and seiche flooding which we have talked about extensively this morning. The staff reviewed the characteristics of the most severe storm surge and seiche flood that can happen at the site.

The specific items of interest in this section are the applicant's choice of the storm surge model and an open item related to that. The applicant has chosen to use the U.S. Army Corps of Engineers' Advanced Circulation hydrodynamic model to simulate the surges from the Gulf and approaching through the Matagorda

Bay toward the site.

We have an open item here which relates to the applicant's ADCIRC analysis. In staff's review we have determined that the applicant has not shown that it has looked through all the plausible PMH scenarios and analyzed that through the ADCIRC model, and we have an RAI that is issued to the applicant. Once the response is received, we will continue with our review, and then upon successful review the open item would be closed.

CHAIRMAN ABDEL-KHALIK: Now you heard the discussion earlier today.

MR. PRASAD: Yes, I have.

CHAIRMAN ABDEL-KHALIK: About the differences between the SLOSH model and the ADCIRC model.

MR. PRASAD: Correct.

CHAIRMAN ABDEL-KHALIK: And one of the reasons that the applicant has attributed to this difference is the presumably better data for topography that is sort of embedded or used in the ADCIRC model, and the question then is: How do the predictions of the two models compare when you compare the maximum surge at the coastline, at the Gulf Coast line, so that the difference or sort of the better resolution that you have as far as topography is concerned with the ADCIRC model wouldn't really enter into that?

So in the table showed by the applicant, it said that this predicted maximum surge at the Gulf Coast was not evaluated in the confirmatory analysis.

MR. PRASAD: Yes. And the reason for that is that, when we do our confirmatory analysis, we don't necessarily share the results with the applicant. All we do is that we use that analysis to inform our review and inform the questions that we are going to ask the applicant.

CHAIRMAN ABDEL-KHALIK: Right.

MR. PRASAD: So that analysis was done, and I don't have the numbers off the top of my head here, but I think they are pretty comparable.

MEMBER BLEY: Can you -- I am sure you can get them for us, so we can see.

MR. PRASAD: Right.

CHAIRMAN ABDEL-KHALIK: I think that would help inform us.

MR. PRASAD: Yes. We can share those

numbers, but my belief is that they are very comparable at the coastline.

CHAIRMAN ABDEL-KHALIK: I think it would be important for the staff to verify that and let us know.

MR. PRASAD: Yes.

CHAIRMAN ABDEL-KHALIK: If possible, today.

MR. PRASAD: Sure. Regarding the -- From that point on, how do those two models behave once you want to predict the storm surge at the site? The applicant has stated that they have used -- or ADCIRC used this high definition topography data, and we do agree that that high resolution topography data combined with the physics that is embedded in the ADCIRC model probably produces a more realistic scenario in terms of predicting the storm surge.

One of the things that the applicant showed you this morning was the profile where there was two spikes located close together that represent the Matagorda City levee. That spike is not reproduced in the SLOSH grid that is used in the most recent version of SLOSH.

What happens is that, when you have

these storm surge coming in from the Gulf coast, once they hit the levee, at that point the amount of obstruction that you see from the levee is probably higher in ADCIRC than it is in the SLOSH model. So what happens is that SLOSH further on from that point inland is going to produce a more conservative result in terms of higher water surface elevations compared to ADCIRC.

That is one of our beliefs. But in order to look at the most severe storm surge at the site, the staff also applied the SLOSH model with multiple PMH scenarios. That can come from different directions, can have different landfall points, can have different storm sizes, and all of those are combined into multiple scenarios.

What the applicant has shown us so far is one storm track that produces this surge that they are talking about at 29.3 feet or so. So one of the open items listed in Section 2.4, 2.4.5, is related to related to that issue, that we want to see more scenarios.

CHAIRMAN ABDEL-KHALIK: Intuitively, as someone who does these calculations on a regular basis, you believe that the difference in topography can impact the results by as much as

10 feet?

MR. PRASAD: Yes. Yes, depending on exactly what those numbers are, if you have a smooth slope and gradually varying slope, you could have the storm surge pushing in much farther inland, and would then inundate a lot higher elevation inland than a storm surge which had much steeper barrier islands and levees that obstruct it. So the effect sort of dissipates much closer to the coastline than proceeding inland.

CHAIRMAN ABDEL-KHALIK: Nevertheless, I think a direct comparison between two unambiguous numbers would be helpful to us.

MR. PRASAD: Yes.

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. PRASAD: Then moving on to Section 2.4S.10, this is where staff reviews the characteristics of the design basis flood that may necessitate any required flooding protection at the site.

The specific items of interest here are flooding protection for safety-related components that would be needed up to the design basis elevation of 40 feet MSL. That is what the applicant's position is. Because of that, they already have a departure identified in the FSAR.

The staff's review has identified an open item here. This is related to a combination failure mode that the staff postulated. When we did our SLOSH calculations, independent of the applicant, we were getting much higher storm surge at the site, and at the site meaning right near the nuclear island.

One of the numbers that you saw which was approximately 38 feet over there, plus you have wind waves on top of that. We were getting values which could have exceeded the 40 feet elevation.

So one question that came to the staff or the mode that we postulated is: Once you have these inundations at the site and the toe of the embankment is also inundated, could the clearance along with the surge result in eroding of the outer face of the embankment and could lead to a failure of the embankment while the storm surge was in place?

If that happened, then with the water surface already at about 38 feet, with the embankment failing, there could be a higher water surface elevation. That is one of the open items that we are pursuing in here.

That postulated embankment ~~p~~breach, due to the storm surge in place, actually relies on the storm surge being higher, at a higher elevation than the toe of the embankment with the concurrent condition that the storm current velocities during the storm surge event would be high enough to erode the embankment face.

So there is no RAI associated with that, but the RAIs in Section 2.4.4 and 2.4.5 that we have are going to inform the staff's review to close out this particular open item and staff's review will be completed after we get through the resolution of these open items.

MR. KINCAID: The next slide moves to the FSAR section on groundwater. I am Charlie Kincaid out of PNNL, and I will present these slides.

The staff reviewed the hydrogeological characteristics of the site, and in doing so what we decided to do is evaluate the applicant's measured characteristics and properties as they support the conceptual model of the site and estimates made of the direction and velocity of groundwater and, hence, radionuclide releases in an accident, an accidental release, which we subsequently used that information in 2.4.13 which we will talk about next.

We also looked to ensure or evaluate that the maximum ground water level remains below the DCD requirement and, if by chance it were above it, we would assess the need for a permanent dewatering system.

With regard to groundwater specific items of interest are that the staff had completed their review of the characteristics and properties of the proposed site, as described by the applicant. The staff has concluded that the hydrogeological characterization is sufficient to support both the conceptual model and the site characteristic determination for maximum groundwater elevation However, at this time the staff also has concluded that further review is needed on three items.

Those three are covered in the open item 2.4.12-1 and RAIs. They are that we need further analyses of the maximum groundwater elevation, further analyses of the hydraulic gradients, and subsequent the travel times of groundwater.

The staff's review of this FSAR section will be completed when we close this open item, and that will be done through the receipt of RAI responses due the 15th of December. There are a number of groundwater simulations, sensitivity cases, that are on the applicant's desk to get out to us.

They supplied a number of simulations and analyses August 30th, but there are some additional sensitivity cases that they have run since then that are being submitted. They also are making a complete revision of the groundwater model documentation.

That includes documentation of all the cases they have run since November of last year, and there is an RAI that just came in, and we haven't had a chance to look at, but on the groundwater side we issued an RAI coupled with that of Dr. Rajiv's where we are looking at the influence, potential influence, of maximum flood elevation on maximum groundwater elevation.

So we look to close this out upon receipt of those RAIs at mid-month.

In the FSAR section on accidental

releases of radioactive liquid effluent, the staff reviewed the postulated accidental release from the radwaste management system and its potential effects on groundwater and surface water.

Our evaluation is of the ability of the groundwater and surface water environment to delay, disperse, dilute or perhaps concentrate liquid effluent; also to describe the effects of the postulated release on known and likely future uses of the water resource.

Specific items of interest are that the staff conclude that the postulated release and the pathway analysis methodologies are acceptable. However, the staff concluded that the open items 2.3.12-1 and 2.4.4-1, which I will describe here, have a potential influence on closing out this particular section's review.

With respect to open item 2.4.12-1, the groundwater pathway analysis by the applicant could be impacted by the closure of this open item, and the resolution of post-construction hydraulic gradient estimates.

They are doing simulations now looking at infiltration through the excavated area and backfilled area, and will be providing us information about groundwater heads and hydraulic gradients, I suspect, in those results they provide us. So that could change, of course. Travel times could change because of that, and that could dovetail into changes in 2.4.13. so we await those RAI responses I just described a moment ago.

The surface water pathway analysis also could be impacted by the open item 2.4.4-1. In this area it deals with the main cooling reservoir breach analysis, and as we discussed more thoroughly this morning in the applicant's presentation as they presented, that was an RAI. They have done further analysis of it. So we wait to see if that has any impact on flood elevations, rates of flow and so on, as they dovetail into the analysis of the release into surface water from the release scenario they have laid out here.

So closure, basically, of this section relies on closure of 2.4.4-1 and 2.4,12-1 open items, any dovetailing changes in those analyses that dovetail into this accident analysis.

MS. GOVAN: At this time, if there are

no questions for Rajiv and Charlie on hydrology, we will move on.

There is a correction on the slide. there is a last minute change. As opposed to Yong Li, at this time, we will have Laurel Bauer and Wayne Bieganousky present technical findings related to geology, seismology, and technical engineering.

This presentation will include ACRS items of interest such as license conditions, ITAACs and open items associated with this section. At this time, I will turn the presentation over to Laurel Bauer.

MS. BAUER: I am Laurel Bauer. I am the geologist responsible for reviewing Section 2.5.1 on basic geologic and seismic information, and Section 2.5.3 on surface faulting.

There were no open items associated with either of these sections. However, we do have a license condition for the geologic mapping during construction excavation.

Basically, that license condition informs the applicant that they must perform geologic mapping of the future excavations for all safety related structures, and evaluate any geologic features that are seen -- that are discovered in those excavations, and then to notify the NRC once the excavations are open for examination by the NRC staff.

The Reg Guides 1.132 and 1.208 both lay out the guidance for conducting the geologic mapping, and this basically ensures that, if there are any geologic features beneath the site, that those are seen in the detailed geologic maps of the walls and of the floor of the excavations.

MR. BIEGANOUSKY: I am Wayne Bieganousky. I reviewed Section 2.5.4 and 2.5.5, stability of subsurface materials and foundations.

The applicant is going to be excavating for the Category 1 structures, and he will be excavating to depths of up to about 90 feet, and it is going to require removal of about 3.5 million cubic yards and then backfill placement of about 2.2 million cubic yards.

The applicant hasn't identified the materials yet, what source he will be using to obtain those materials. So we don't have the engineering properties of those backfill materials, but he has progressed, and he has assumed engineering properties for those backfill materials.

We have one open item on RAI 2.5.4-37 requesting the applicant provide the tests and frequency of testing that he will use to identify the material properties. The applicant has submitted that information, and we are evaluating it.

There are three design considerations in backfill placement: The density of the backfill, the shear wave velocity of the backfill, and the engineering properties that we already mentioned. All three of them actually work together in determining the engineering properties of the material. If you place the material to a specific density, you are going to get a shear wave velocity of a certain amount. So they are all interrelated.

We have three ITAACs: One to test the density of the material to ensure that they have achieved at least 95 percent of modified. We have another ITAAC that is going to test for the shear wave velocity that they actually obtained, and then we have the ITAAC which will determine the engineering properties of those materials.

They will compare those engineering properties to the engineering properties that they used in their analyses to see if they fall within the limits that they have assumed.

We have another issue with settlement. The applicant has predicted settlements in the range of eight to 10 inches for some structures and three to five inches for other structures. The settlement -- Total settlements of the eight to 10 inches is not a problem. Typically, what you are more concerned with is differential settlement, because that will determine whether or not you will exceed the stresses that you designed for in the basemat.

We actually have an interface between geotech and structures here. We are concerned about the settlement they predicted. They are concerned about the settlement that actually occurs.

The way we resolved this issue is the applicant provided us with an ITAAC where he will measure the settlement at certain points during construction, and ensure that the settlement doesn't exceed the values that he assumed in his design, and the maximum allowable tilt or distortion that we are looking for is one in 600, which is one inch in 100 feet.

CHAIRMAN ABDEL-KHALIK: Well, back to the in situ density testing.

MR. BIEGANOUSKY: Yes, sir.

CHAIRMAN ABDEL-KHALIK: Is this a random test as far as the location where the test is to be performed?

MR. BIEGANOUSKY: There is a frequency of testing. The applicant is going to test in the most crucial areas, most critical areas where we expects the settlement -- the density will be the least. It can be selected by any member of the staff who goes out there and says I want you to test at that location, if the inspector thinks that maybe that area hadn't been densified.

CHAIRMAN ABDEL-KHALIK: Well, how much variability would you expect on a site this large from your desired 95 percent theoretical value?

MR. BIEGANOUSKY: Because of the equipment that they are using and the controls that they have, I wouldn't expect that you would be getting less than 95 percent modified Proctor. I expect that they are going to be getting more like 96, 97, 98 percent, because the equipment is so heavy.

The density that you are predicting with the laboratory test, the moisture-density relationship based on modified Proctor is that energy that goes into predicting that relationship is less than what you would get with the conventional compactors today.

So as long as they have uniform materials, uniform moisture content, and they have compacted the number of times that -- they run it over it with the number of passes that they say they are going to use, they ought to get the density.

They are going to have a test fill, and in that test fill they are going to determine how large or how thick the lift thickness can be, how many passes with a particular type of equipment. So they are going to have it all pretty well laid out before they start compacting it.

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. BIEGANOUSKY: Issue number three was the shear wave velocity departure. This issue was actually covered in Chapter 3, but shear wave velocities were presented in Chapter

2. So we are just giving you a heads up on Chapter 3.

They address a departure, because they didn't have 1,000 feet per second throughout the profile. So they have submitted a departure. They have run the structural analyses they need to run, and they presented them in Chapter 3, Appendix 3A and Appendix 3H, which is not listed on this slide.

CHAIRMAN ABDEL-KHALIK: Okay.

MS. GOVAN: Next slide. This actually concludes the NRC staff's presentation of the Chapter 2 site characteristics. At this time, we would like to ask the Committee if they have any additional questions related to this review. We will be happy to answer those at this time.

CHAIRMAN ABDEL-KHALIK: Any additional questions for the staff?

MS. GOVAN: We did capture one action item that, hopefully, we can close by the end of today, and that was related to the applicant's Slide 33 where we have NRC confirmatory analysis not evaluated, which actually has been evaluated, and we are going to compare our analysis to the applicant's analysis and get back to you all on the results of that.

CHAIRMAN ABDEL-KHALIK: That would be very helpful. Thank you.

MS. GOVAN: Thank you so much.

CHAIRMAN ABDEL-KHALIK: All right. So at this time, we will go back to STP, and we will continue from Slide 41, I believe -- or Slide 40.

MR. HEAD: This is the first topic you asked us to -- on the airplane --

CHAIRMAN ABDEL-KHALIK: Right.

MR. HEAD: -- frequency.

CHAIRMAN ABDEL-KHALIK: I think it is probably John who is happy with this, but please go ahead.

MR. HEAD: Well, like I say, at the last meeting we provided the details of our response, and I guess we certainly left with the impression that we had addressed your questions at the time, but we wanted to confirm that.

MEMBER STETKAR: Yes, Scott. Regarding your point, the aircraft analysis, I did receive the RAI response. I went through it. The analysis is fine. I understand what you did. I understand how you estimated frequencies. I am happy with it.

MR. HEAD: Good. Thank you. We will move on.

MR. BENSE: Action item 58, you noted that you observed different groundwater levels. Yes, you did.

MEMBER STETKAR: These days, you know, I don't trust pretty much many of my observations. So, thanks.

MR. BENSE: The DCD site design parameter is 61 centimeters or two feet below grade, which would be 32 feet main sea level. One item you saw in various places as the highest observed level was approximately 26 feet in the power block area. However, we use a design value of 28 feet, and we acknowledge that it could be clearer on which numbers are used where, and we recognize that an FSAR update will be necessary to clarify that.

MEMBER STETKAR: You are just going to update the FSAR and kind of fix it.

MR. BENSE: Yes, we are just going to fix it.

MEMBER STETKAR: Part of the reason for the conclusion is I had to re-index everything to sort of grade zero, for example, because grade zero is different in different parts of the documentation. So you are going --

MR. BENSE: We are going to clarify it to ensure that it is clear.

MEMBER STETKAR: But ultimately, regardless of what the actual numbers are, is the conclusion from this slide that indeed the mean groundwater elevation at the site is more than two feet below grade?

MR. BENSE: Yes.

MEMBER STETKAR: Okay. That was the reason for my concern, because I was led to the impression that it might be really close to grade level at certain points on the site.

MR. HEAD: And as alluded to, we are still in dialogue with the staff on certain aspects of that.

MEMBER STETKAR: Okay. Thank you.

MR. BENSE: So we will be getting back to you on an action item here.

MR. HEAD: I am just going to ask: This is one of those where we have a follow-on to the follow-on, and have we closed the action item by acknowledging what we have to do or do we need -- I mean, how would we -- How would ACRS want to?

CHAIRMAN ABDEL-KHALIK: I think we will just leave it open until you close your discussions with the staff.

MR. HEAD: Okay.

CHAIRMAN ABDEL-KHALIK: We are not approving methodology where we want the details.

MR. BENSE: The second item, Action Item 54, a question about the three second gusts for wind loading on hurricanes, and you asked about the 100-year history. Your observation was that the wind speeds associated with hurricanes that have been observed at the site appear to exceed the values that we used.

The FSAR and the SER already discuss the NOAA historical record. You asked about the 50 or 100-year record of storms within 50 miles. All that information is currently in the FSAR. We believe the issue is how the ASCE 7 wind load is applied, and that is discussed extensively in the commentary for ASCE 702.

We believe that we have applied that correctly in conformance with the ASCE guideline.

