UNITED STATES ATOMIC ENERGY COMMISSION

POOR ORIGINAL

IN THE MATTER OF:

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160th GENERAL MEETING

of the

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

CENTRAL FILES 50-289

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Place - Washington, D. C.

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COMMITTEE ON REACTOR SAFEGUARDS

Friday, 10 August 1973

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UNITED STATES OF AMERICA

ATOMIC ENERGY COMMISSION

160th GENERAL MEETING

of the

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Room 1046
1717 H Street, N. W.
Washington, D. C.

Friday, 10 August 1973

The 160th General Meeting of the Advisory Committee on Reactor Safeguards was reconvened, pursuant to adjournment, at 11:10 a.m.

BEFORE:

MR. HAROLD G. MANGELSDORF, Chairman

MR. MYER BENDER, Member

MR. HAROLD ETHERINGTON, Member

DR. HERBERT S. ISBIN, Member

DR. WILLIAM KERR, Member

DR. HARRY O. MONSON, Member

DR. DADE W. MOELLER, Member

DR. DAVID OKRENT, Member

DR. NUNZIO J. PALLADINO, Member

DR. CHESTER P. SIESS, Member

DR. WILLIAM R. STRATTON, Member

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P R O C E E D I N G S

DR. MANGELSDORF: This is a public meeting of the ACRS on the subject of an operating license for Three-Mile Island. The applicant as a group is or are represented by Metropolitan Edison Company, who have served as representatives for a group of utilities in the construction and plant operation of this facility.

This meeting is being conducted in accordance with the provisions of the General Advisory Committee Act, and in attendance at this meeting as the designated employee is Mr. Ray Fraley, on my right, or his designated representative for such periods as he may be temporarily absent from the meeting.

Ray Fraley

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The rules for the conduct of this meeting were included with the notice of the meeting and provisions for public participation. By that I mean any presentations by representatives of the public, provide for notice in advance. And it is my understanding that we have not received notice of intent of members of the public to prepare--to present statements to this meeting.

Consequently, they have not been scheduled and we are not expecting any. A transcript of the meeting is being kept, and with that in mind, I would request that each of you, as you appear in presenting information, please introduce yourself for the benefit of the reporter and please use the microphones, speaking quite directly into the microphone, because these are highly directional microphones to avoid feedback. So as to get the benefit, one must speak quite directly and fairly closely into them.

Transcripts of the meeting, the public part of the meeting will be available within a few days. With that introduction, I will call on Mr. Miller of Metropolitan Edison Company to make what introductory remarks he cars to make, and then proceed in introducing members of his organization in presenting material along the lines of a plan that has been discussed with him.

We will enter speakers' remarks from the applicant with comments from the regulatory staff, again according to plans.

Mr. Miller.

XXXXXX MR. MILLER: My name is John Miller.

I am vice president of Metropolitan Edison Company and the corporate representative. I am also vice president of production for the GPU Service Corporation with overall responsibility for all generation within the GPU Organization.

We are quite happy to be here today and to have reached this milestone in our efforts to construct and prepare Three Mile Island for operation.

On my right is Richard W. Heward who is Project

Manager for the construction effort at Three Mile Island. On his right is Thomas Crimmins who is Safety and Licensing Manag[illegible] GPU Service Corporation.

I would also like to introduce the key people from Metropolitan Edison Company involved in the operation at Three Mile Island. Mr.Robert C. Arnold, Manager of Generation of the Generation Division for Metropolitan Edison Company. To his left is Mr.Robert F. Jones, Manager of Engineering, Generation Division. And to his left is Jack Herbein, the Assistant Superintendent of Three Mile Island, who has the primary responsibility for getting Three Mile Island One ready for operation.

Mr.Thomas Crimmins, the Safety and Licensing Manager, will be the lead spokesman for our group. Tom.

MR. CRIMMINS: My name is Tom Crimmins. Thank

XXXXX you, Mr. Miller.

Gentlemen, the first presentation will be given by the Project Manager, Mr. Heward, who will bring you up to date on the project status.

MR. HEWARD: My name is Richard Heward, GPU Service Corporation. The Unit One project status at the present time is as follows: The project is 93 per cent complete. 84 per cent of the plant systems have been turned over for testing to the Start-up and Test Group. The major incomplete work at this time includes pulling of cable in the reactor building which is somewhat over 50 per cent complete. There are a small number of valves and nuclear pipe joints to be completed. The control rod drives are being finally assembled at this time and the reactor internals have been completed and trial fit in the reactor vessel.

The steam generator hydrostatic test is in process and is presently incomplete due to some corrections to the leak tightness of manways on the generators. Initial fill of the reactor coolant loops is scheduled for October, 1973. Hot functional testing is to begin in December, fuel-holding will be in March and a 100 per cent power is scheduled for July. Commercial operation is scheduled for August, 1974.

MR. CRIMMINS: The next presentation will be a description of the site. I will use the slide projector.

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(Slide)

MR. CRIMMINS: Three Mile Island site is located in the Susquehanna River about ten miles southeast of Harrisburg, Pennsylvania. This first figure which shows the southeastern portion of the Commonwealth of Pennsylvania generally locates the station.