MEMBER STETKAR: I think that -- You know, quite honestly, my eyes glaze over for ASCE guidelines and any of those standards. I tend to like to look at actual historical data, where the first bullet here you have noted that, since 1851, there are 11 tropical cyclones with wind speeds that exceed the design basis wind loading. And indeed I did my own search, and I came up with since 1901, 10. So we are probably using the same NOAA database.

If I divide 10 or 11 by -- If I divide 10 by 109 years or 11 by a hundred and -- whatever it is -- 54 years, I come up with numbers that are much larger than one in 100-year return period. So that causes me concern regarding stylistic use of some standard that apparently is not consistent with actual observed experience.

That is my basic concern, is if the experience indeed shows a return period of something on the order of -- if you look at the NOAA records, there are indirect strikes versus direct strikes, and I am not sure exactly the extent of the wind speeds.

What we are talking about are numbers that are on the order of .1 to .06 per year, not .01, something on the order of at least five to

10 times higher than the frequencies that are cited in terms of the design basis as a 100-year return period for these peak wind gusts.

That led to the concern about indeed what is the 100-year peak wind gust, if that is what we are supposed to be designing the structures to, because it seems that the 100-year peak wind gust is higher than the gusts that are cited in the design certification.

MR. BENSE: And we believe that that is in accordance with the guidelines, and the guidelines take that --

MR. HEAD: Let me just go ahead.

MEMBER STETKAR: If a building falls down, people go back and they look at the guidelines and revise the guidelines.

MR. HEAD: Clearly, that information was available to the people that built the standard, and the discussion that we talked about, they define not the casual -- the Category 1, 2, 3 and 4 and 5 that we are used to hearing all the time.

They used that information and their concepts of the storms to define the wind gust, and that wind gust is what we use as part of --

but that information was available to -- and they also -- they note that the conservatisms that are available in the buildings, that if the buildings are designed to those wind gust loadings, that they should withstand the hurricanes that we expect.

So we are left in a position where we believe it is the appropriate standard to use, and that is, in essence, how we have moved forward. Debating about -- You know, our ability to debate the background of the standard, though, is limited to what is available to us in the actual document. And I would note, there are no -- In their tables, they don't really encounter a Category 5 hurricane as part of their --

MEMBER STETKAR: There are no Category 5 in the NOAA records, but there have been. If I just look at Matagorda County, there has been one Category 4 direct, two Category 4 indirect, whatever that means, meaning it hit Brazoria. It didn't hit Matagorda County.

Three Category 3s, a couple of Category 2s, and if I look at the three-second wind gust for a Category 2 hurricane using kind of standard -- you don't find wind gust speeds for hurricanes. You find maximum sustained wind speeds, and they typically say that the three-second wind gusts are about 30 percent higher than the maximum. That is kind of a rule of thumb.

MR. HEAD: And that is discussed in the standard, specifically how to make that calculation.

MEMBER STETKAR: And that three-second wind gust gets you into the mid-range of a Category 2 hurricane, if you look at the maximum sustained wind speeds for a Category 2. So essentially, the experience -- and as you note here, 11 tropical storms with wind speeds that exceed design basis wind loading in 154 years or whatever. And yet in the standard that is categorized as a 100-year return period.

So I am curious how that is -- I understand the standards, but if the standard is contrary to actual experience, I am not sure what we should be doing.

MR. HEAD: I believe the standard. I don't have any -- but I believe that the standards makes it clear that designing to that maximum is not reasonable, given the conservatisms that are inherent in buildings, and certainly inherent in the design of a nuclear power plant.

All of this, though, is somewhat -- You know, I don't know that we can resolve that issue. Our point, though, was the last bullet on the page, that is --

MEMBER STETKAR: That indeed might be the ultimate, that if indeed the structures are designed for the peak tornado loading, they will certainly withstand the hurricane force winds, because we are not talking about Category 5s here.

So I guess where we are left on this is that, you know, we can agree to disagree on whatever the return period is for a hurricane induced maximum wind gust, but as long as the buildings are indeed designed to withstand the tornado loading, that certainly envelopes the hurricane wind speeds.

MR. HARVEY: Mr. Chairman, this is Brad Harvey with the staff. Can I add a couple of comments on the ASCE standard, not necessarily in defense of it, but my understanding of it a little bit.

There is a table, again in the commentary section, which tries to convert the sustained wind speed over water, which is the one minute, to a gust wind speed over land. I understand, I think, the design basis for the safety systems is 139 mile an hour.

MEMBER STETKAR: Something like that.

MR. HARVEY: All right. That is almost mid-range Category 3, if you look at their conversion from a one-minute average over water to a three-second gust over land. Okay? So again, I refer you to Table 6C-2 in the commentary section, at least of ASCE 7, 2005 version of it, which I think is very similar to what is in 2002.

The other statistic that you present is eight or 11 hurricanes of Category 3 or higher that have occurred within 100 miles of Matagorda County.

MEMBER STETKAR: Just for the record, I actually have hurricane data for all the counties within a 50-mile radius of the plant site, and the data I have show much, much more than 11 hurricanes within a 50-mile radius of the plant site. I just -- The numbers I cited were strictly those that made landfall within Matagorda County itself, which is the county where the site is, or where the damage in Matagorda County was essentially equivalent to a landfall.

This is a NOAA summary by location. I mean, it is pretty detailed.

MR. HARVEY: Yes, and I went to the same database, and I don't know if I came to the same conclusion as you, or I looked at a NOAA-CSC database.

The other point I am trying to make is, if you have seen these wind speeds within 50 or 100 miles of the site, it doesn't necessarily mean you are going to see them at the site, because the extent of the maximum wind speeds is not going to cover the entire 50-mile radius.

So I think that, if you had a hurricane with at one speed occurring within 50 nautical miles, it doesn't mean you are going to see those same wind speeds necessarily at the site itself.

MEMBER STETKAR: Again, just for the record, the numbers that I cited are for hurricane strikes at Matagorda County. I didn't expand -- I do have the data for the 50-mile radius here, but because of that decreasing wind speed as a function of distance, in today's meeting I haven't cited the numbers outside of the direct county that the site is located in, and those numbers are six direct strikes of Category 2 and higher, four direct strikes of Category 3 and higher, one direct of a Category 4, and no indirect strikes of Category 2. Indirect is fringe effects. So I am not quite sure what the peak wind speeds would be from those, of Category 3 and two of Category 4.

That excludes the other categories, you know, 50 miles radius from the site east or west or north or south or whatever direction the coastline goes there. There are larger numbers of strikes, but further distances. But again, you know, quibbling over the frequency, if indeed the buildings are able to withstand a 200 mile per hour wind speed, then the frequency of 139 mile hour wind speeds is somewhat irrelevant.

CHAIRMAN ABDEL-KHALIK: Okay. Thank you, John. Let's proceed.

MR. BENSE: The next item was identification.

MEMBER STETKAR: Now we get to what kind of tornado wind speed are they designed to withstand.

MR. BENSE: Extreme winds which were determined in accordance with the guidance provided in Regulatory Guide 1.76, and your question was why did we select Region 2 when we were so close to the boundary for Region 1?

In fact, Regulatory Guide 1.76 does say sites located near the general boundaries of adjoining regions may have additional considerations. Right? And the additional consideration is that, instead of looking at boxes that are based on a two-degree -- if you down to a one-degree radius.

We have done that. In response to an RAI, we have already looked at that, and we show -- On Slide number 44, we show the position of the STP site in the one-degree box and the probability level, and the adjacent wind speeds.

We satisfy the requirements for being within that block. If you look at the process --

MEMBER STETKAR: I am glad wind is no perfect squares.

MR. BENSE: We are putting our faith

in the people that develop the guidance. We, in fact, you know, followed the requirements. We believe that it is reasonable. If you look at the block, you take the average of the four adjacent blocks, and we are within the 200 mile region. So our selection of the region to be in Region 2 is in accordance with the guidance.

CHAIRMAN ABDEL-KHALIK: I mean, it is right there in the corner.

MR. BENSE: I was thinking 173 was really where we should be. You know, the process was to take the average of the four adjacent blocks, and we have done that.

MR. HEAD: We should note that these are just for the site specific structure.

MEMBER STETKAR: Yes. This is the basis for your 200 mile an hour tornado wind speed, which is --

MR. HEAD: Right. The DCD buildings are designed for the Category 2 -- or Category 1 buildings, because obviously, the DCD -- they could have put the plant anywhere.

MEMBER STETKAR: Yes. Okay, thank you.

MR. BENSE: The next item challenged

us about the ability to make the reactor building access door watertight, and your concern was the fact that you concluded that there would be railroad tracks, and we do say that in the DCD in Chapter 9 it does specify that it is a truck-railroad access door. However, in Chapter 2 we do mention that there are no railroads within five miles of the site.

MR. HEAD: But even if it was -- If we had put a railroad through there, then we would still have to be able to configure a door that would be watertight, including potentially removing the rails; because, obviously, railroad access -- You know, 1 and 2 have railroad access also, but they have been disabled because there is no real need.

So whatever we were going to put through there, it will have to be watertight, and whatever mechanism we have to use.

MEMBER STETKAR: So even if you do, for example, decide to lay in rail spur to bring in heavy equipment during construction, you will seal that?

MR. HEAD: If we keep it, then whatever door is there will have to -- we will either have to remove the rails and put them to the side or have them stored somewhere so that, if we ever want to -- All right. But the design basis --

MEMBER STETKAR: There will be stuff on the bottom or something. No offense.

MR. HEAD: The design basis will trump whatever. But it was an interesting question. We have looked into it, and we have -- You know, we have moved forward on our door design as a result of the question.

MR. BENSE: It is part of the detailed design which hasn't been developed yet, but that we acknowledge, it definitely exists.

MEMBER STETKAR: It is at least worth thinking about it.

MR. BENSE: The next item regards waterproof membranes for the foundation, and the concern that you expressed was the waterproof membranes went up to one foot below grade, and you were concerned that, since we changed our design flood level from slightly below grade to six feet above, would that require that these waterproof membranes be moved up to the same level.

We reviewed that, and we determined that the purpose of the waterproof membrane was the long term corrosive effects of the groundwater, not a short term flood duration. Several feet of concrete is acceptable. We do have a waterproof coating on the buildings, but the membrane has nothing to do with flood levels. It is all for groundwater levels, and we are well within that.

MEMBER STETKAR: Well, my actual concern was also related to the groundwater level, because as I said, the initial discussion was there seemed to be indications that at certain points on the site the groundwater level might be relatively close to surface.

So I was actually more concerned because of the question about the groundwater level, and as long as you can confirm that the groundwater level at the -- you know, at the UHS basin will also be more than two feet below the surface, then I don't care about the transitory external surface flooding, basically. Thanks.

MR. BENSE: The last item is turbine missile damage probabilities, action item number 59. Once again, we find the requirements in accordance with the guidance provided in the Standard Review Plan, Section 3.5.

Your question was use of the word conservative. I'm stymied right there. We have established the requirements, and I believe it says that you could apply -- if it applies to 10^3, that the word conservative applies.

So it is possible that it may have been a less than appropriate application of the word conservative. However, we do satisfy the requirement of the Standard Review Plan, because the probabilities were calculated in accordance with the guidance.

MEMBER STETKAR: Well, again, you know, here we are kind of constrained by a stylistic number that is in guidance that may not necessarily apply on a plant specific basis. The genesis of my original question was have you done an evaluation to give you on a plant specific basis confidence that indeed that 10^{-2} number is a bounding number for your particular configuration, not a stylistic configuration in guidance but actual configuration of South Texas 3 and 4. Where that P2, P3 -- you know, that is the -- because that is the arrangement of equipment in the plan.

MR. HEAD: We have a basis to believe it is conservative. We believe, once have we finished our analysis with the turbine, it will show that it is. Based on our experiences with 1 and 2, we believe it is a conservative number. So we -- It is the appropriate number, whether it is -- for our analysis, we believe.

Bill, do you want to add anything?

MEMBER BLEY: You said, once we finish our analysis. Is this the PRA analysis or what?

MR. HEAD: It is the analysis we have to do on the turbine that we still owe the staff.

MEMBER STETKAR: Well, it is -- I think Dennis' question was, is that turbine analysis that you owe the staff the integrated damage analysis or is it simply the frequency of ejecting turbine missiles, which is the P1 probability?

This question doesn't address the P1 probability. This is simply the conditional probability of a strike and then, given a strike, the conditional probability of damage to a safety-related piece of equipment or cable or whatever.

So is the analysis that you still owe the staff the turbine missile frequency analysis?

MR. HEAD: We are either going to get some additional help or we are going to have to provide that.

MEMBER BLEY: I rather thought you would come back with a fairly simple 3D geometrical probability calculation that laid this to rest very easily, but apparently not.

MEMBER STETKAR: Yes, that is what you -- You are kind of curious, and maybe it isn't so easy to lay to rest without that simple analysis.

MEMBER BLEY; I suspect it is, but I haven't seen it.

MR. STILLWELL: Bill Stillwell. I am the PRA supervisor for STP 3 and 4. You maybe asked why PRA, because it says probability analysis.

For STP 1 and 2, we did, in fact, in the FSAR develop a P3 calculation for turbine missiles for Unit 1 on Unit 2 equipment, and then vice versa for Unit 1.

If I remember right, and I have not checked, the P2, P3 calculation was we are well below 10^{-2} in terms of consequences for Units 1 and 2. There is not a similar calculation for 3 and 4, although the guidance in the Regulatory Guide, and I believe there is a NUREG also, say that 10^{-2}, because of all the possible convolutions and the difficulties in evaluating an actual re-damage to the RSW pumphouse from a strike on Unit 3 or from a missile on Unit 3, that 10^{-2} is probably a reasonable value to use for the probability of the consequences of a strike.

Our evidence from 1 and 2 is that was consistent with what we saw in 1 and 2 back in the final safety analysis for A phase, which were early Eighties.

MEMBER BLEY: I am just a little confused. If you did it for 1 and 2, why can't you do it for 3 and 4?

MEMBER STETKAR: Well, the only difference is did you look at high trajectory missiles on 1 and 2 also? You know, the guidance has kind of evolved a little bit. The range of the missiles that you look at are different.

MR. STILLWELL: I would have to go back and look at 1 and 2, because it has been removed from the FSAR now because of additional guidance that we didn't need to maintain it in the FSAR. We would have to go back and look at the 1 and 2 analysis. But my recollection for the 1 and 2 direct strikes is the probability and consequences were well below 10^{-3} and more likely on 10^{-4}, 10^{-5} range.

Just as further background, 1 and 2, I believe, were actually closer together than 3 and 4. So that helps a little bit in terms of spread and trajectory, spread of the possible missiles. I don't know if that answers your question.

MR. HEAD: Let's agree it doesn't. I think, clearly, from the initial impression, I thought you were just taken aback by the word conservative, and --

MEMBER STETKAR: I was taken aback by, I think, the use of the word conservative without any justification for its technical basis. It might be a reasonable number to use. It might be a stylistic number to use, given the guidance, but it isn't necessarily numerically conservative unless you have some evidence to show that it is conservative.

MR. HEAD: Actually, I think we were

basing that on the guidance, and it sounds like you actually want a little more depth with respect to our basis, our own basis for the word conservative.

MEMBER STETKAR: I think -- I am just an individual, and individuals don't run subcommittees. A depiction of the locations -- As Dennis said, even a three-dimensional depiction of the geometries and the locations of relevant safety-related equipment that could be impacted, you know, within the zone of influence of those turbine missiles, might help to gain confidence.

MEMBER BLEY: I mean, we already know--

MEMBER STETKAR: We sort of know.

MEMBER BLEY: -- there is a range over which missiles come out and kind of how likely they are over that range, and it would be more comforting to --

CHAIRMAN ABDEL-KHALIK: You guys will follow up.

MR. HEAD: Yes, sir. We will leave this one open.

CHAIRMAN ABDEL-KHALIK: Thanks.

Great. Thank you.

MR. BENSE: The last item in our presentation, we were supposed to just identify that there is ITAAC site specific for backwave -- or, excuse me, backfill, which we presented to the staff, and they are still evaluating.

Shear wave velocity, because we have the departure not to do the seismic structure interactions which will be presented in Section 3.7 and 3.8, and then the settlement criteria which was discussed by the staff, and there is nothing of interest.

We have presented everything to the staff that they have asked for so far, and waiting for their response.

CHAIRMAN ABDEL-KHALIK: Okay. Thank you.

MR. HEAD: And like I say, obviously, John, you missed the ADCIRC discussion. I just want to note that everything we have covered in there is covered in great detail in the RAI response that is referenced in the presentation.

CHAIRMAN ABDEL-KHALIK: Let me just try to capture what we arrived at during this.

Action Item Number 58, which relates

to the groundwater level: I guess we will wait until you present results to the staff.

Action Item 54, hurricane wind speed: I guess the conclusion is that it is not important as long as less than the maximum tornado wind speed for which the buildings are designed. So that item can be closed out.

Item Number 55, tornado wind speed: Two hundred miles per hour, looking at where the point is, it is as close as it can cut it.

MEMBER STETKAR: It is good enough.

CHAIRMAN ABDEL-KHALIK: Okay. Item Number 56, the large exterior doors. I think we will consider that closed.

Item Number 57, the waterproof membrane. Consider that closed.

MEMBER STETKAR: That is -- Yes. I mean, that is contingent on the groundwater.

CHAIRMAN ABDEL-KHALIK: Item Number 59, turbine missile damage. You will do some more work.

MR. HEAD: Appreciate the insights.

CHAIRMAN ABDEL-KHALIK: Okay. Great. Thank you. I guess at this time, we will move on to the Chapter 15 --

MR. HEAD: May I suggest, as this was such a big discussion, should we do follow-up items here or did you want to do them -- because I don't think 15 will -- Well, of course, it could. I just wondered if we wanted to go over follow-up items that we had during the Chapter 2 discussion.

CHAIRMAN ABDEL-KHALIK: Yes, that would be fine. Please.

MR. HEAD: Okay. The hydro drag force.

CHAIRMAN ABDEL-KHALIK: And that was closed.

MR. HEAD: That was closed. The elevations on the north side versus the south side at the reservoir.

CHAIRMAN ABDEL-KHALIK: I think that is closed, unless Dennis -- Okay.

MEMBER BLEY: Yes, I am good on that now.

MR. HEAD: I believe NRC and we still have an action item. I don't know if we will address it today, regarding the SLOSH/ADCIRC at the coast for that comparison.

CHAIRMAN ABDEL-KHALIK: Right.

MR. HEAD: And if that happens, then we will certainly be willing to support that.

CHAIRMAN ABDEL-KHALIK: Right.

MR. HEAD: That is all I have, and I will ask the rest of my staff if anyone has anything.

CHAIRMAN ABDEL-KHALIK: That is all I have, too.

MR. HEAD: Okay. Maitri?

MS. BANERJEE: The scale or figure on page 37. That was a question.

CHAIRMAN ABDEL-KHALIK: It is not a critical question, but if you can -- I think somebody mentioned the whole range is 50 miles or something like that.

MR. HEAD: It is on the order of that, right.

MR. CHAPPELL; Using the MCR footprint as a scale model, it is about 59 miles -- 50 miles.

CHAIRMAN ABDEL-KHALIK: Okay, that's fine. Just trying to get an order of magnitude.

MR. HEAD: Okay. Thank you for that.

CHAIRMAN ABDEL-KHALIK: So the only open item is the joint open item, the comparison between SLOSH and the ADCIRC model. Okay, thank you.

At this time, we will move to the presentation on Chapter 15, and we will start with STP.

MR. CHAPPELL: My name is Coley Chappell from STP. The follow-on for Chapter 15 is to discuss a couple of interesting items. We initially brought Chapter 15 to the ACRS Subcommittee on March 2nd with just a few items to discuss.

Just a recap of the basic points of Chapter 15 is that it is essentially a certified design. The main issues are that the accident analysis are incorporated by reference, largely due to no departures that originated in Chapter 15 other than some admin departures, and that the impacts from other chapters, departures from other chapters, were largely consistency or minor changes to information in Chapter 15.

The COL information items have been addressed, and there are no associated ITAAC with this chapter.

A couple of interesting areas that, just because there is a limited number for

Chapter 15, deal with radiological consequence analysis in response to a staff RAI regarding information for dose calculations to the technical support center.

We completed some detailed design to provide these results and demonstrated that we met the comparable to the control room requirement for GDC 19 for total dose 5 gram.

We also responded to another RAI that dealt with a question about in two instances for site specific chi over Q that were not bounded by the ABWR DCD information that was provided. So we re-performed control room dose calculations for those particular instances using the information also provided in the DCD for accident release information, and determined that in all cases that we met the acceptance criteria for GDC 19, and all the RAIs have been responded to, largely clean-up information, in Chapter 15, and confirmatory evidence have been included for Revision 4.

That is largely it. Are there any questions?

CHAIRMAN ABDEL-KHALIK: Any questions for STP on Chapter 15? Okay, we will go to the staff then.

MR. MUNIZ: Okay. My name is Adrian Muniz. I will be presenting the Chapter 15 presentation, transient and accident analysis. Here with me, I have Jay Lee who is going to be supporting the closure of the two open items that were considered to be technical open items, but we also have other members of the staff in the audience, should you have any other questions on this presentation.

The closure of open items is going to be the main focus of the presentation, and they were discussed by STP in their presentation as well.

We have two -- well, actually, four open items, two of which were considered to be technical open items. The first open item we are going to be discussing right now is the -- It was found that the site specific chi over Q values exceeded the values in the DCD for two instances: four to 30-day turbine building release and out to 30-day reactor building release.

The evaluation of the site specific chi over Q values can be found in Section 2.3S.4 of the staff's SER. However, in Chapter 15 we evaluated the information provided by the applicant in regard to the control room radiological consequence analyses for these two instances following a design basis accident using the site specific control room chi over Q values.

For those two instances, the staff found that the dose acceptance criteria are specified in SRP Section 15.0.3 was met. Next slide.

With regard to the Technical Support Center open item, that issued in Chapter 13, RAI 13.03-73 requesting the applicant to provide the TSC radiological consequence analyses for the design basis accident in order to demonstrate that it meets the acceptance criterion of 5 rem TEDE specified in SRP 15.0.3.

The results showed that they are well within the dose criterion of SRP 15.0.3, and also the staff audited the Westinghouse dose calculations and related assumptions for the TSC radiological habitability analyses.

Staff found these calculations were performed in accordance with SRP 15.0.3, and the guidance provided in Reg Guide 1.183.

In conclusion, we basically closed all

the open items. There were no ACRS action items related to this chapter, and the staff still has to confirm. Even though they were incorporated in Rev. 4, we still need to confirm that the changes were made to the FSAR.

That concludes our presentation, but should you have any questions, we are here to take them.

CHAIRMAN ABDEL-KHALIK: Are there any questions for the staff on Chapter 15? Thank you very much.

At this time, we will open the phone line and see if there are any members of the public who would like to make a statement. Okay, the phone line is open. Are there any members of the public who wish to make a statement or present some information to the Subcommittee? No? Okay.

Are there any members of the public here in this room who wish to make a presentation to the Subcommittee? Again, the answer is no.

So at this time I would just like to briefly go around the table and see if there are additional issues or questions that members of the Subcommittee would like to bring up. Jack?

MEMBER SIEBER: I am satisfied that the questions under review today are appropriately answered by the applicant and the staff, and even though there are a couple of items the staff continues to need to close out, pending their closure I will be satisfied.

CHAIRMAN ABDEL-KHALIK: Thank you, Jack. Dennis?

MEMBER BLEY: I thought they were good presentations today, very helpful to me, and nothing additional.

CHAIRMAN ABDEL-KHALIK: Thank you. Joy?

MEMBER REMPE: I concur. I have no additional comments.

CHAIRMAN ABDEL-KHALIK: John?

MEMBER STETKAR: Nothing. Thanks.

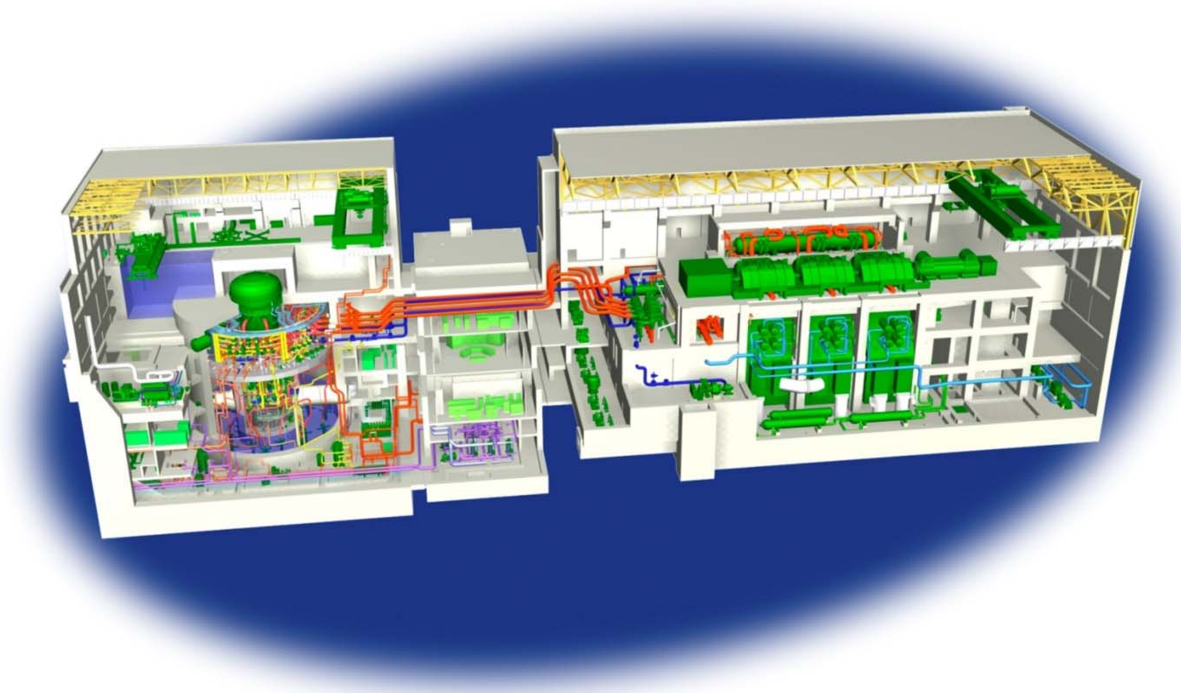
CHAIRMAN ABDEL-KHALIK: Okay. Well, on behalf of the Subcommittee, I would like to thank both the applicant and the staff for very informative presentations. Thank you very much.

The meeting is adjourned.

(Whereupon, the foregoing matter went off the record at 11:30 a.m.)

South Texas Project Units 3 & 4

Presentation to ACRS ABWR Subcommittee:
Chapter 2 Site Characteristics



Agenda

- Introduction
- Attendees
- Summary and Contents
  - Departures
  - COL License Information Items
  - Items of Interest
- ITAAC

Items of Interest

- Main Cooling Reservoir (MCR) Embankment Breach
- Wave Generation during MCR Breach
- Probable Maximum Storm Surge (ADCIRC)
- Action Items:
  - Groundwater Levels
  - Extreme Winds (Tropical Storm History)
  - Extreme Winds (Region II versus Region I)
  - Watertight Truck Door
  - Waterproof Membrane for Building Foundations
  - Turbine Missile Damage Probabilities

Attendees

Scott Head	Manager, Regulatory Affairs, STP 3&4
Dave Dujka	Design Engineering Supervisor, STP 3&4
Bill Stillwell	PRA Supervisor, STP 3&4
Coley Chappell	Regulatory Affairs, STP 3&4
Dick Bense	Regulatory Affairs, STP 3&4
Bob Hooks	Sargent & Lundy
Paul Jensen	PBS&J
Randy Graham	PBS&J
Bob Bailey	Exponent Engineering and Scientific Consulting
Craig Swanner	MPR (TANE)
Steve Frantz	Morgan, Lewis & Bockius
Harry Moate	Bechtel Power Corporation
Altheia Wyche	Bechtel Power Corporation

Attendees (continued)

Mike Brooks	Bechtel Power Corporation
Yigen Lin	Bechtel Power Corporation
Kit Ng	Bechtel Power Corporation
Stewart Taylor	Bechtel Power Corporation
Hillol Guha	Bechtel Power Corporation
Chris Fuller	WLA
Guy Winebrenner	MACTEC

Chapter 2 Site Description – Summary

South Texas Project site is located near the Gulf of Mexico:

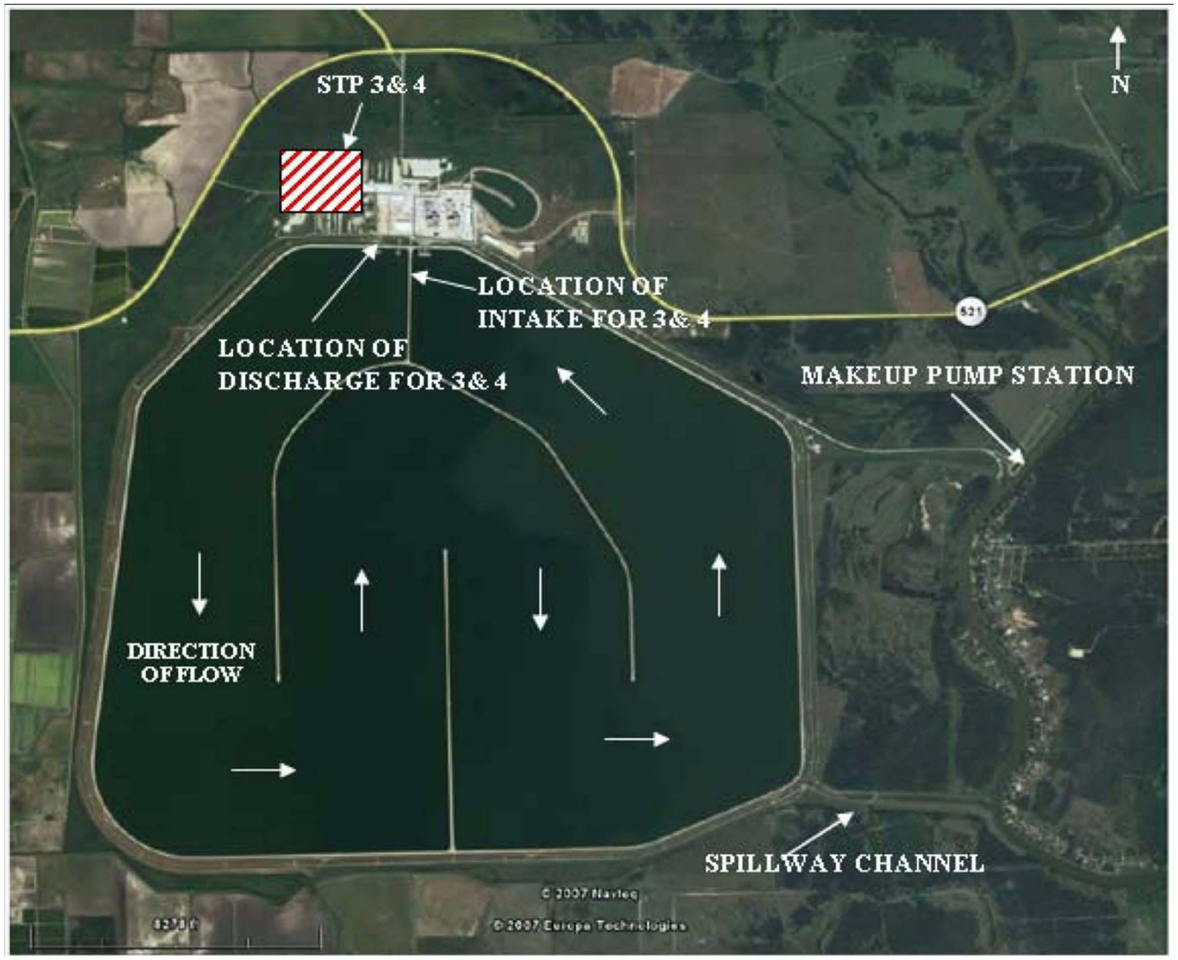
- Large site, 12,200 acres
- Main Cooling Reservoir sized for four units, 7000 acres
- Infrastructure in place
  - ✓ Road and barge access
  - ✓ Transmission corridor
- Low population density nearby
- Existing State, County and Site Emergency Plans
- Strong community support

Chapter 2 – Site Description (Continued)

South Texas Project Site:

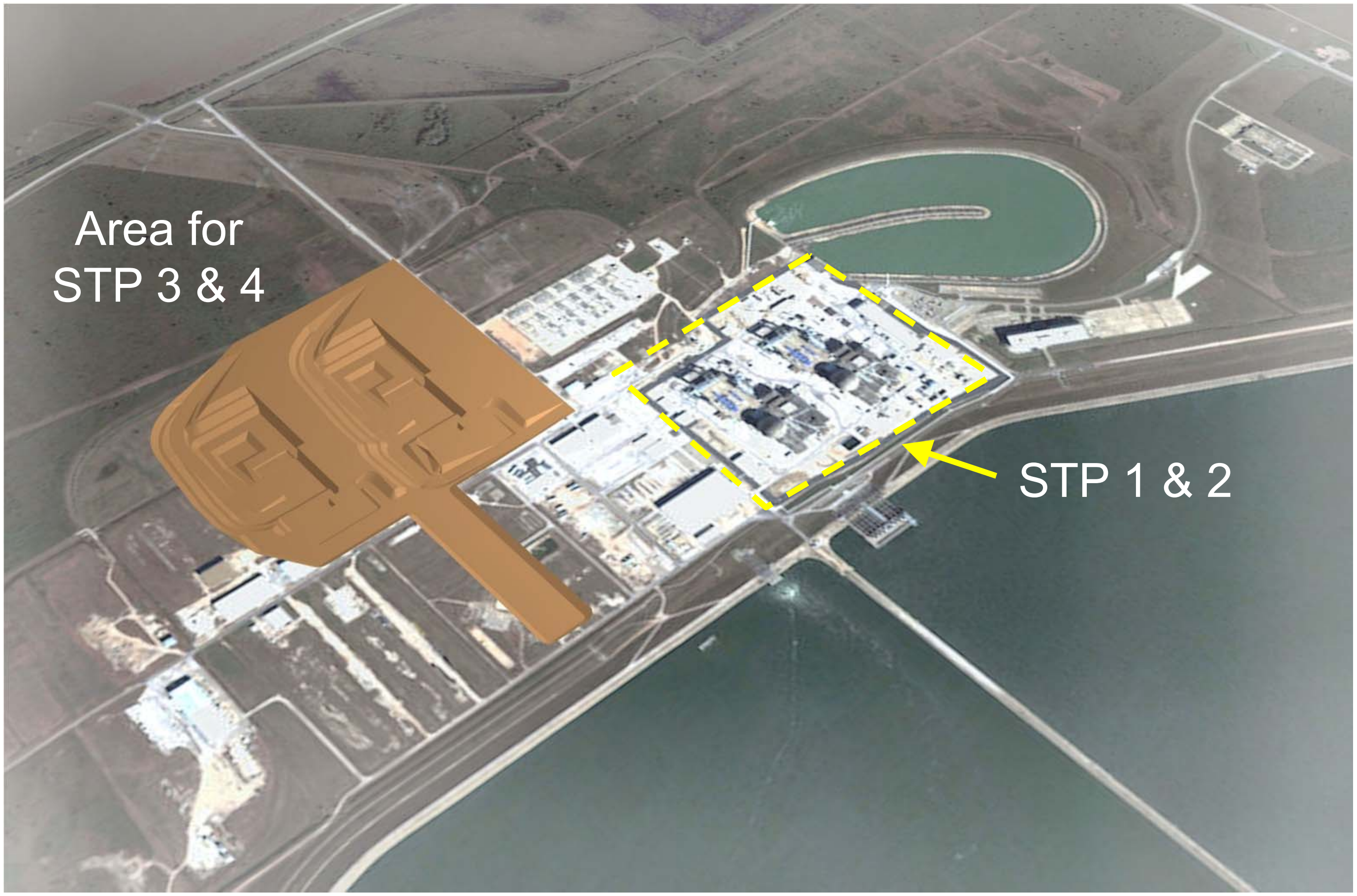
Chapter 2 – Site Description (Continued)

Site layout showing Main Cooling Reservoir (MCR) and locations of STP Units 1 & 2 and STP Units 3 & 4:



Chapter 2 – Site Description (Continued)

Site layout showing Main Cooling Reservoir (MCR) and locations of STP Units 1 & 2 and STP Units 3 & 4



Chapter 2 – Site Characteristics

2.1 Limits on Site Characteristics established by ABWR Standard Plant Acceptance Criteria in each of the following areas:

1. Geography and Demography
2. Nearby Industrial, Transportation and Military Facilities
3. Meteorology
4. Hydrology Engineering
5. Geology, Seismology and Geotechnical Engineering

2.2 Requirements for ABWR Site Acceptability:

1. Design Basis Events
2. Severe Accidents

2.3 COL License Information: Nearby Industrial, Transportation and Military Facilities

2.4 COL License Information: Hydrology Engineering

2.5 COL License Information: Geology, Seismology and Geotechnical Engineering

Chapter 2 – Site Characteristics (continued)

- **ABWR Standard Plant Site Design Characteristics**
- STP 3&4 site parameters are bounded by the ABWR DCD Site Characteristics **EXCEPT** for the following (STP DEP T1 5.0-1):
  - Maximum Flood (or Tsunami) Level
    - DCD limit: 30.5 cm (1.0 ft) below grade
    - STP site: 182.9 cm (6.0 ft) above nominal plant grade (34 ft)
  - Precipitation (for Roof Design): Maximum rainfall rate
    - DCD limit is 49.3 cm/hour and 15.7 cm/5 min
    - STP site is 50.3 cm/hour and 16.3 cm/5 min

Chapter 2 – Summary (Continued)

STP 3&4 site characteristics NOT bounded (continued)

- Ambient Design Temperatures:
  Maximum wet bulb (coincident) and (non-coincident)
- Soil Properties: Minimum Shear Wave Velocity
  - Shear wave velocities at multiple depths below the foundations of seismic Category I structures are less than minimum ABWR DCD limit of 305 m/s (1000 ft/sec).
  - The deviations from the minimum shear wave velocity requirement are justified by site-specific soil structure interaction analysis (FSAR Sections 3.7 and 3.8).