Key landmarks to try to better localize what you are looking at here are Philadelphia, this is the Maryland-Pennsylvania border, Harrisburg is right here, and the plant site. For reference purposes the circle shown here is 25 miles in radius.

(Slide)

TMI is located in Londonderry about three miles south of Middletown. The Island lies closer to the east shore of the Susquehanna River and the York Haven Dam extends from both sides of the Island to the river banks. Middletown is located here. The site, York Haven Dam crosses here, and here. A small hydroelectric station is associated with the York Haven Dam at this point.

Other noteable features that can be seen on this slide, Harrisburg International Airport is located approximately two and a half miles from the site along the, in this case the northeastern portion of the Susquehanna River near Middletown.

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A Pennsylvania State Highway 441 and a Pennsylvania

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Railroad Line run down the eastern side of the river and a Penn Central line and a small road line the western bank of the river.

The low population zone is also indicated on this figure. It has a radius of two miles, 1970 population of 2300 and a projected population for the -- maximum projected population for the life of the plant of 3400. The land in the area of the site is primarily used for farming.

And it is relatively sparsely populated. Approximately 600,000 people live within 20 miles of the site. Harrisburg with a 1970 population of 68,000 is the largest or, excuse me, is the closest of the large population centers.

You will also note the exclusion radius on this slide and the next slide will show that in more detail.

(Slide)

The exclusion radius for the site is 2000 feet. All of the land within the exclusion radius is owned by Metropolitan Edison. The station actually occupies about 200 acres of the 472 acre Three Mile Island in this area. Three Mile Island is owned in its entirety by Metropolitan Edison, and Shelly Island is owned by the public with an exception of a few acres at the southern end.

For reference purposes Three Mile Island is 11,000 feet in length and 1700 feet wide. There are two bridges from the Island that connect with Pennsylvania State Highway

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441. This northern bridge is a permanent structure, includes the railroad siding and is the -- presently used for plant persoı .el and will be the permanent access bridge for the site.

There is also nct shown on this figure a road that runs down the length of the Island with a bridge approximately this location which is currently used for the construction personnel. This road will be sealed when both units are completed at this point, and the bottom portion of the Island will be developed for recreational uses.

(Slide)

This slide is of a photograph and shows more of the plant features. The plant is protected from flooding in the Susquehanna River by a system of dikes which surrounds the plant. This being the upstream direction, surrounds the plant here. The highest point on the dike is at the northernmost point and it is -- its elevation is 310 feet above mean sealevel.

The dike gradually decreases in height to approximately 305 feet in this area. Plant elevation is 304 feet above mean sealevel. The average height of the river is 278 feet above mean sealevel. Unit one reactor is here. Turbine building here. Unit 2 is also shown on this slide, the reactor building here and turbine building.

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Intake structures and the cooling towers which are

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used for cooling each plant. That concludes my remarks on the site. We also have a brief presentation on the interfaces and shared systems between units 1 and 2. Mr. Jack Herbein, Assistant Plant Superintendent will give that presentation.

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DR. MANGELSDORF: Any questions on the site?

DR. MOELLER: This may be more appropriate for the Staff. But I was curious. We have noted in a number of the nuclear power stations that are being constructed that the Applicants are building recreational facilities nearby. Has the Staff looked at this in terms of the wisdom of taking this approach?

For public relations I am sure it is good for the Applicant.

MR. DE YOUNG: The Staff has reviewed many of the plants for recreational facilities. It has a policy that it will accept such facilities provided that they can meet the criteria required by the regulations. So it has a policy that it is more or less in favor of such things, provided they can meet the regulations.

DR. MANGELSDORF: Go right ahead.

MR. CRIMMINS: Mr. Herbein.

MR. HERBEIN: Jack Herbein, Metropolitan Edison Company.

First let me say that no engineered safety feature systems are shared between Units 1 and 2.

Three Mile Island Nuclear Station Unit 1 will make use of some facilities on a shared basis with Unit 2 when Unit 2 goes into operation.

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The shared components include the fire protection system, the miscellaneous waste evaporator, the fuel handling crane, auxiliary steam boilers and new fuel storage facilities.

None of the previously mentioned shared components are connected with safety features or control systems of either nuclear steam supply system.

The two units were designed and built as if the other did not exist.

Each unit has an emergency power system completely independent of the other.

In addition, all other engineered safeguards and control rooms are independent for each unit.

That concludes my remarks.

DR. MANGELSDORF: Any questions on shared facilities?

(No response.)

Go right ahead.

MR. CRIMMINS: Thank you.

Mr. Herbein would also give some prepared remarks on the interface between the two units and what will be done to provide security and safety for Unit 1 while Unit 2 is under construction.

MR. HERBEIN: The following describes our plans with regard to maintenance of building security and admittance of personnel to the confines of the plant during the operational phase of Unit 1 and the construction phase of Unit 2.

The physical barrier used to control construction personnel access will consist of an eight-foot high Cyclone fence with three strands of barbed wire at the top.

Station security system facing east, west and south runs along the top of the flood dike. The north portion encloses cooling towers and attaches to the service building.

This fence, along with the temporary security system fencing, will be used to isolate Unit 1 from Unit 2 until Unit 2 construction completion.

Gates which form a part of the station system fencing will normally be secured in the closed position.

The gate on the mainland side of the permanent access bridge at the north end of the island will be automatically controlled by a coded key system at the gate or by a switch from the station security office.

The security office located just inside the northeast access door to the service building.

The northeast station security system boundary entrance to the service building will be remotely controlled from the security office.

The employees' entrance to the service building will be automatically controlled by a coded key system.

The temporary fence which is interconnected with the permanent fence will completely isolate all Unit 1 equipment and activities from Unit 2 construction activities.

All gates in the temporary fence will be locked and their keys will be kept under the shift supervisor's control.

A temporary barrier eight feet high and a locked door will be installed at the south end of Unit 1 fuel handling building to prevent access from Unit 2 fuel handling building into Unit 1.

All Unit 1 entrances will normally be locked except for the service building entrance which will have a guard on duty continuously.

In the event of an emergency requiring evacuation of all construction workers from the site a distinguishable, audible alarm will be initiated from the Unit 1 control room by the operating shift supervisor.

This alarm will sound within the confines of Unit 1 and will, in addition, be audible toward the east and west shores of the island and to the north and south of the plant site.

In addition to the audible alarm, the construction operating superintendent will be notified of the evacuation. He, in turn, will order all construction workers to evacuate the island via the bridge at the southern end of the island.

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Should it become necessary for construction personnel to enter the confines of Unit 1 while Unit 2 is under construction, access will be permitted only through manned gates where the security guard or plant personnel are stationed.

At this point construction workers will be signed in and issued appropriate identification badges by plant personnel or the security guard.

That concludes my remarks.

DR. MANGELSDORF: All right.

DR. BENDER: When construction forces are inside the operating reactor area, aside from the badging, are there any other controls over where they are and what they are doing?

MR. HERBEIN: Yes, sir. There would be in the event they were required to enter an area where radiation exposure would be possible. They would be suitably badged and records would be maintained.

DR. BENDER: What about the matter of whether they may enter areas where they can accidentally create an operational disturbance?

MR. HERBEIN: Just a minute, sir.

(Pause.)

Sir, we are considering the desirability of having them escorted at all times.

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MS. HOWARD: I believe you said that, Jack, in your previous statement, did you not?

MR. HERBEIN: No, I did not.

DR. BENDER: What does considering mean?

MR. HERBEIN: Just a minute, sir.

(Laughter.)

(Pause.)

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MR. HERBEIN: Sir, we will control the points that they have access to in unit 1. In the event the nature of their work is such that an escort would be required, why, we anticipate doing that.

DR. BENDER: Well, you haven't made clear what criterion you would use to decide whether escorting is necessary, and I think the experience that people have had with construction personnel in operating areas is that there is always the possibility that they will do something they should not do.

I wonder who would decide and how you would decide.

MR. HERBEIN: Again, I feel that this would be decided by the station staff. And by that I mean that the operating shift supervisor, and again it would depend strictly on the conditions of the nature of the work that people were going to resolve.

DR. BENDER: Couldn't you preestablish areas where you would require escort?

MR. HERBEIN: Again I think I mentioned that I could and certainly all the areas that could involve potential exposure to the hazards of radiation would be considered.

DR. BENDER: It might be better to say you would than that you could. I guess that is the point.

MR. MILLER: Sir, I can say that we will.

DR. MANGELSDORF: That is clear.

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DR. MOELLER: He mentioned in the event of an emergency that the construction workers would leave by the bridge at the south end of the Island. I understood there were two bridges over to the Island from the mainland. Can you visualize circumstances where it would not be wise to leave by the bridge at the south end?

MR. HERBEIN: Yes, sir, and I think particularly in the condition where some construction workers were perhaps within the confines of unit 1 and escorted as I think we just agreed they would be. In this particular case we envision that the construction workers would leave with the visitors and vendors and non-essential plant personnel by the north access to the Island, off the north bridge.

DR. MOELLER: Well, is there anything in your emergency instrumentation that would tell you which is the better route to take? Or are there restrictions or something that makes it necessary for a group to leave by a particular bridge?

MR. HERBEIN: Well, the people involved on unit 2 would logically traverse the south bridge, not having to pass by the unit 1 reactor building, whereas the people involved in work on unit 1 would leave by the north bridge, again, avoiding the unit 1 reactor building.

DR. MANGELSDORF: Does that answer your question for the moment?

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DR. MOELLER: Not necessarily, but it is adequate for the moment.

DR. MANGELSDORF: Okay. Any other questions? Then go right ahead.

MR. CRIMMINS: Sir, in response to a question from the committee, Mr. Bob Arnold will give the makeup and qualifications of our safety committee.

MR. ARNOLD: Robert Arnold of the Metropolitan Edison Company. Four years ago we established two safety committees, one at the corporate level and one at the plant staff level. The corporate safety committee, general office review board, presently has 11 members. These members are taken from the GPU Service Corporation, management staff, Metropolitan Edison management positions, consultants from Babcock & Wilcox, and also consultant from Pickard-Lowe Associates.