Chapter 2 – Content

Section 2.2 Requirements for ABWR Site Acceptability:

- 2.2.1 Design Basis Events
  - Site is acceptable because all Site Design characteristics fall within envelope of ABWR Standard Plant Site Design parameters except where noted and justified.
  - RG 1.206 specifies internal and external design basis events are accidents that have a probability $\geq 10^{-7}$ per year with potential consequences that 10 CFR Part 100 limits could be exceeded.
- 2.2.2 Severe Accidents
  - Site-specific accident consequence analysis demonstrated that DCD acceptance criteria met.
    - MACCS2 code used in accordance with NUREG/CR 6613 in lieu of outdated CRAC2 (STD DEP 2.2-5).

Chapter 2 – Content (Continued)

- Potential Hazards from nearby Industrial, Transportation, and Military Facilities
  - Analyses included STP 1&2, Natural Gas & Chemical Pipelines, Highways, Airports, Air and Water Routes, Chemical Storage, etc.
  - Only STP 3&4 site aircraft hazard exceeded ABWR DCD limit $<10^{-7}$ per year - estimated at 1.09×10^{-7} (FSAR Subsection 2.2S.2.7.2, RAI 03.05.01.06-1),

Chapter 2 – COL Information Items

Section 2.3 COL License Information Items – all items addressed by supplemental information in the FSAR Sections 2.3S, 2.4S and 2.5S:

- 2.1 Demonstrate non-seismic site characteristics do not exceed capability of ABWR design.
- 2.2 Demonstrate seismic site characteristics do not exceed capability of ABWR design (SSE ground motion and bearing capacity)
- 2.3 Provide site location information including political subdivisions, natural and man-made features, population, highways, railways, waterways, and other significant features.
- 2.4 Provide information related to activities that may be permitted within the designated exclusion area.
- 2.5 Provide population data for site environs.
- 2.6 Provide Information about industrial, military, and transportation facilities and routes to determine magnitude of potential external hazards.
- 2.7 Describe potential accident situations in site vicinity and how potential accidents are accommodated in the design.

Chapter 2 – COL Information Items (Continued)

2.8	Evaluate effects of external impact hazards, such as aviation or nearby explosions.
2.9	Describe local meteorology.
2.10	Describe onsite meteorological measurements program.
2.11	Provide site-specific short-term dispersion estimates and ensure release concentrations are not exceeded for the site.
2.12	Provide annual average atmospheric dispersion values for reactive releases.
2.13	Describe all major hydrologic features in the vicinity and provide elevations of site and all safety-related, structures, exterior accesses, equipment, and systems.
2.14	Describe historical flooding and potential flooding at the site, including flood history, flood design considerations, and effects of local intense precipitation.

Chapter 2 – COL Information Items (Continued)

2.15 Describe design-basis flooding and flood protection required for safety-related SSC.

2.16 Demonstrate that safety-related SSC and the water supply are not affected by ice flooding or blockage.

2.17 Describe hydraulic design of MCR and channels used to transport and impound the cooling water.

2.18 Provide information related to channel diversion for the STP site.

2.19 Provide flooding protection requirements.

2.20 Describe natural events that may limit cooling water supply and measures to ensure adequate water supply exists to operate and shut down the plant.

2.21 Describe ability of surface water environment to disperse, dilute, or concentrate accidental releases and describe effects of releases on existing and known future uses of surface water resources.

Chapter 2 – COL Information Items (Continued)

2.22 Describe flood protection measures for safety-related SSC and provisions that ensure adequate water supply to shut down and cool the reactor.

2.23 Provide regional and site physiography, geomorphology, stratigraphy, lithology, and tectonics.

2.24 Provide geological, seismological, and geotechnical data, including a comparison of the site-specific to design requirements for ground motion response spectra.

2.25 Provide site-specific geological data used to evaluate surface faulting.

2.26 Describe properties and stability of site-specific soils and rocks under both static and dynamic conditions including the vibratory ground motions associated with the STP site-specific SSE.

2.27 Describe site conditions and geologic features including topographical features and location of various Seismic Category I structures and appurtenances (pipelines, channels, etc.) with respect to the source of normal and emergency cooling water.

Chapter 2 – COL Information Items (Continued)

2.28 Provide type, quantity, extent, and purpose of the field explorations including borings and test pits and results of geophysical surveys and records of field permeability tests and other special field tests.

2.29 Describe number and type of laboratory tests to assess the site and the location of samples taken. Provide results of laboratory tests on disturbed and undisturbed soil.

2.30 Describe engineering classifications and descriptions of the soils supporting the foundations and history of soil deposition and erosion, past and present groundwater levels, other preloading influences, and any soil characteristics that may present a hazard to plant safety.

2.31 Describe excavation and backfilling required for construction and site-specific soil properties below foundations. Discuss excavating and dewatering methods, excavation depths, field inspection and testing of excavations, protection of foundation excavations from deterioration during construction. Provide sources, quantities, and static and dynamic engineering properties of borrowed materials.

Chapter 2 – COL Information Items (Continued)

2.32 Provide analysis of the groundwater, including effects on site geotechnical properties such as total and effective unit weights, cohesion and angle of internal friction, and dynamic soil properties.

2.33 Provide liquefaction potential under and around all Seismic Cat I structures, including buried pipelines and electrical ducts. Justify selection of soil properties used in liquefaction potential evaluation (e.g., laboratory tests, field tests, and published data) and the magnitude and duration of the earthquake, and the number of earthquake cycles is provided.

2.34 Provide dynamic soil properties and shear modulus and material damping as a function of shear strain and determine strain-dependent properties for determination of the ground motion response spectra (site-specific SSE)

2.35 Provide minimum static bearing capacity at the foundation level of the Reactor and Control Buildings.

2.36 Provide site-specific evaluation of static and dynamic lateral earth pressures and hydrostatic groundwater pressures acting on safety-related facilities.

2.37 Provide soil properties used for the seismic analysis of Seismic Category I buried pipes and electrical conduit.

Chapter 2 – COL Information Items (Continued)

2.38 Provide static and dynamic stability and the foundation rebound, settlement, differential settlement, and bearing capacity. Assumptions must be confirmed by as-built data to confirm as-built data are bounded by the assumptions. (COM 2.3-1)

2.39 Describe instrumentation and monitoring programs for surveillance of the performance of the safety-related foundations.

2.40 Provide information on static and dynamic stability of all soil and rock slopes at the STP site whose failure could adversely affect plant safety.

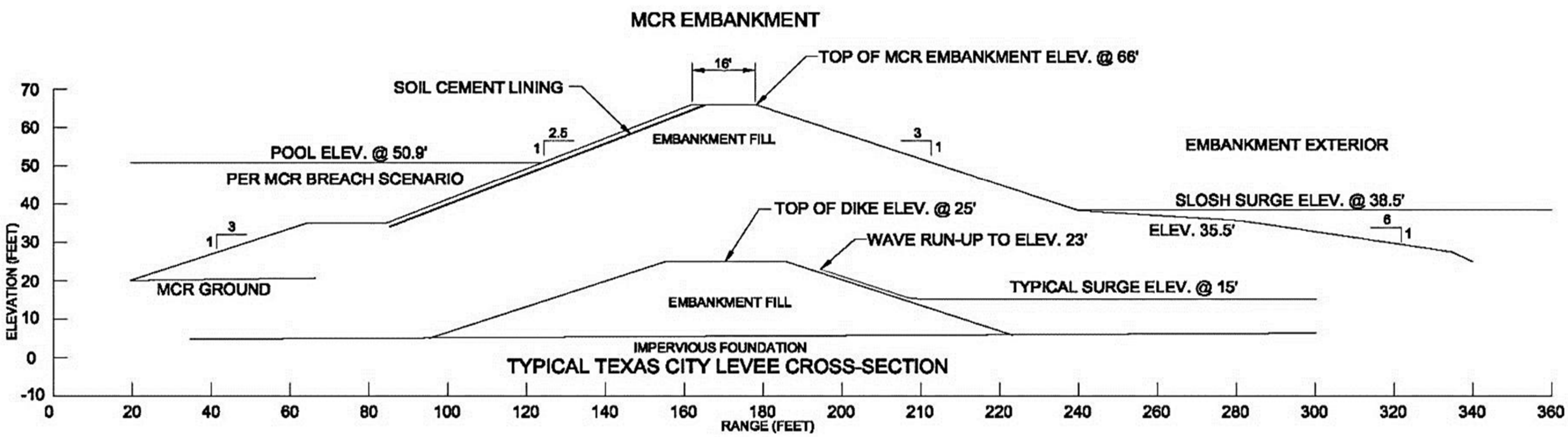
2.41 Describe embankments or dams that impound water required for safe operation. (Not Applicable)

2.42 Demonstrate compliance with acceptance criteria, data input and the analyses for determining site acceptability for severe accidents.

Main Cooling Reservoir (MCR) Embankment Breach

MCR formed by 12.4-mile-long embankment constructed above natural ground surface enclosing a 7000 acre reservoir . Minimum embankment crest elevation is 65.8 feet MSL. Normal max operating level is 49 feet MSL. Toe of embankment is approximately 29 feet MSL at the north end.

MCR Embankment Breach (continued)



MCR Embankment Cross Section with superimposed cross section of typical Texas City Hurricane Storm Levee

MCR Embankment Breach (continued)

MCR Breach is the Design Basis Flood.

MCR Breach causing a DBF is a highly improbable event because:

- Overtopping not possible due to very large freeboard.
- Seismic-induced failure not plausible based on design and low potential for significant seismic activity in site vicinity.
- Failure along most of the 12.4 mile perimeter has no impact on site structures.
- Piping caused by an uncontrolled water level build-up within the embankment is considered highly improbable due to engineered design (independent relief wells) and existing operation, maintenance, and inspection requirements.

Piping is the postulated failure mechanism for analysis of Design Basis Flood.

MCR Embankment Breach (continued)

Flood level caused by MCR breach is determined by the following:

- Location of the breach relative to the safety related structures.
- Speed at which the breach develops.
- Size of the breach at the time of peak flow.

Breach locations adjacent to STP SSC (east and west) conservatively selected.

Breach width and speed predicted using several methods and most conservative predictions used for each (RAI 02.04.04-14).

Breach parameters estimated using two different empirical equations from Dam Safety Office of the US Bureau of Reclamation. Most conservative breach width (Froehlich's equations) combined with most conservative breach speed (MacDonald Landgridge equations) to determine input size and speed of breach for FLDWAV model.

Independent confirmatory analysis using NWS BREACH model.

MCR Embankment Breach (continued)

Results of the Breach Analysis:

- ❑ MCR Breach peak water level of 38.8 feet MSL occurred at the Unit 4 Ultimate Heat Sink structure from the west breach scenario.
- ❑ Design Basis Flood was conservatively established at 40 feet MSL.
- ❑ Estimated duration of inundation (above 34 feet) at safety-related SSCs is 20.5 hours.

MCR Embankment Breach (continued)

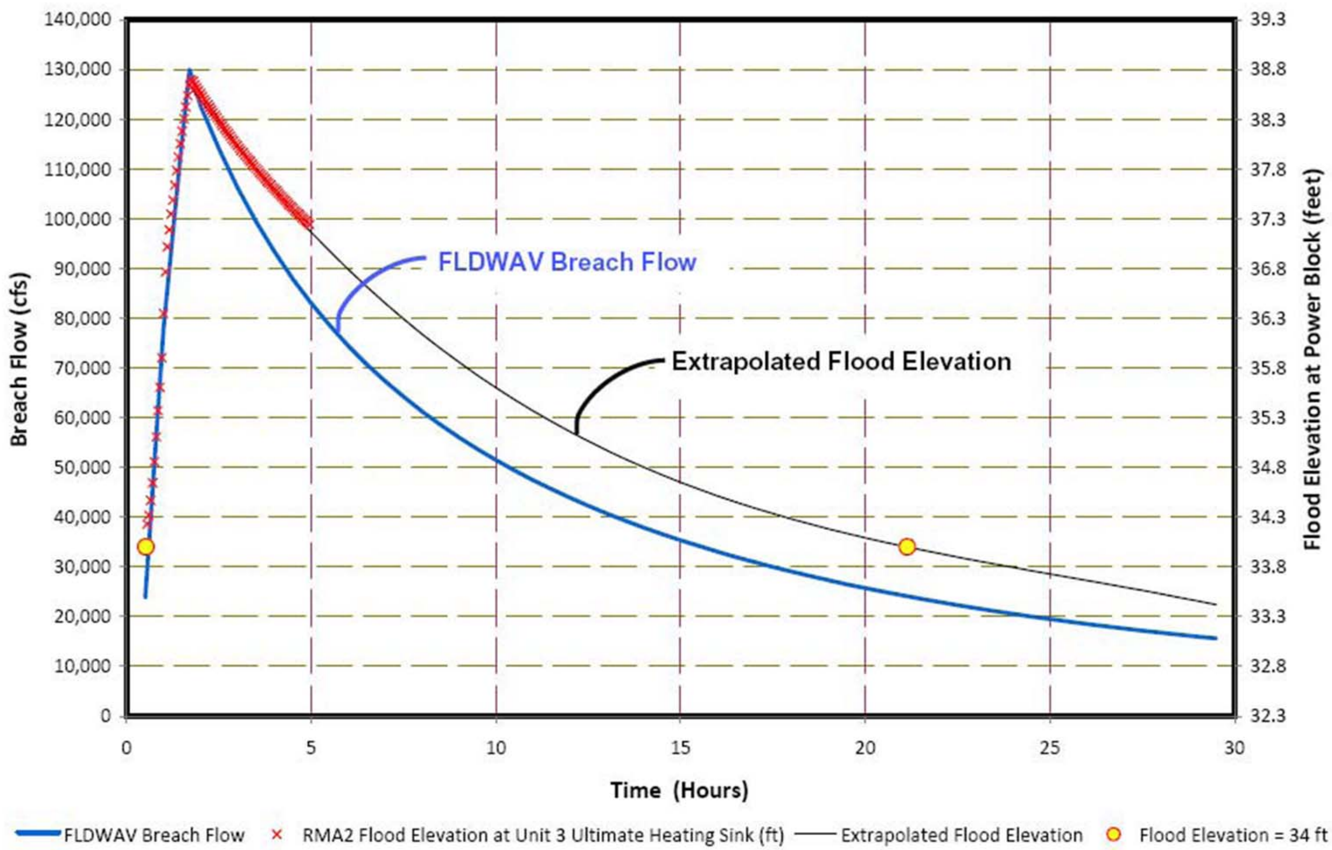


Figure 2.4S.4-21j Breach Outflow and Flood Elevation to Determine Duration of Inundation at Safety-Related SSCs (RAI 02.04.04-14)

MCR Embankment Breach (continued)