Within this group of 11 people they have an average nuclear experience of approximately 15 years with a minimum of seven, ranging up to 30 years. They cover all areas of expertise recommended for the safety committee by the National Standards Institute Guide 18.7. At the plant site the safety committee there has five supervisory site personnel assigned, assistant superintendent, station engineer, supervisor of operations, supervisor of maintenance, and the nuclear engineer.

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These five people have an average experience in the nuclear field of 7 and a half years. In addition to those five site supervisors there are two members assigned who are also members of the general office review board. Those two people have 15 or more years of experience in the nuclear field.

For specific meetings, other supervisory personnel such as the radiation protection supervisor or the chemistry supervisor are brought in as appropriate for the particular meeting in progress. All minutes of the plant committee are forwarded to the general office review board, and the coordination between these groups is maintained at a very close level.

That concludes my remarks.

DR. MANGELSDORF: Questions?

DR. KERR: Has the staff looked at this committee and do you have comments on the adequacy?

MR. BERNERO: Bernero, Licensing. The section of the technical specifications which includes the constitution of both these committees which were mentioned is the one outstanding section of the technical specifications we covered.

Our requirements which are based on broad standards, industry standards, our published guides were transmitted to the Applicant. They have implemented, they told us they have implemented a constitution of committees that will satisfy our standards but we have not yet seen it.

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I was offered the opportunity to meet with the Applicant on this subject just recently. I had to decline because of the burden of the meetings here. But next week we are scheduled to meet on next Thursday,in fact, on this very subject.

I expect that their committees will in general certainly meet our requirements because we have been quite clear in what requirements there are. There may be some minor alterations to the voting rights and so forth which is not uncommon.

MR. ARNOLD: We do not anticipate any difficulty in satisfying the AEC Staff that we entirely fulfill their criteria.

DR. MOELLER: It was stated that the Health Physics Supervisor would attend the safety committee meetings from time to time. I also note, in regulatory guide 8.8 that this person should -- the Chief of Radiation Protection should be responsible to someone at a high management level and he should not be part of the operations or production oriented divisions.

I wondered if this was true at Three Mile Island.

MR. ARNOLD: That recommendation within that guide we are not organized in accordance with at this time. The Health Physics area is covered by station staff personnel who are directly responsible to the station management people.

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We do have staffing requirements on the Metropolitan Edison Company home office staff for personnel with expertise in this area.

DR. MOELLER: Could I ask if the staff is reviewing this situation?

MR. BERNERO: Yes. I might add that we do accept the reporting chain where the Radiation and Health Physics Engineer or whatever title is used at a station reports at the station superintendent or assistant superintendent level, and is not considered part of the shift staff in the sense that the operation supervisor, so that if the company has both a home office and a site capability, that this can be acceptable to report at the station superintendent or assistant superintendent level.

DR. MANGELSDORF: Other questions? Herb, is this a good time to get a statement from the Staff on the QA program, or when did you have that planned?

DR. ISBIN: This would be a good time.

DR. MANGELSDORF: We have requested that the Staff give us their appraisal of the QA program and this seems like a reasonable time to introduce it, if you are ready, Bob.

MR. BERNERO: Yes, I am ready. And I was prepared to address all of the outstanding items in a sequence. I can single out that and do it first, which ever you prefer.

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DR. MANGELSDORF: Why don't you go ahead with the QA?

MR. BERNERO: The quality assurance program for this site, we can divide it into two phases and I will do them in reverse order. I will do the operational QA program first and then the construction QA program. Their operational QA program has been furnished to us in draft form. It is under review at this time and prior to licensing we will assure ourselves that they have an adequate operational QA program in accordance with appendix B. The implementation of that program of course will be a matter of surveillance by the Regulatory Operations Regional Staff.

Turning now to the construction QA program, the history of the project was such that we gave a great deal of attention to the quality assurance program. We believe they have an adequately constituted program at this time. However, I would like to mention that in construction there are surveillance matters which continue to be of concern and one which I would like to single out for your attention because of previous experiences on another project.

In the surveillance area, the Applicant is at the present time stressing the reactor building, that is, tightening the tendons in the building. And the procedures the Applicant uses allows up to a quarter of an inch recession of the tendon bearing plates. In the tendons which have been

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stressed to date, the recessions have been measured up to about sixty percent of the allowable or specified value. Something less than point 15 inches is the worst case. Our concern deriving from experience with these tendons and recession of these plates on another project has led to an inquiry to the Applicant, first of all, the Staff, the Regulatory Operations Staff by the way is the lead in this matter, the Staff is concerned that the specification may indeed be not sufficiently conservative.

And a suggestion was made to the Applicant that while he has all the equipment on site and available to him, that he should cut off or so-to-speak peel a couple of the greatest recession plates and examine underneath to confirm the phenomenon measured. The Applicant, because of the effort involved, prefers first to meet with the Staff to justify the basis of his specifications of point 25 inches as an allowable recession.

So at this time we are to meet with the Applicant to discuss the specifications, and the outcome of that meeting of course, may lead to one or the other of the possible actions indicated. And -- question?

DR. MANGELSDORF: Go ahead.

MR. BERNERO: I have no further remarks on QA.

DR. MANGELSDORF: Any questions, Mike?

DR. BENDER: The Staff as I understand it is

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considering invoking the new ANSI standard on construction quality assurance for operational quality assurance. Is that new standard being reviewed for this plant?

MR. BERNERO: I could not answer that. I don't know. The only requirement and commitment we have in this case is appendix B.

DR. BENDER: As I understand it there is a new safety guide that is on its way. It is being published.

MR. BERNERO: No, the fact that it was not explicit in previous actions regarding this matter makes me suspect that we are not invoking it in this case.

DR. SEISS: I would like to explore with the Staff and/or the Applicant this question of the tendong bearing plate movements. Is this an appropriate time or should we defer that?

DR. MANGELSDORF: As far as I know. Go right ahead.

MR. BERNERO: Yes, do it now I would suggest.

DR. SEISS: You said their specification was that a quarter of an inch movement of the bearing plate was acceptable?

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MR. BERNERO: Yes.

DR. SEISS: Quarter of an inch with respect to what, with respect to the concrete immediately adjacent to it?

MR. BERNERO: May I stop at this moment and turn the microphone over to someone more qualified to speak, Mr.

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Beratan of the Regulatory Operations Staff?

MR. BERATAN: I can't answer the question. I think that I will have to ask the Applicant to answer it.

DR. SEISS: Before I ask him, movements on the order of a tenth of an inch or more were observed you said.

MR. BERATAN: Yes, point one four three I think.

DR. SEISS: Were those observed in the plate with respect to the adjacent concrete?

MR. BERATAN: Yes.

DR. SEISS: How were they measured?

MR. BERATAN: They put a bar across and put some Doyle gauges on and took readings from the Doyle gauges.

DR. SEISS: Were these movements that occurred during prestressing?

MR. BERATAN: During and after prestressing.

DR. SEISS: How long a period after?

MR. BERATAN: Immediately after.

DR. SEISS: These are 170 wire quarter inches ---

MR. BERATAN: Yes, they are the big tendons.

DR. SEISS: What are they prestressing to, eight tenths of ultimate and then backing off?

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MR. BERATAN: Backing off.

DR. MONSON: Compared to the other plants you referred to, isn't this amount to ---

MR. BERATAN: It is a little in excess, with the

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exception of one or two plates, the rest of the recessions were a matter of a couple sixty-fourths of an inch.

DR. SEISS: Those tendon bearing plates on Calvert Cliffs with that much movement when removed did show voids.

MR. BERATAN: Significant voiding.

DR. BENDER: How was the concrete placed behind these?

MR. BERATAN: The concrete was poured and the concrete was raised up to the upper side of the bearing plate so there was potential for entrapment of air.

DR. SEISS: What is the size of the bearing plates?

MR. BERATAN: 14 by 14 by about -- four inch plate, three and three-quarters, four inches.

DR. SEISS: I guess I would like to address a question to the Applicant.

DR. ISBIN: There is a correction.

MR. NODLAND: I would like to correct a number, the size of the bearing plate. I think it was set it was 14 inches. That dimension is 20 and a half by 20 and a half by three and three-quarter inches thick.

DR. SEISS: Could you give me the basis for the specification which permits a quarter inch local movement of the bearing plate as being acceptable? 1411 028

How that was arrived at? And what would be the source of such a movement relative to the concrete adjacent

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to it?

MR. NODLAND: We have installed Doyle gauges, two diametrically opposite the center of the bearing plate. And measurements are taken to the concrete, adjacent concrete that is not moving. And this was proposed during the writing of these work procedures, to have a control over excessive displacement based on a problem we know of existed.

DR. SEISS: How did you arrive at a figure of a quarter inch as not being excessive? This is a local displacement.

MR. NODLAND: That is correct.

DR. SEISS: And a quarter of an inch, even if it extends over considerable depth, corresponds to very large strain. If a quarter inch deformation occurred over a 25 inch depth that is a strain of point 01, which is obviously an excessive strain even for confined concrete.

And this strain could not occur over a very great depth, or you would have the concrete adjacent to the plate moving down also. You are talking about a displacement of the plate relative to the concrete immediately next to it, which suggests that the deformation that leads to that displacement is very local beneath the plate which of course correlates with the findings on the Calvert Cliffs.

I am interested in how you arrived at a quarter of an inch as being acceptable.

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MR. NODLAND: We wanted to use and measure as indicating where further study and investigation should be made on a situation where we have lost large displacement. We did not -- we do not expect under normal -- under the normal condition as we know to have displacement of this magnitude.

It is a long measure that we have to do something. We have to investigate and find out what is wrong and take corrective action. The question I believe you are asking is how far can we go up to point 25 inches before we have problems.

Is point 2 acceptable? Is point 17 inches acceptable? Or what? Most of the bearing plate of displacement, I believe less than a tenth of an inch. Several of them, in the order of five hundreds of an inch.

DR. SEISS: Let me say this. Both on the basis of those calculations I can make and on the basis of experience that we have gained from another plant that confirms those calculations, if there is complete fill, complete contact of concrete beneath the bearing plate, a movement of even a tenth of an inch or perhaps something that large relative to the immediately adjacent concrete, this should not occur.