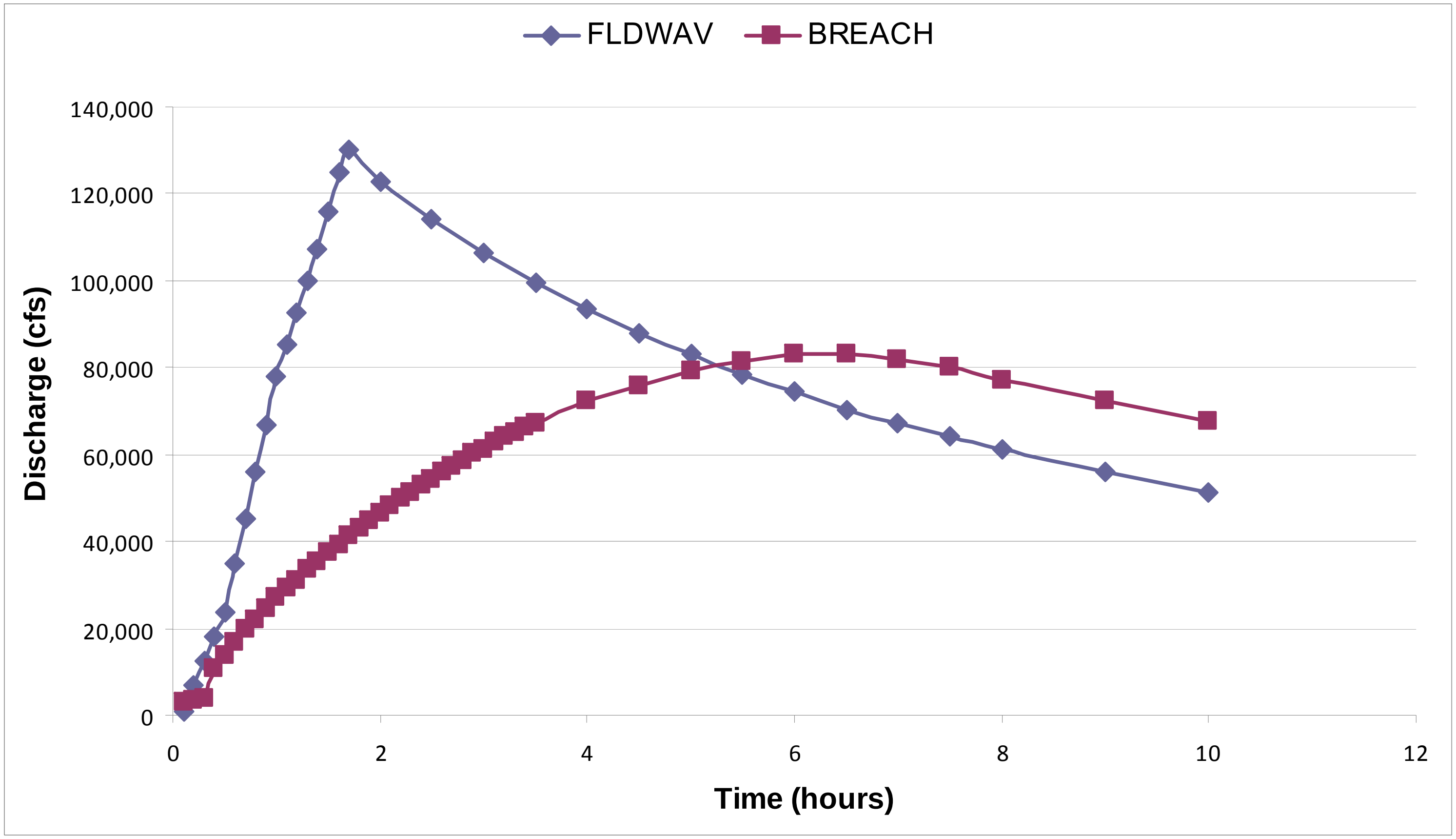


Figure 2.4S.4-13c Comparison of BREACH and FLDWAV Outflow Hydrographs (RAI 02.04.04-14

Wind-Wave Contribution to Hydrodynamic Loading during MCR Breach (Action Item 61)

RAI 03.04.02-11 requested STP to "Evaluate the effect of water waves that may propagate on the water surface of the governing flood event."

Prior to RAI 03.04.02-11, STP concluded **"Coincidental hydrodynamic wind wave forces were not considered with the conservative Main Cooling Reservoir (MCR) breach flood level because of the short duration of this flood."** (RAI 03.04.02-11)

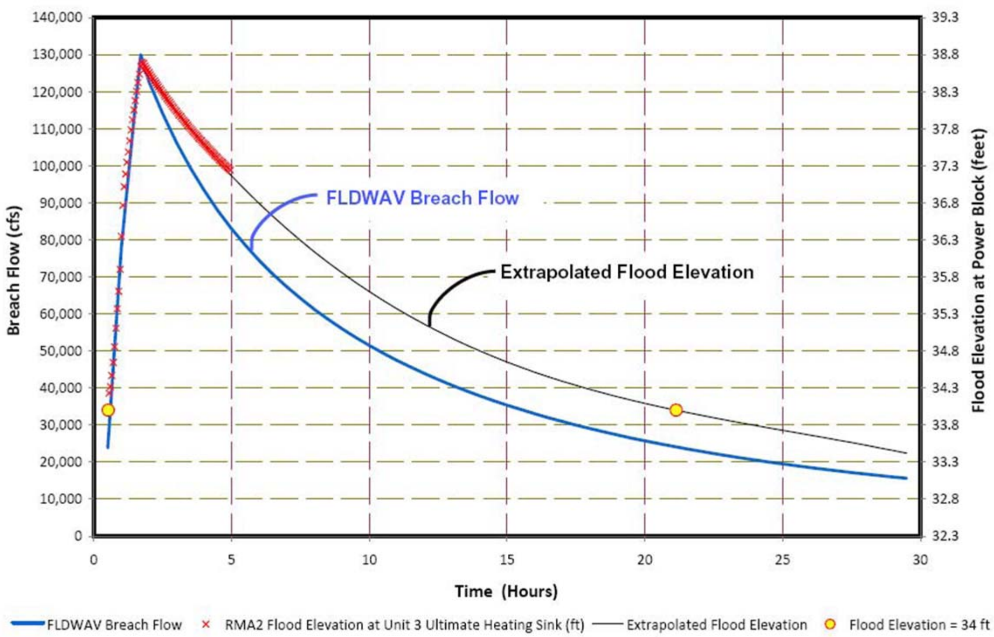


Figure 2.4S.4-21j Breach Outflow and Flood Elevation to Determine Duration of Inundation at Safety-Related SSCs (RAI 02.04.04-14)

Wind-Wave Contribution to Hydrodynamic Loading during MCR Breach (continued)

Loading due to wind generated waves coincident with peak MCR Breach flood level was calculated in response to RAI 03.04.02-11.

- Two-year fastest mile wind speed of 50 mph applied coincident with the max MCR breach flood level to determine the hydrodynamic load due to the flood level plus wind generated waves.
- Methodology from Coastal Engineering Manual.

Max wave height predicted to be 3.1 feet above max flood level .
Including wind wave effect:

- Maximum water level near Unit-4 UHS = 38.8 + 3.1 = 41.9 feet.
- Maximum water level near Unit-4 power block = 38.2 + 3.1 = 41.3 feet.

UHS and RSW Pump Houses are watertight to 50 feet MSL.

Power block safety-related structures are watertight to 41.0 feet MSL. One foot threshold above the design basis flood level of 40 feet MSL.

Splash flooding above the 41-foot elevation due to wave run-up elevation of 41.3 feet MSL will be minor and addressed by normal housekeeping.

Wind-Wave Contribution to Hydrodynamic Loading during MCR Breach (continued)

External walls of the structures shall be capable of resisting the following loads:

- Hydrostatic force considering a conservatively established design basis flood level of 40’-0” MSL.
- Hydrodynamic drag force of 44 psf due to flood water flow, applicable to above grade portion.
- Impact due to a 500 lbs floating debris traveling at 4.72 ft/sec.
- Wind generated wave forces equivalent to 3.1 ft above nominal flood level.

Probable Maximum Storm Surge

- Wide variation between results of different computer models used to calculate Probable Maximum Storm Surge (PMSS) resulting from the Probable Maximum Hurricane (PMH):
  - Storm Surge Analysis modeled with SURGE and HEC-RAS
  - Storm Surge Analysis modeled with various versions of Sea, Lake, and Overland Surges from Hurricanes (SLOSH)
  - Storm Surge Analysis modeled with Advanced Circulation Model (ADCIRC)
- GDC-2 is met no matter which model is used to predict PMSS because all models predict PMSS is less than the 40 ft MSL design basis flood level.

Probable Maximum Storm Surge (continued)

PMSS and Wave Run-up Analysis Results from RAIs 02.04.05-10 &11

Model	Predicted Max Surge (Gulf Coast)	Predicted Max Surge (STP Site)	PMH Max Level inc Wave Run-up
SURGE + HEC-RAS Model (FSAR 2.4S.5.2.3)	20.04 feet MSL	24.29 feet MSL	Less than plant grade.
Extrapolation from SLOSH Display CDI (Version 2007) (FSAR 2.4S.5.2.4)	25.98 feet MSL	31.1 feet MSL	Less than plant grade.
NRC Confirmatory Analysis (SLOSH Model Version 2009)	Not evaluated	Approximately 37 to 38 feet MSL	Approximately 39 to 40 feet MSL
SLOSH Model (April 2010) PMH with Decaying Intensity	Not evaluated	36.16 feet MSL	38.59 feet MSL
ADCIRC Model (Version 49 with Texas Grid 13) PMH with Decaying Intensity Inland (RAI 02.04.05-10 results)	21.5 feet MSL	26.5 feet MSL	26.5 feet MSL
ADCIRC Model (Version 49 with Texas Grid 13) PMH with Decaying Intensity Inland, using NWS 48 wind profile (RAI 02.04.05-11 results)	Not docketed	29.3 feet MSL	**29.3 feet MSL**

Probable Maximum Storm Surge (Continued)

- PMSS and wave run-up analysis results:
  - The response to RAI 02.04.05-10 and presentations during a site audit conducted by NRC staff provided detailed justification for the conclusion that the ADCIRC model provided the most reliable PMSS predictions for the STP site.
  - ADCIRC predicted the PMSS for STP site, including wave run-up, is 26.5 feet MSL. Additional ADCIRC modeling using very conservative assumptions predicted PMSS for the site is 29.3 feet MSL. These results are below the 34 feet MSL nominal site grade for STP 3 & 4.
  - PMSS with ADCIRC results are provided in the responses to RAI 02.04-05-10 and 11

Probable Maximum Storm Surge (Continued)

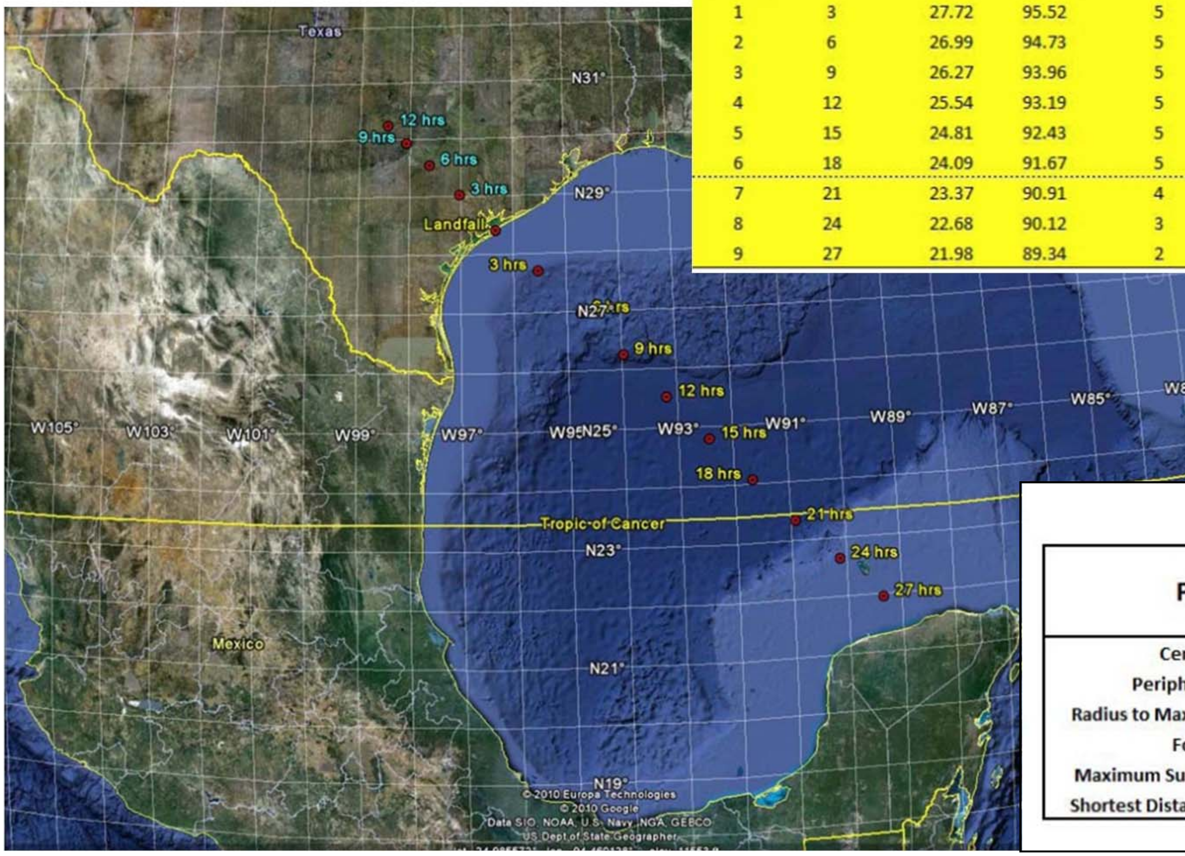
STPNOC evaluation concluded ADCIRC is best suited for STP site vicinity based on the following:

- Designed for high simulation accuracy in complex shoreline and bathymetry.
- FEMA-certified for storm surge analyses and Flood Insurance Rate Maps (FIRMs) in STP vicinity.
- Standard coastal model used by U.S. Army Corps of Engineers, National Oceanic and Atmospheric Administration, the Naval Research Laboratory, and the Interagency Performance Evaluation Task Force (IPET) study.
- Digital elevation maps for STP vicinity based on LiDAR data with very high grid resolution (50 m x 50 m) for improved ability to model surface friction.
- Accurately models topographic features (*e.g.* highways) that block or accelerate storm surge flooding.

Probable Maximum Storm Surge (Continued)

Figure 2.4S.5-9:
PMH used in conjunction with ADCIRC model

Center of Eye	Time to Landfall (hrs)	Coordinates: Latitude (°N)	Coordinates: Longitude (°W)	Storm Features: Category (SSI)	Storm Features: Central Pressure (Mb)	Storm Features: Radius to Max. Winds (miles)	Distance Between Points (nm)	Distance Between Points (miles)	Forward Speed (mph)	Forward Speed (knots)
D	-12	30.26	98.43	1	994	10	26	30	10	8.7
C	-9	29.95	98.06	2	979	13	34	39	13	11.3
B	-6	29.56	97.60	3	964	16	44	51	17	14.7
A	-3	29.04	97.01	4	944	20	52	60	20	17.3
Landfall	0	28.42	96.32	5	887	24	60	69	23	20
1	3	27.72	95.52	5	887	24	60	69	23	20
2	6	26.99	94.73	5	887	24	60	69	23	20
3	9	26.27	93.96	5	887	24	60	69	23	20
4	12	25.54	93.19	5	887	24	60	69	23	20
5	15	24.81	92.43	5	887	24	60	69	23	20
6	18	24.09	91.67	5	887	24	60	69	23	20
7	21	23.37	90.91	4	944	20	60	69	23	20
8	24	22.68	90.12	3	964	16	60	69	23	20
9	27	21.98	89.34	2	979	13				

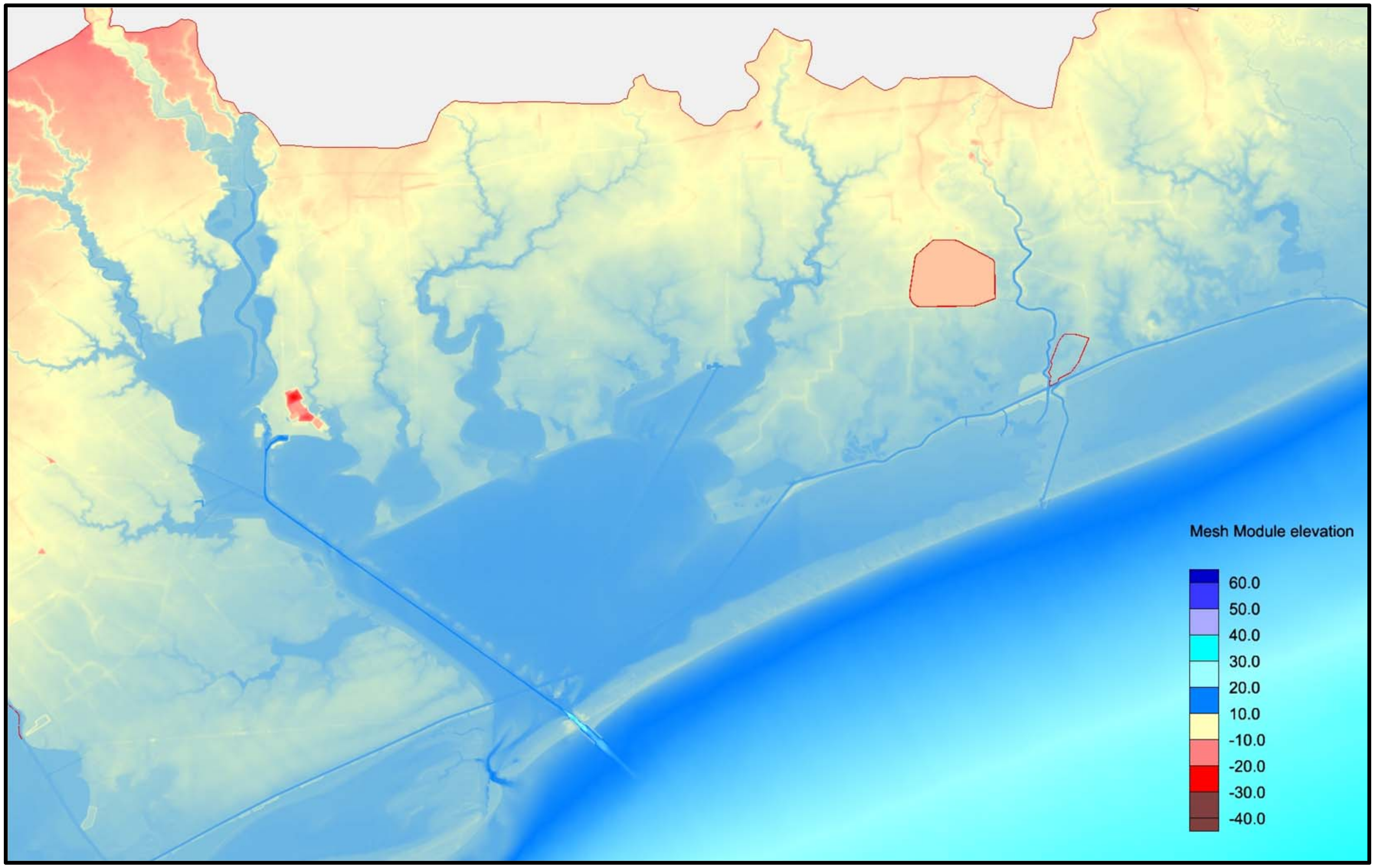


NORTHWEST

PMH Storm Features

Central Pressure:	887 Mb	(26.19 in. Hg)
Peripheral Pressure:	1020 Mb	(30.12 in. Hg)
Radius to Maximum Winds:	21 nm	(24 miles)
Forward Speed:	20 knots	(23 mph)
Maximum Sustained Wind:	160 knots	(184 mph)
Shortest Distance from site:	20.9 nm	(24 miles)