There is just no way for it to occur by compressing the concrete below. It involves too high a stress compared to the stress you have, too large a strain compared to the stress you have. So I would think that any movement of the

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order of a tenth of an inch, and certainly without any question whatosever, movement of the order of a quarter of an inch would indicate that you did not have complete bearing, and that there had been some overstress, considerable overstress of the concrete immediately beneath the bearing plate.

So I don't quite see how you arrived at your criterion that if you only had a quarter of an inch, everything was fine. That certainly was not true from the experience at Calvert Cliffs.

MR. NODLAND: I recognize that, that a quarter inch displacement is a value that we better stay away from. If we do have displacement close to this value, obviously there is local high stress values. These are going into plastic, a certain amount of crushing takes place, and there is redistribution of stresses underneath the bearing plate.

And new equilibrium exists that then will be within an elastic condition. So a certain amount of this phenomenon is bound to take place. The question is how much is too much. And we believe the value chosen in this case also keeping in mind that the load on the bearing plate, stressing it up to 80 percent of ultimate and releasing it -- seeding at 70, then seeded and anchored, the bearing plate and the concrete beneath it has seen an experienced maximum load it will ever have. This size of load or these kinds of stresses, even under an accident or structural integrity test

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the increase in load under the bearing plate, if we have -- during construction and integrity test will be fairly small.

DR. SEISS: I think I can agree with you if everything is as you have postulated it. If I had a quarter inch void beneath the bearing plate and it depressed into that void, then contacted completely sound concrete, I don't think I would be concerned about anything except what it might have done to the tendon trumpet which we like to have intact in order to protect against corrosion.

But I don't know that there is any assurance simply because the movement has been point 14 inches that you had the conditions you have described. You have no way of knowing whether there might be very deep voids there, and that you have only flattened out the peaks and come to an equilibrium condition, and those voids might give you some trouble later on.

Of what type, I don't care to speculate. It just seems to me you don't know what is under there, you don't know what has caused this. You have postulated a cause which if it is correct, probably leads to a structure that is in reasonably good shape. But there are other things that could be there, and I think you need to find out. I understand the Staff has indicated that they would like for you to look at a couple of these. This is what the Staff wanted then on Calvert Cliffs, and I don't think anybody was too happy

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at what they found when they looked at it. They did not get the kind of comfort that you seem to get from your postulated conditions.

MR. NODLAND: I would like to discuss this if you please with Mr. Howard.

(Pause)

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MR. HEWARD: As Mr. Bernero pointed out, we do intend to meet with the Staff and discuss the matter. He expressed his interest to do this prior to the meeting and we agreed. The initial reaction I had to pulling two plates off was one that I have in the past pulled plates off on my own initiative for suspicious reasons, and to this date have not had any reason to do so, in that the concrete underneath the plates have been satisfactory.

Now, the Calvert Cliffs experience has been discussed there, but it has not been discussed essentially thorough enough for me to feel that I understand it because I understood the deflections there were considerably in excess of what we are looking at. However, we will talk to the Staff about it and proceed in a proper fashion.

DR. SEISS: I think at Calvert Cliffs some were considerably in excess. And that led to a little stronger recommendation that they remove plates. I might say they were equally reluctant to remove plates, at least for the first one. After the first one, I don't think there was too much reluctance, after they found something.

DR. MANGELSDORF: I gather that the point has been made, and that the Applicant and Staff agree that this needs to be reviewed further.

DR. ETHERINGTON: Under the worst possible conditions of nonsupport the plate would bend, wouldn't it?

MR. NODLAND: Would you repeat the question?

DR. ETHERINGTON: Under the worst possible condition of nonsupport, say supported at the end, the plate would bend, wouldn't it?

MR. NODLAND: Yes, definitely.

DR. ETHERINGTON: Has there been any measured bending in the plate?

MR. NODLAND: Not to my knowledge.

DR. ETHERINGTON: Has it been tested for bending, measured, I mean, for bending, straight edge across the plate?

MR. NODLAND: These displacement we are talking about here --

DR. ETHERINGTON: I understand that you are talking about, but I am over and above that.

MR. NODLAND: No, we have not.

DR. ETHERINGTON: The question really was did you measure to see if it had bent or not?

MR. NODLAND: No, we did not measure that.

DR. MANGELSDORF: Any other comments on this subject? Let's proceed with the next subject.

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MR. BERNERO: Mr. Chairman, yes, I would --

DR. MANGELSDORF: This is by the Staff. Go ahead.

MR. BERNERO: Yes, I would like to comment on the other matters which we consider as resolving or outstanding.

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This particular case we have reviewed with the Applicant the question of high energy line rupture outside containment. And the combination of that review and discussion with the Applicant, the Applicant has filed his amendment on this subject documenting that they have reviewed the plant in total following the Staff required criteria. We have that amendment under review at this time and will write a report on it shortly. The changes involved in the plant due to consideration of high energy line rupture outside containment are relatively few in number.

As I mentioned in the case yesterday, the question of the letdown line came up. If you follow the letter of the criteria, one perhaps ought to consider the letdown minus a cold water line, but we required the Applicant to treat it as a hot water line due to the change in heat exchange properties that would ensue if you had a full break. And modification in the area of the letdown line was found to be necessary to protect some cable waste, a pipe whip question. The Applicant has agreed to make this change.

The only other changes are in the intermediate building. This is an aircraft hardened structure which is on the side of the reactor building, generally opposite the auxiliary building. And it is the building which contains the reactor building penetrations and lead-off lines for the main steam lines and the feed water lines and the like.

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This plant is a two-loop plant. It has, however, four main steam lines penetrating or leaving containment. They run in the intermediate building along with the feed water system. And with the emergency feed water systems. The emergency feed water system components are located in the lower reaches of this intermediate building. A number of changes were determined to be necessary within the building with respect to the addition of pipe restraints and barriers. These are relatively routine matters and post no significant problem in identification or resolution. However, in one area, the main steam lines as they leave the reactor building go into the intermediate building through very small subcompartments.

As I said before, this is an aircraft hardened structure. It has a roof that is of the order of five feet thick, and the partitions within the building are of the order of three feet thick. In these small subcompartments two of the four subcompartments, the two smallest, are of such small size that it is possible that even such thick concrete partitions could be over-pressured by a double-ended rupture of the main steam line. These compartments are so tight that we agreed with the Applicant that it would not be reasonable to require encapsulation of the line because the mechanical problems of installing an encapsulating sleeve or device might indeed cause an unknown stress

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distribution because of the very cramped nature of the compartment. The structure itself is a hardened one. And to sta c cutting away concrete to provide vent area just flies in the face of reason because of the other requirement. So we accepted the proposal that enhanced in service inspection would provide sufficient assurance of the integrity of these critical welds in these subcompartments. These two subcompartments. And the tech specs will so require.

The Applicant has agreed to provide a 100 percent volumetric inspection of these welds at every cold shutdown, although not to exceed once every six months. If there are any questions in that area, I would like to treat them now.

DR. BENDER: Have you established with the Applicant some plan for checking the thermal movement of the piping systems and verifying that it is in accord with the design and that proper restraints are properly working?

MR. BERNERO: Yes, we have. There is in every case that we have, a review of the start-up and test program with respect to this. And vibration.

DR. BENDER: Who will do this inspection?

MR. BERNERO: Well, the Applicant would have to say who.

DR. BENDER: Which of the Applicant's staff? Will his own personnel do it or the architect --

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MR. BERNERO: I would have to turn that question to

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them.

MR. HEWARD: This will be done by the start-up and test organization at the site which is under our direction.

DR. BENDER: What information will you receive from the designers as a basis for determining?

MR. HEWARD: I am not prepared to say.

DR. BENDER: Well --

MR. HEWARD: I don't have that information right now to give you.

DR. BENDER: Do you have some plans for getting it?

MR. HEWARD: Mr. Behen advises me that Gilbert Associates, the engineer, will have piping engineers with the start-up and test people that are the system designers and provide this information to them.

DR. BENDER: It is unlike you will be able to directly simulate all the thermal effects that have to be accounted for in the design. How would one plan to verify the thermal movements?

DR. MANGELSDORF: We are not receiving you well on this end.

DR. BENDER: Do you want to repeat the question?

DR. MANGELSDORF: I will appreciate it. 1411 039

DR. BENDER: The question asked was since it is unlikely that you could simulate all of the thermal movement

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that had to be accounted for by design, how would one verify this in the preoperational testing?

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DR. MANGELSDORF: Okay.

MR. BEHEN: The conventional way of doing this is to check the pipe in the cold position to verify that the stops in the hangers are removed and the hangers have freedom, to heat up the pipes and then to visually inspect and check by measurement to see that the movements in the respective hangers are correct, that the hangers are not buckling, that they have moved and they have moved in the general magnitude that we expect.

We also check where a pipe comes through a sleeve that there is freedom in that sleeve or that restraint, or that snubber.

DR. BENDER: Unless the pipe comes to the temperature which you have specified for in -- over the range of conditions for which you design, you can't be certain that it is behaving all right merely because it is free after it is expanded. You wo ld have to have some prediction of how much movement it will have at a particular temperature.

Will you have a table or some kind of tabulation that shows how much movement you expect at each point of restraint?

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MR. BEHEN: We will have to have something of that magnitude, but I would like to point out that what we

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check this for is for the operating conditions and for not the higher design condition.

DR. BENDER: You have to check it for the design condition for which it is designed in some way.

MR. BEHEN: Design temperature is usually a rounded-off number of the operating temperature.

DR. BENDER: Yes, but the thermal expansion is a function of the maximum temperature which the pipe is likely to see, for example.

MR. BEHEN: I believe the curve you are talking about extrapolated would satisfy that purpose, could it not?

DR. BENDER: It could be interpolated rather than extrapolated, but you would have to do the interpolation.

MR. BEHEN: Interpolating from --

DR. BENDER: If the temperature doesn't happen to go as high as you predicted in design during the hot testing, and some portions of it probably won't --

MR. BEHEN: I see your concern, that you will not reach normal operating temperatures during hot functional.

DR. BENDER: I would be surprised if you did in some cases.

MR. BEHEN: In some cases, I think that's correct.

DR. BENDER: That is all. Thank you.

DR. MANGELSDORF: That covers your point?