Probable Maximum Storm Surge (Continued)



STP Vicinity ADCIRC Model

Probable Maximum Storm Surge (Continued)

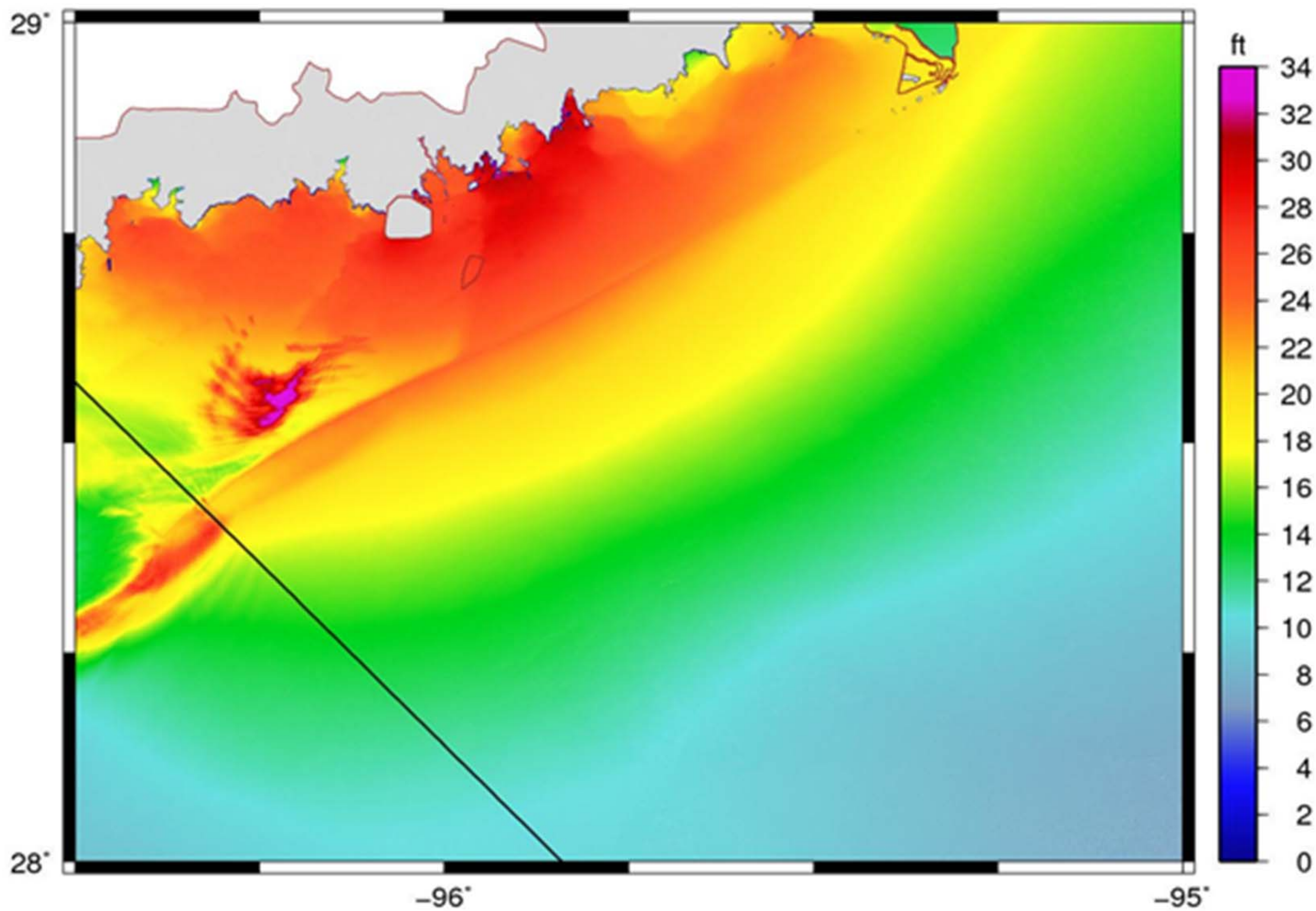
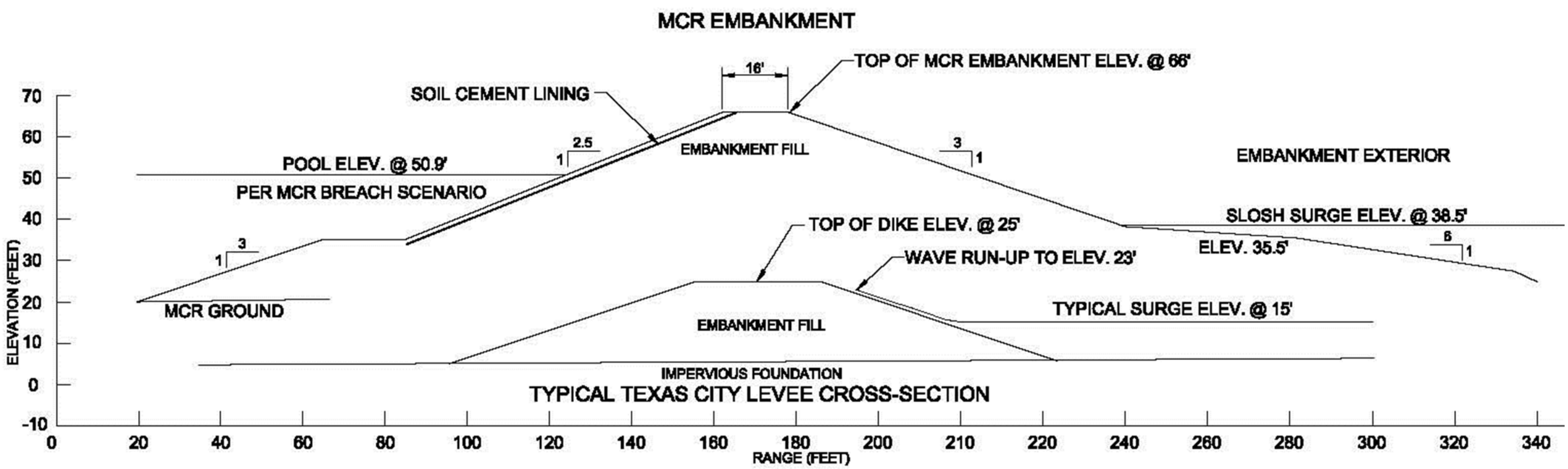


Figure 2.4S.5-10 PMSS Prediction based on the ADCIRC model

Probable Maximum Storm Surge (Continued)

- PMSS potential threat to MCR Embankment (RAIs XXXXX)
  - SLOSH models do exceed 34 ft. In “worst case” the flood level is ≥ 34 ft for < 80 minutes. No wind waves and only moderate current.
  - There is no threat to MCR Embankment.



MCR Embankment Cross Section with superimposed cross section of Texas City Hurricane Storm Levee

Groundwater Levels (Action Item 58)

Groundwater Level Limits and Nominal Groundwater Level

- Explain the various groundwater elevations referenced in different locations in the COLA, examples include 2 feet below grade, 6 feet, etc., what is the correct level and why the different descriptions?
- Groundwater levels
  - DCD Site Design Parameter is 61.0 cm (2 ft) below grade (32 ft MSL)
  - Highest observed groundwater level at the STP 3&4 power block is approximately 26 ft MSL (2.4S.12-7)
  - STP Design Groundwater level is 28 ft MSL (Table 2.0-2, Table 3.4-1)
- FSAR update will be necessary to clarify use of groundwater levels in design calculations.

Extreme Winds (Tropical Storm History) (Action Item 54)

Discuss 3-second gust for wind loading, hurricane winds, and provide 100 year history within 100 nm of STP:

- NOAA-CSC historical record of tropical cyclone tracks and intensities near STP from 1851 to the present identified eleven tropical cyclones with wind speeds that exceed a design-basis wind loading for STP 3&4 calculated in accordance with SEI/ASCE 7-02.
  - ASCE 7 design wind speeds are multiplied by wind load factors to correlate with Saffir-Simpson Hurricane Intensity Scale wind speeds.
  - ASCE 7 design winds for Gulf Coast region have been adjusted based on hurricane data.
  - ASCE 7 considers reduced intensity of hurricanes after landfall.
- Wind speeds identified during this review are bounded by 322 km/h (200 mph) maximum tornado wind speed site characteristic value and do not represent threat to the integrity of any STP SSCs.

Extreme Winds (Region II versus Region I) (Action Item 55)

Explain STP location in Region II vs. Region I as shown in RG 1.76, Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants, Revision 1.

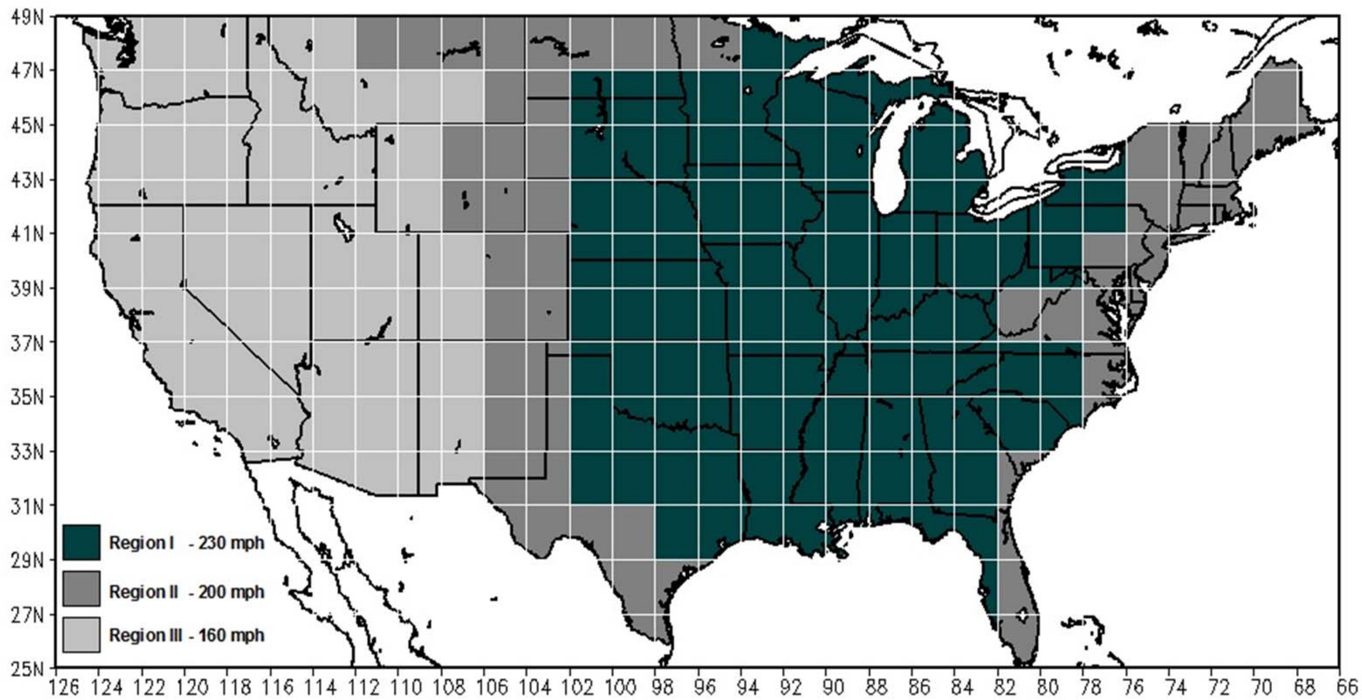


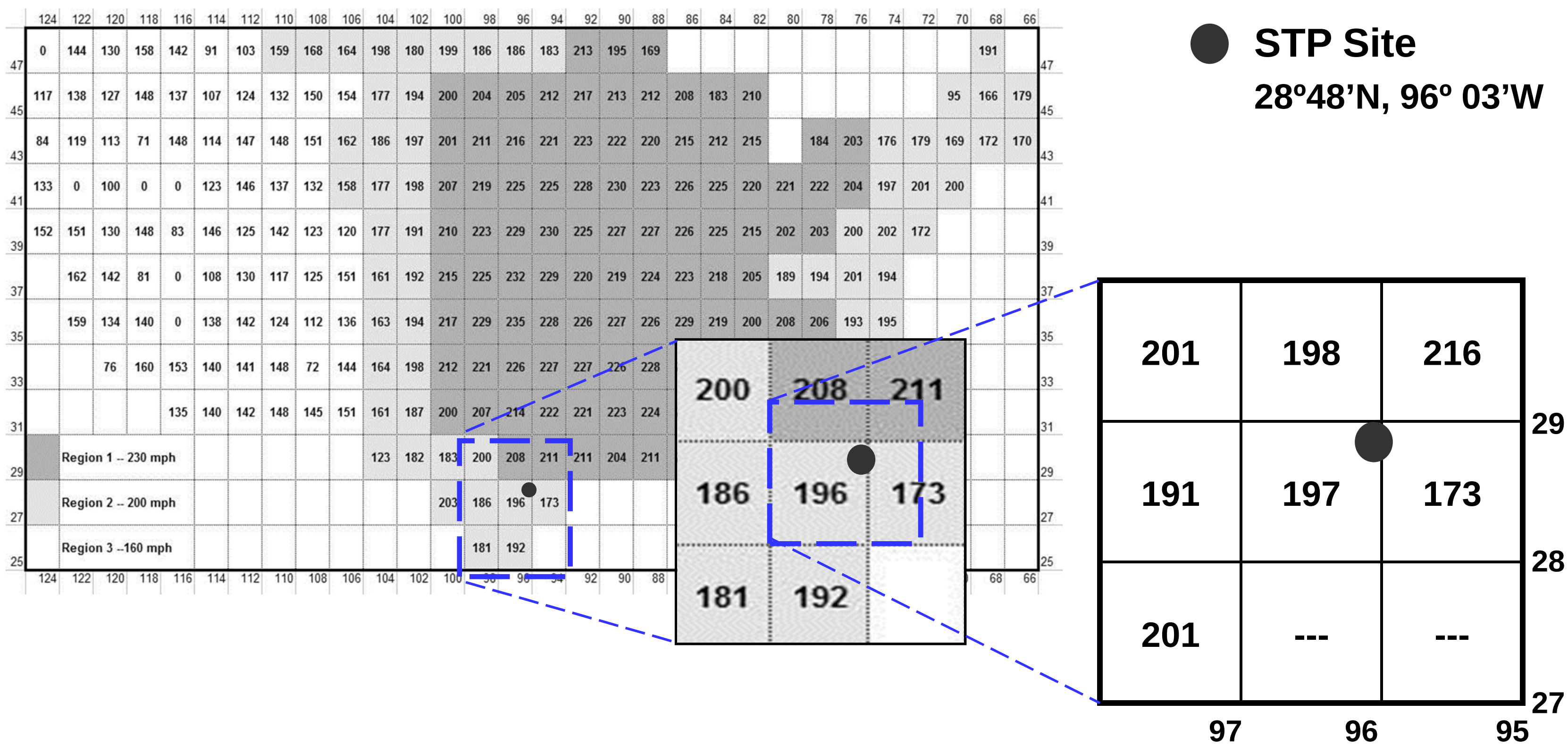
Figure 1. Tornado intensity regions for the contiguous United States for exceedance probabilities of 10^{-7} per year

Extreme Winds (Region II versus Region I) (continued)

- RG 1.76 regulatory position for design-basis tornado parameters: “Sites located near the general boundaries of adjoining regions may involve additional considerations.”
- Response to RAI 02.03.01-3 (ABR-AE-08000039, 5/29/08) provided an explanation of how information presented in NUREG/CR-4461 Revision 2 was used to select the RG 1.76 Region II design basis tornado characteristics for STP site.
- STP site is located about 28°48'N, 96°03'W, within a 2° box (SE corner 27°N, 96°W) in tornado intensity Region II as provided in Appendix A of NUREG/CR-4461.
- Appendix C to NUREG/CR-4461 presents detailed results of tornado analyses for 1° lat and long boxes. Placement of the STP site in Region II is consistent with NUREG/CR-4461 data.

Chapter 2 – Content (Continued)

- NUREG/CR-4461 Figure 8-3. Recommended Tornado Design Wind Speeds for the 10^{-7} yr $^{-1}$ Probability Level



Watertight Truck Door (Action Item 56)

Confirm that the large exterior truck access door (R/B) is watertight.

The exterior door of the R/B Large Equipment Access at EL 12300 (35') will be watertight or protected by an additional barrier that is watertight up to Elevation 41 feet.

While the specific details of this door are to be provided by the vendor, design is anticipated to include a watertight compression seal.

Waterproof Membrane for Foundations (Action Item 57)

Confirm levels of water-proofing of Reactor Service Water (RSW) pump house foundation:

FSAR Subsection 3H.6.6.4:

- The foundations for the UHS basin, cooling towers, and pump house consist of a reinforced concrete mat and a lean concrete mud mat supported on undisturbed soil.
- To prevent groundwater seepage through the common foundation or through the walls of the UHS basin and RSW pump house, a waterproofing membrane is applied to the exposed concrete surface of the mudmat and installed on the walls up to one foot below grade.
- The waterproof membrane will protect the walls from deleterious effects from groundwater.

Turbine Missile Damage Probabilities (Action Item 59)

Explain FSAR 3.5.1.1.1.3 description “conservative” as applied to the value 1E-02 per year per plant chosen for the product of strike (P2) and damage (P3) probabilities.

- This was applied in accordance with the requirements of SRP Section 3.5.1.3.
- For damage consequences to safety-related systems after a missile is generated, due to an unfavorably oriented turbine generator, Acceptance Criterion 1B of SRP Section 3.5.1.3 provides a conservative acceptable value of 1E-02 per year per plant for the product of missile strike probability P2 and damage probability P3.
- Refer to RAI 03.05.01.05-1, U7-C-STP-NRC-090096 Att. 7

ITAAC

- Site-specific ITAAC:
  - STP has established ITAAC for backfill, shear wave velocity, and settlement.
  - These ITAAC include specific tests, frequency, and standards.

Chapter 2

Questions and Comments

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Presentation to the ACRS Subcommittee

South Texas Units 3 and 4 COL Application Review

SER/OI Chapter 2
“Site Characteristics”

November 30, 2010

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

ACRS Subcommittee Presentation
SER/OI Chapter 2

Staff Review Team

- **Project Managers**
  - George Wunder
  - Tekia Govan
- **Technical Staff**
  - RSAC, Acting Chief, David Brown
  - RHEB, Chief, Richard Raione
  - RGS, Chief, Christopher Cook

Summary of Staff Review

- Geography and Demography
- Nearby Industrial, Transportation, and Military Facilities
- Meteorology
- Hydrology
- Geology, Seismology, and Geotechnical Engineering

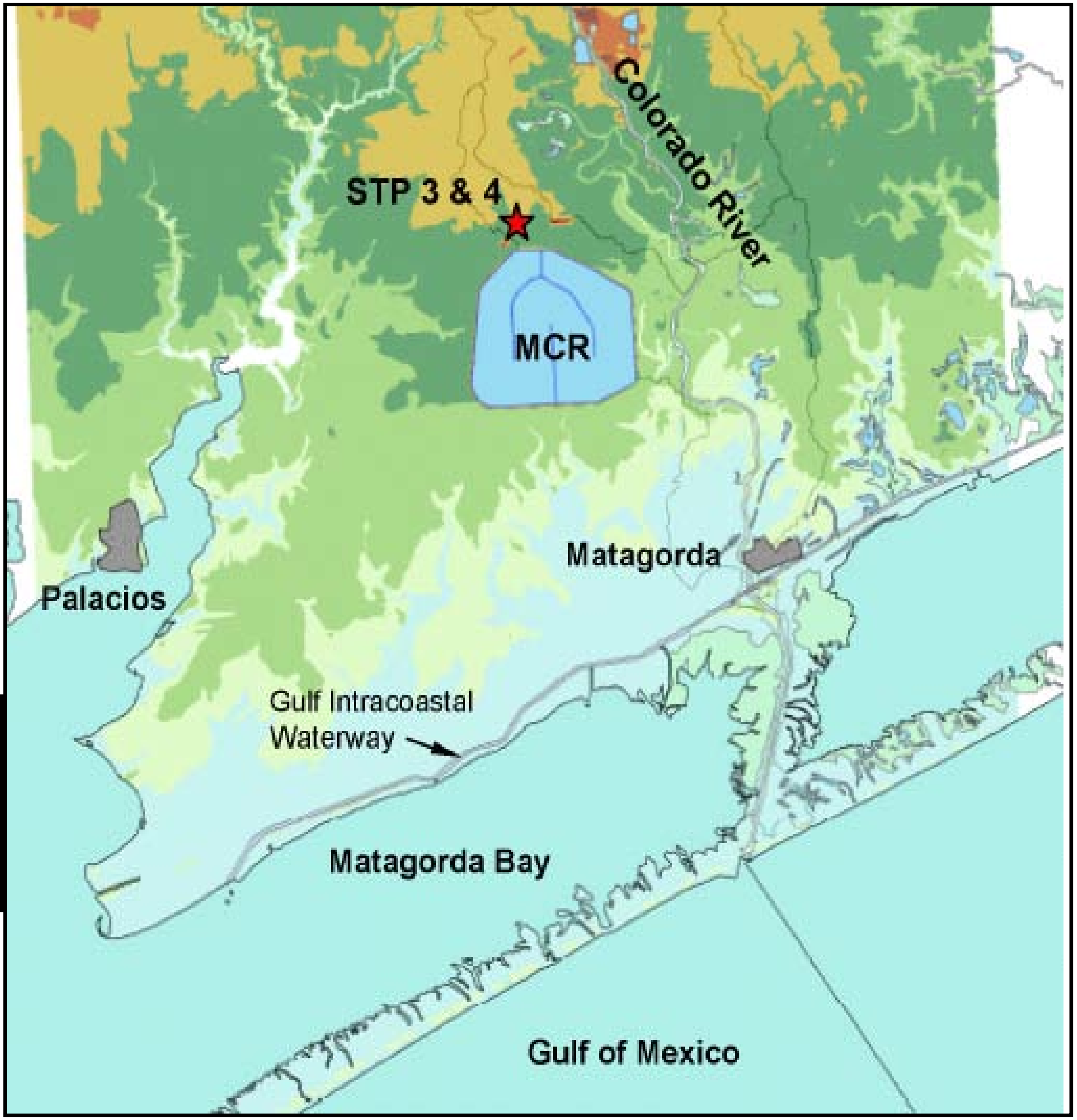
STP COL Chapter 2.4 Hydrology

Lead NRC Reviewer: Hosung Ahn
Presenters:
Rajiv Prasad, PNNL
Charles Kincaid, PNNL

Floods (FSAR Sections 2.4S.1 through 2.4S.10)

- The staff reviewed various flooding mechanisms to determine the site characteristics related to design-basis flood and required flooding protection.
- Specific items of interest:
  - **Departure STP DEP T1 5.0-1**: The site-specific design-basis flood elevation and the site-specific local intense precipitation exceed the respective ABWR DCD standard site design parameters.
  - The applicant identified the flood caused by a breach of the Main Cooling Reservoir embankment as the design-basis flood.
  - The staff has identified Open Items 2.4.4-1, 2.4.4-2, 2.4.5-1, and 2.4.10-1.
- The staff's review of Sections 2.4S.4, 2.4S.5, and 2.4S.10 will be completed following resolution of the Open Items.

The STP Site, nearby Cities, and major hydrologic features



FSAR Sections 2.4S.4: Potential Dam Failures

- The staff reviewed various dam breach scenarios to determine the characteristics of the most severe dam breach flood.
- Specific items of interest:
  - **Open Item 2.4.4-1**: The main cooling reservoir embankment breach flood analysis needs to be updated to describe the sensitivity of the flood to plausible breach widths and breach time parameters.
  - **Open Item 2.4.4-2**: The staff has identified several issues related to the choice of a parameter in the FSAR analysis of main cooling reservoir embankment breach flood.
- The staff's review of FSAR Sections 2.4S.4 will be completed following resolution of Open Items 2.4.4-1 and 2.4.4-2.

FSAR Section 2.4S.5: Probable Maximum Surge and Seiche Flooding

- The staff reviewed probable maximum surge and seiche scenarios to determine characteristics of the most severe storm surge and seiche flood.
- Specific items of interest:
  - The applicant has chosen to use the U.S. Army Corps of Engineers' Advanced Circulation (ADCIRC) hydrodynamic model to simulate surges from Probable Maximum Hurricane scenarios approaching the Matagorda Bay.
  - **Open Item 2.4.5-1**: The staff has determined that the applicant has not shown that the ADCIRC model results account for the most conservative plausible PMH scenario and the descriptions and results of these model applications have not been included in the FSAR.
- The staff's review of FSAR Sections 2.4S.5 will be completed following resolution of Open Item 2.4.5-1.

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FSAR Section 2.4S.10: Flooding Protection Requirements

- The staff reviewed the characteristics of the design-basis flood for any required flooding protection.
- Specific items of interest:
  - The applicant has identified that flooding protection of safety-related SSCs would be needed up to the design-basis flood elevation of 40 ft MSL.
  - Because the design-basis flood elevation exceeds the site grade, the applicant has identified the Departure STP DEP T1 5.0-1.
  - **Open Item 2.4.10-1**: The staff has found that erosion of the toe of main cooling reservoir embankment could occur during the probable maximum storm surge which could result in a more severe flood than that from the postulated embankment breach.
- The staff's review of FSAR Sections 2.4S.10 will be completed following resolution of Open Item 2.4.10-1.

FSAR Section 2.4S.12: Groundwater

- The staff reviewed the hydrogeological characteristics of the site.
  - Applicant measured characteristics and properties to support groundwater conceptual models and estimate direction and velocity of potential radioactive contaminants.
  - Maximum groundwater level remains below the DCD requirement, and assess need for a permanent dewatering system,
- Specific items of interest:
  - Staff reviewed the characteristics and properties of the proposed site as described by the applicant.
  - Staff concluded that hydrogeological characterization is sufficient to support both the groundwater conceptual model and the site characteristic for maximum groundwater elevation.
  - Staff also concluded further review is needed on three items
    - **Open Item 2.4.12-1:** RAI responses needed to resolve issues with the maximum groundwater elevation, hydraulic gradients, and travel times of potential radioactive contaminants.
- The staff's review of the FSAR Section will be completed following:
  - Closing the Open Item 2.4.12-1 through receipt of RAI responses due 12/15/2010 on groundwater model simulations, the revised groundwater model documentation, and the relationship between the maximum flood level and the maximum groundwater elevation

FSAR Section 2.4S.13: Accidental Releases of Radioactive Liquid Effluent in Groundwater and Surface Water

- The staff reviewed postulated accidental release from the radwaste management system and its potential effects on groundwater and surface water.
  - Evaluation of the ability of the groundwater and surface water environment to delay, disperse, dilute, or concentrate liquid effluent.
  - Describe the effects of postulated releases on known and likely future uses of water resources.
- Specific items of interest:
  - Staff conclude the postulated release and pathway analysis methodologies are acceptable
  - Staff also concluded that
    - The groundwater pathway analysis by the applicant could be impacted by closure of **Open Item 2.4.12-1**, and resolution of post-construction hydraulic gradient estimates
    - The surface water pathway analysis by the applicant could be impacted by closure of **Open Item 2.4.4-1**, and resolution of issues with the main cooling reservoir breach analysis
- The staff's review of the FSAR Section will be completed following:
  - Closing the Open Item 2.4.13-1 through receipt of RAI responses and closure of Open Items 2.4.4-1 and 2.4.12-1 which have implications for release and pathway analyses

STP COL Chapter 2.5 Geology, Seismology, and Geotechnical Engineering

Presenters:
Yong Li
Wayne Bieganousky

Presentation Outline

Section 2.5.1:

- License Condition for Geologic Mapping During Construction Excavation

Section 2.5.4:

- Backfill Open Item and ITAACs
- Settlement and associated ITAAC
- Shear Wave Velocity Departure

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Section 2.5.1- Basic Geologic and Seismic Information

Section 2.5.1- Basic Geologic and Seismic Information

License Condition 2.5.1-1

The applicant must perform geologic mapping of future excavations for safety-related structures; evaluate any geologic features discovered in the excavations; and notify the NRC once excavations for safety-related structures are open for examination by the NRC staff.

Section 2.5.1- Basic Geologic and Seismic Information

License Condition 2.5.1-1 (continued)

Regulatory Guides 1.132 and 1.208 provide the guidance for conducting detailed geologic mapping of construction excavations for safety-related structures and other excavations important to the verification of subsurface conditions.

Detailed mapping of the excavation surfaces ensures that no features indicative of capable tectonic structures or geologic features that may pose a hazard to the site occur in the excavations.

Section 2.5.4 - Stability of Subsurface Materials and Foundations

Section 2.5.4 - Stability of Subsurface Materials and Foundations

Issue 1: Backfill

The applicant plans to import 2,200,000 cubic yards of backfill. However, the backfill source has not been identified and the engineering properties are unknown.

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Section 2.5.4 - Stability of Subsurface Materials and Foundations

Issue 1: Backfill (cont.)

Resolution:

Open Item 2.5.4-37, requests the applicant to provide the tests to be performed, as well as the testing frequency that will be followed as part of the Backfill ITAACs.

Issue 1: Backfill ITAACs

Design Requirements for Backfill ITAACs under Seismic Category I Structures

1. Density to meet a minimum 95 percent of the modified Proctor density
2. Shear wave velocity to meet the values used in the site-specific analysis
3. Engineering properties to bound the values used in the site-specific analysis

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Section 2.5.4 - Stability of Subsurface Materials and Foundations

Issue 1: Backfill ITAACs

Tests and Analysis to meet the Design Requirements:

1. In situ density testing will be performed during placement of backfill materials.
2. Field measurements of shear wave velocity will be performed at approximately, 1) foundation depth; 2) finished grade level; and 3) half way in between 1) and 2).
3. Laboratory tests to measure engineering properties of backfill materials will be performed prior to placement

Acceptance Criteria for all the above tests/analyses require an individual engineering report to confirm that results meet the engineering property requirements.

Section 2.5.4 - Stability of Subsurface Materials and Foundations

Issue 2: Settlement

Verification that actual settlement does not exceed the settlement assumed in the basemat design

COL Application Part 9, Table 3.0-13

Section 2.5.4 - Stability of Subsurface Materials and Foundations

Settlement ITAAC

Tests to meet the Design Requirements:

– Field measurements of actual settlement of Seismic Category 1 structures will be collected

Acceptance Criteria:

– Maximum allowable tilt is 1/600

Section 2.5.4 - Stability of Subsurface Materials and Foundations

Issue 3: Shear Wave Velocity Departure

Issue:

– Shear wave velocity for subsurface materials is less than 1000 fps (Tier 1 information departure).

Resolution:

– Applicant performed a site specific SSI analysis using the site specific SSE.

– Results described in Appendix 3A.

Discussion/Committee Questions

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Back up Slides

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Section 2.5.1- Basic Geologic and Seismic Information

Growth Faulting in the Gulf Coastal Plain

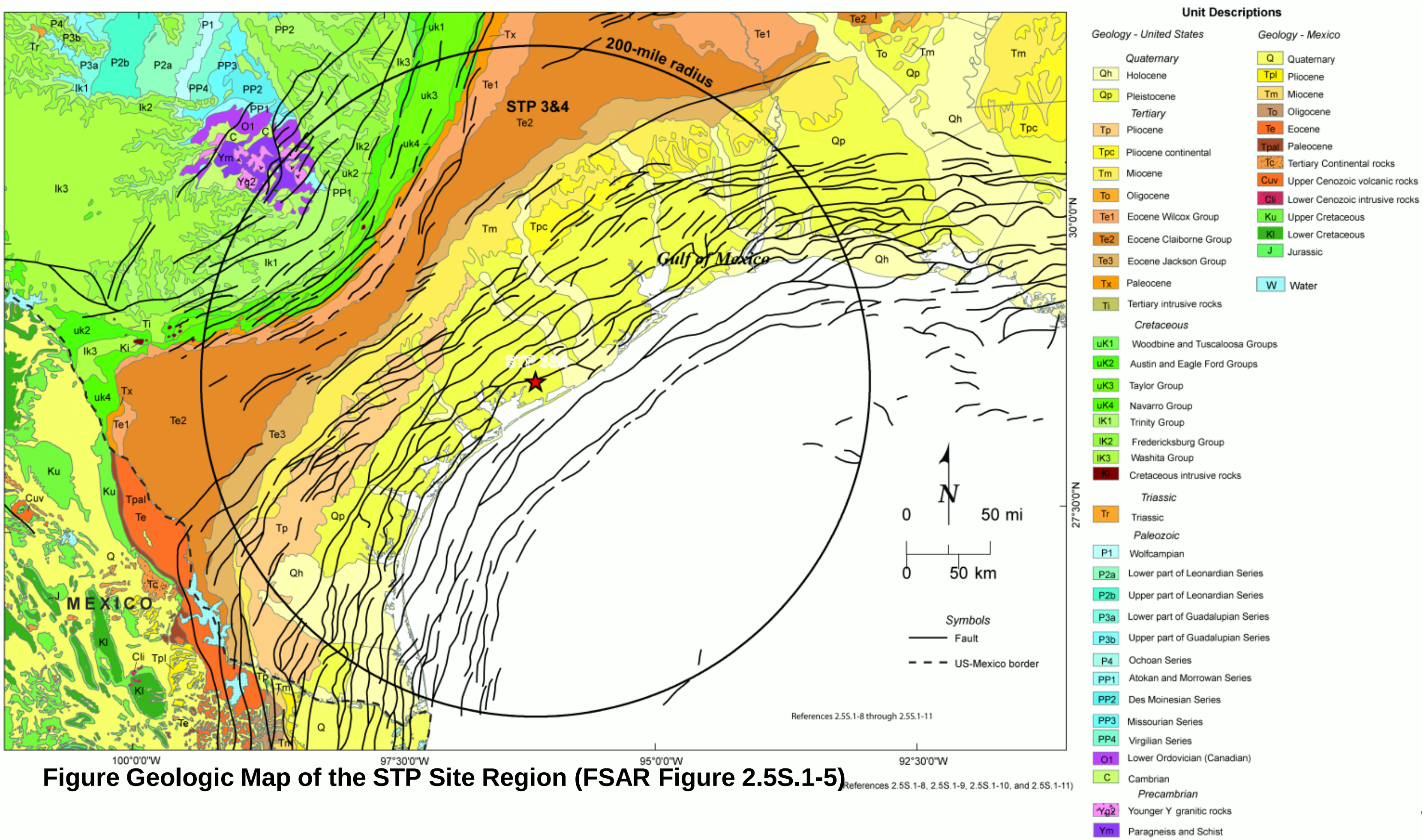
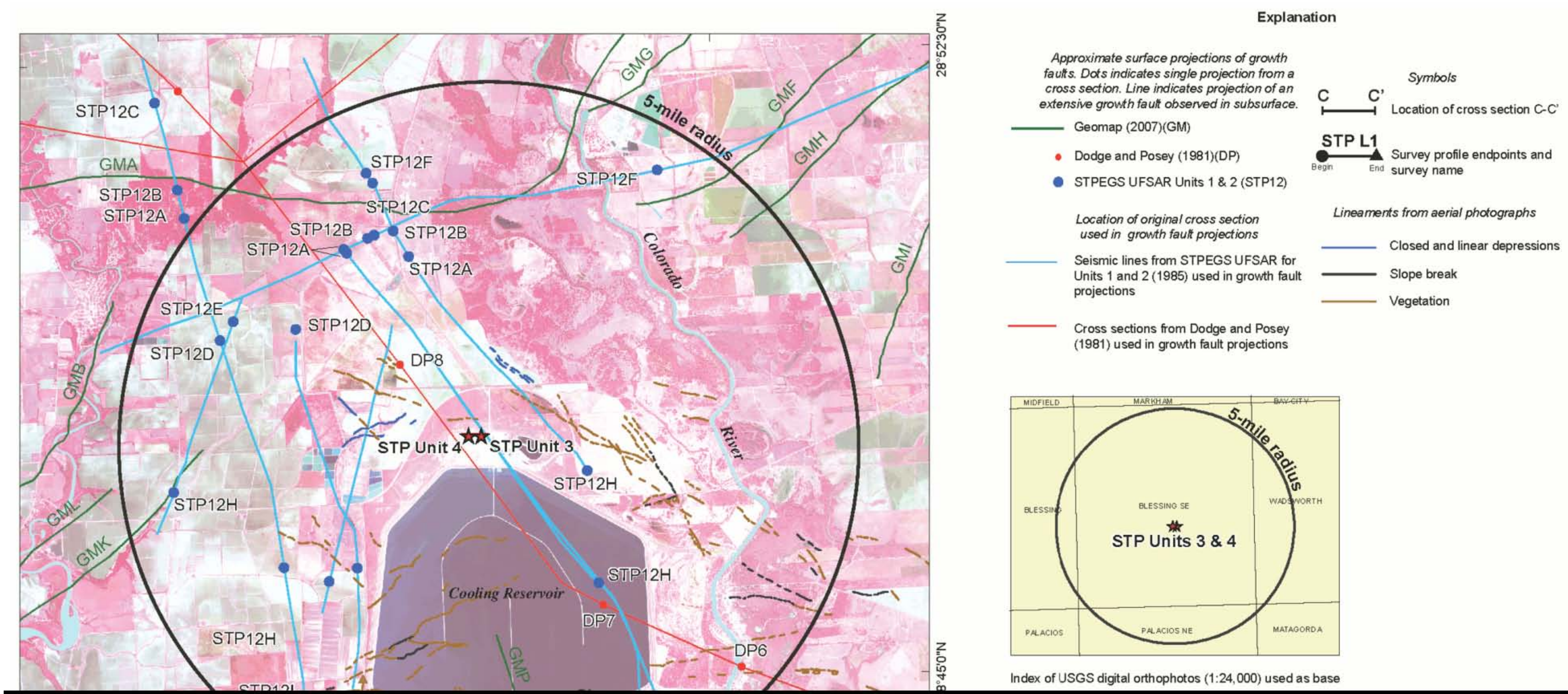


Figure Geologic Map of the STP Site Region (FSAR Figure 2.5S.1-5) References 2.5S.1-8, 2.5S.1-9, 2.5S.1-10, and 2.5S.1-11)

Growth Faulting in the Gulf Coastal Plain

- The applicant identified two growth faults in the STP site area (within a 5-mile (8-km) radius of the STP site) that may deform sedimentary units younger than 5 million years old
  - Both faults project to within 800-1,000 km of the surface in seismic reflection profiles
    - Growth fault “A” projects to within 3 km of the STP site to the northwest
    - Growth fault “I” projects to within 3.8 km of the STP site to the southwest.

Growth Faulting in the Gulf Coastal Plain



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Map of Growth Fault Projections, Lineaments, and Topographic Survey Points Within the STP Site Area (Reproduced from FSAR Figure 2.5S.1-45)

Growth Faulting in the Gulf Coastal Plain

- No evidence of surface deformation associated with growth fault “A”
- The closest documented geomorphic expression of potential surface tilting due to growth fault movement on fault “I” is 7.5 km from site
- No evidence for discrete surface fault displacement at the STP site

Growth Faulting in the Gulf Coastal Plain

- No growth faults project to within 1 km of the STP site.
- No direct evidence for surface deformation hazards due to growth faulting at the STP site

Update on Gulf Coastal Seismic Source

Issue

- The Gulf Coastal seismic zone is included in EPRI/SOG source modeling. Its magnitude distribution was updated by the STP applicant because two earthquakes occurred in the Gulf of Mexico in 2006 with magnitudes (mb) 6.1 and 5.5, exceeding the maximum magnitude distribution estimated by the original EPRI teams.

Update on Gulf Coastal Seismic Source (continued)

- The applicant updated the maximum magnitude distribution for EPRI sources using the SHAAC Level II approach. The TI team recommended to update the maximum magnitudes for all the related ERPI sources to 6.1-7.2, and the weighted average is 6.73. But the SSHAC review panel rejected the TI’s recommendation and the final weighted average of the maximum magnitude for the Gulf Coastal seismic zone is 6.14.

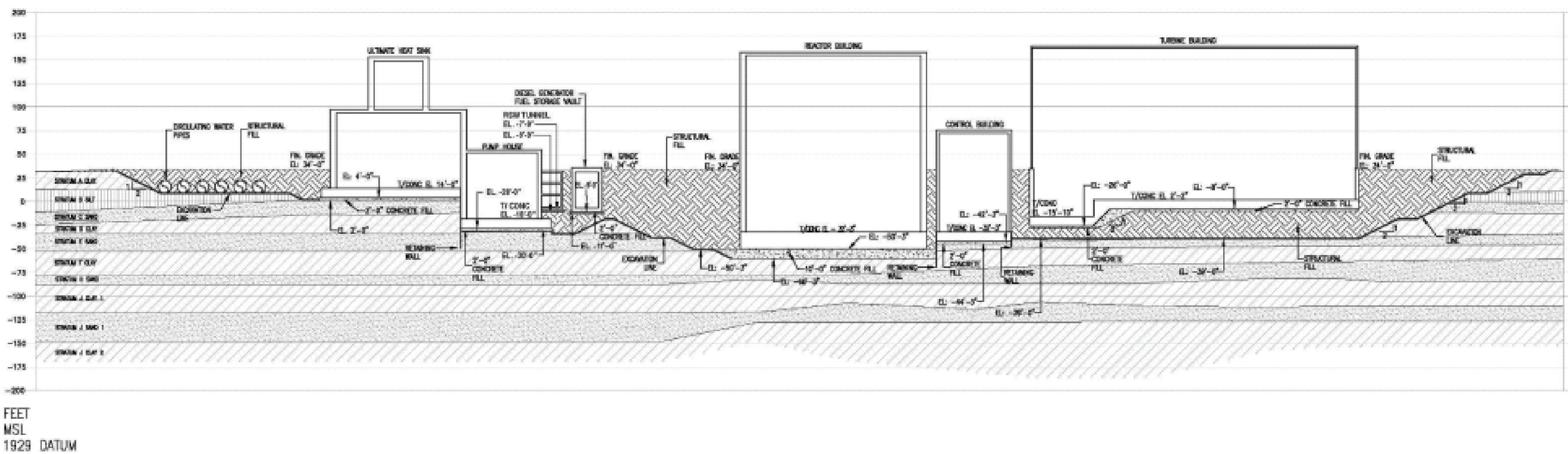
Update on Gulf Coastal Seismic Source (continued)

- The staff believes that the TI's recommendation on the maximum magnitude update reflected the technical community consensus, therefore, the final maximum magnitude distribution for the Gulf Coastal seismic zone should be based on the TI's recommendation.

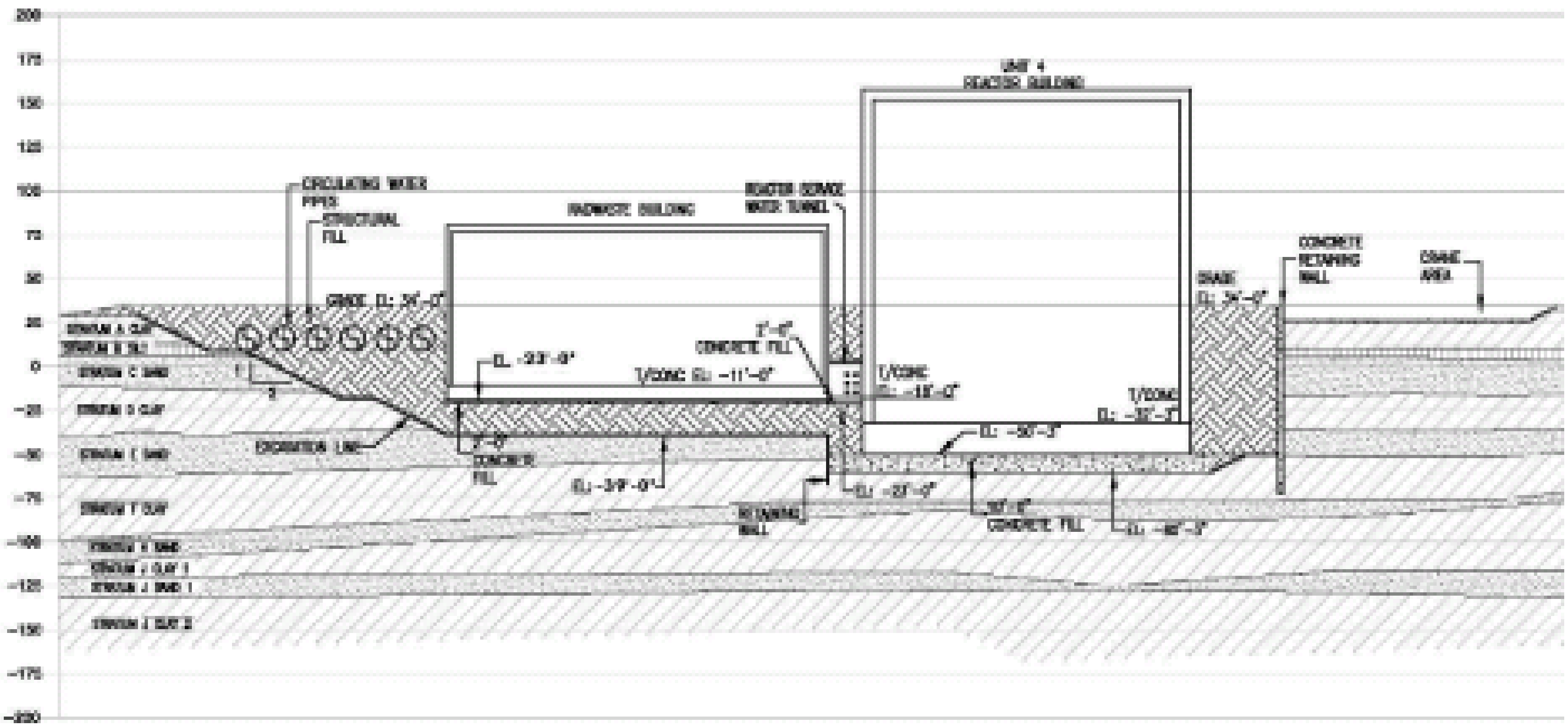
Update on Gulf Coastal Seismic Source (continued)

- The applicant implemented a sensitivity test with different magnitude distribution update scenarios. The sensitivity test indicates that even using recommended distribution of TI’s, the seismic hazard increase at the STP site is relative small. Therefore, this issue is resolved.

Cross-section showing backfill under Category I structures



Cross Section showing backfill under RSW tunnel



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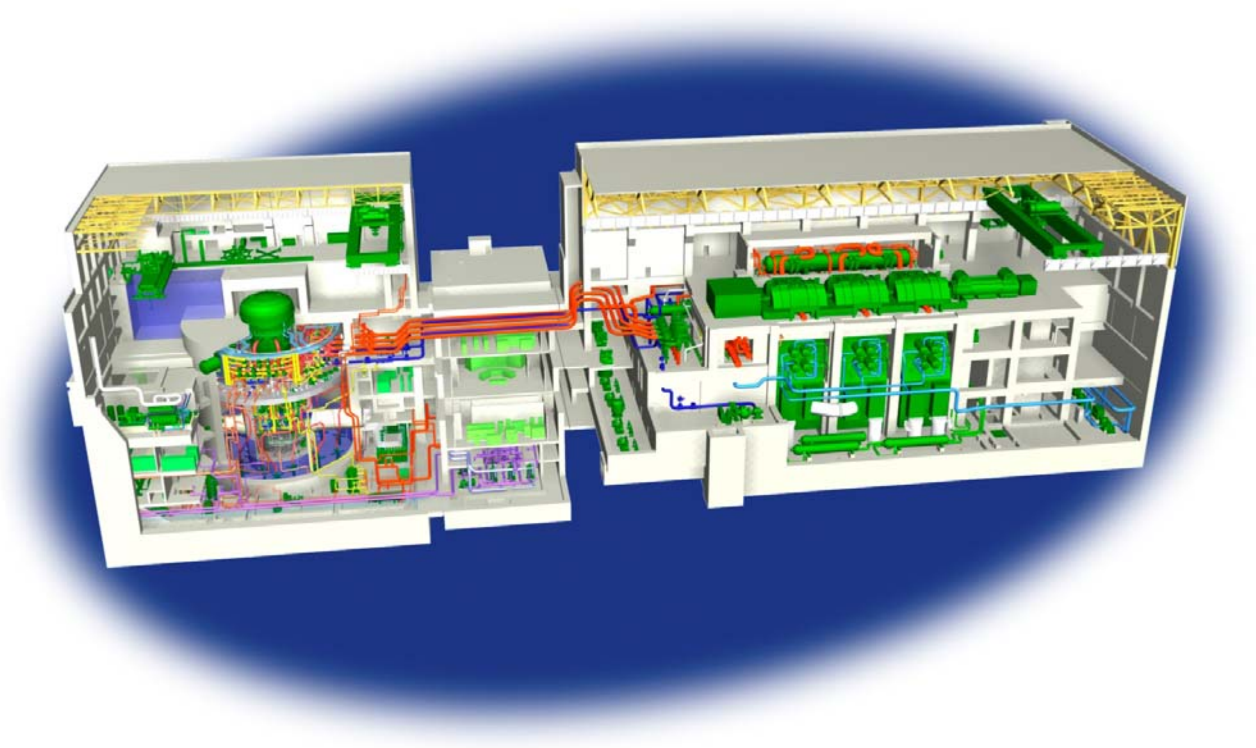
Settlement Monitoring

- Response to RAI 2.5.4-4 describes in substantial detail the monitoring that will be done to ensure that the excavation does not adversely impact existing structures.
- Response to RAI 2.5.4-30 provides details on the settlement monitoring of the SSCs to ensure settlements after fuel load will not exceed design values.

South Texas Project Units 3 & 4

Presentation to ACRS ABWR Subcommittee: Chapter 15 Accident and Analysis



Chapter 15 Overview

- Essentially identical to the certified design
- No departure from the certified fuel design
- No departures based on Chapter 15 content
- Minor descriptive changes consistent with departures in other chapters
- All COL Information Items addressed
- No ITAAC

RAIs of Interest

- RAI 13.03-73, Technical Support Center (TSC) Dose Calculation
  - Radiological consequences analyses for TSC under postulated design basis accidents (DBAs)
  - TSC is located within the Service Building Clean Area, additional changes to Service Building HVAC System:
    - Provided automatic start of the emergency filter train
    - 4-inch charcoal filter for 99% efficiency, consistent with RG 1.140 Rev 2
  - Results well within does acceptance criterion of 5 rem total effective dose equivalent (TEDE) for duration of accident

RAIs of Interest

- RAI 15.00.03-1, Control Room Dose Calculation
  - Radiological consequences analyses for control room relevant to the turbine building and reactor building releases were re-calculated using the updated site-specific χ/Q values
  - Two instances for control room dose calculation for which STP site-specific exceeds DCD value: 4-30 day turbine building release, and 4-30 day reactor building release
  - Results show control room doses for these two instances are still less than acceptance criteria

- All confirmatory information was incorporated in COLA Revision 4

Chapter 15

Questions and Comments

Presentation to the ACRS Subcommittee

South Texas Units 3 and 4 COL Application Review

Advanced Final Safety Evaluation - Chapter 15.0
"Transient and Accident Analyses"

November 30, 2010

STP COL Chapter 15 Staff Review Team

- Project Managers
  - George Wunder, Lead PM
  - Adrian Muñiz, Chapter PM

- Technical Staff
  - Jay Lee, RSAC
  - George Thomas, SRSB
  - Dinesh Taneja, ICE2
  - Stephen Williams, CHPB

Summary of Discussion

- Closure of Open Items

Site-Specific χ/Q Values and Control Room Doses OI

- Site-specific χ/Q values exceed the value in the DCD for:
  - 4 to 30 day turbine building release
  - 4 to 30 day reactor building release
- Evaluation of the site-specific χ/Q values is in Section 2.3S.4 of the staff's SER.
- Applicant provided the control room radiological consequence analyses for the turbine and reactor building releases following a design basis accident (DBA) using the site-specific control room χ/Q values.
- The control room doses for these two instances are still well within the dose acceptance criteria as specified in SRP Section 15.0.3.

Technical Support Center (TSC) OI

- RAI 13.03-73 requested the applicant to provide the TSC radiological consequence analyses for the DBAs in order to demonstrate that it meets the dose acceptance criterion of 5 rem Total Effective Dose Equivalent (TEDE) as specified in SRP 15.0.3.
- Applicant's results showed that they are well within the dose criterion for the duration of an accident as specified in SRP Section 15.0.3.
- Staff audited the Westinghouse dose calculations and related assumptions for the TSC radiological habitability analyses.
- Staff found that the TSC radiological habitability dose calculations performed by Westinghouse were in accordance with SRP 15.0.3 and the guidelines provided in RG 1.183.

Conclusion

- All the Open items were resolved.
- Staff will confirm changes to the application in the next revision of the FSAR.