DR. BENDER: Yes.

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DR. MANGELSDORF: Bob, where does that leave us on resolving items?

MR. BERNERO: The only one I would remark on now is the question which we discussed at such length yesterday on fuel densification. In this plant, the Applicant has submitted their final first cycle fuel densification report including the as built data. They have used the Staff recommended model for that evaluation in that report. The review is underway. They have also furnished the draft version of their proposed alterations to technical specifications due to the fuel densification analysis. However, that draft version does not include these most recent matters with respect to moderator temperature coefficient. The Applicant agreed yesterday and may indeed address that today, to provide a technical specification on moderator temperature coefficient with respect to limitation of power as long as the moderator coefficient is positive.

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And making more explicit or making explicit in the technical specification, the kilowatt per foot or peaking factor equation and definition.

And, lastly, the matter of the design transient hold period, of how we discussed yesterday the 100 percent to 30 percent and back-up would involve a hold at 80, and then the use of the in-cores to determine that.

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DR. OKRENT: A couple questions along this line.

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With regard to the moderator coefficient, it is my recollection that the bulk of the analyses reported by the Applicant used a negative coefficient. You have used the term "positive" to its zero moderator coefficient in your latest test discussion as a region in which power might be reduced. Do you have either the Applicant's or your own analyses for a zero moderator coefficient as compared to a negative one?

MR. BERNERO: I believe some of the B&W representatives can better answer this. But they displayed the results of some analysis for the effect of the change in moderator coefficient on a continuous basis, from the slightly positive through the zero and into the negative regime. It is my understanding that they will present adequate analysis to support the technical specification which will say words to the effect that, do not exceed X percent power unless the moderator temperature coefficient is zero or minus.

DR. OKRENT: So there is more information that you are going to review yet in this regard?

MR. BERNERO: Yes, that is my understanding. Perhaps B&W could amplify on it, to the character of it. 1411 043

MR. GLEI: Greg Glei, Babcock & Wilcox. Yes, Mr. Bernero's explanation is correct. I believe at the subcommittee meeting earlier this week, we did parameterize for the worst loss-of-coolant accident on the moderator

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coefficient. I believe it was analyzed from a ranже of a negative 1.8 up to a positive plus nine times 10^4. Delta K over K degree F temperature coefficient. And it is my understanding that we will supply, as the Staff indicated, this information or the results of this analysis to them for their review in establishing the tech specs.

DR. OKRENT: Could you tell me for a specific break what the effect was going from minus 1.8 to plus .9? I thought he might have it handy.

MR. GLEI: Yes, I do. The calculation for the worst cold leg break, this is 8.5 square foot break, at a moderator coefficient of a negative 1.8 times 10^4, the peak kilowatt per foot which gave you the approximately 2300 degree limit was 18.1 kilowatts per foot. At the positive plus nine moderator coefficient the tem-- 10^4, the resultant maximum kilowatt per foot was 17.5.

DR. OKRENT: Thank you. If I can continue with the Staff.

DR. MANGELSDORF: Go ahead.

DR. OKRENT: Is the Staff -- does the Staff have independent confirmation of the analysis of the -- this class of reactor over a spectrum of postulated loss-of-coolant accidents?

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MR. DE YOUNG: As I understand the Staff reviewed this matter yesterday, and as I recall, they said they did

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have independent calculations for a spectrum of breaks.

DR. OKRENT: I guess I will have to go back. I couldn't recall that that in fact was the situation. And this is partly why I am --

MR. DE YOUNG: We could check by a call.

DR. OKRENT: Could I ask another question? Does the Staff with regard to the control on what is called imbalance as an operating condition so one does not exceed limiting heat rating with regard to loss-of-coolant accident conditions, is the Staff going to independently examine the -- not only the proposed limitations, but the bases for the proposed limitations and verify to its satisfaction the technical back-up?

MR. BERNERO: Yes, the Staff will indeed verify the basis for the so-called shaded area and the alarms associated with it. One of the outstanding items of this matter I alluded to earlier is just that. The basis for it. And the Staff will so do.

DR. OKRENT: When you say you will do this, do you mean that in fact you will look into the, independently -- look independently into the calculations one has to do and the error estimates and so forth one has to do in establishing this?

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MR. BERNERO: Yes, I think that's -- I would condition the answer. I don't know that that necessarily means

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we would do an independent calculation ourselves. I would have to refer to the appropriate technical staff for that. But we will look into the method of calculation, and the error analyses necessary to have confidence in that calculation.

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DR. ISBIN: In this regard may I ask the Applicant's position with reference to alarms on the shaded area?

MR. CRIMMINS: The Applicant has indicated to the Staff that we will provide a tech spec that will include limits and monitoring requirements for the imbalance measurement.

We also have indicated that we will accomplish this monitoring by the use of computer calculations which will be alarmed, or by a manual calculation of the imbalance in the absence of an alarm.

DR. ISBIN: Would you mind going over that again and giving us a little more detail as to what you mean?

MR. CRIMMINS: Sir, the plant computer system which calculates the imbalance and displays it will have an alarm associated with it, and this will be a system on the plant.

DR. KERR: You refer to calculating the imbalance. Is the input from the ex-core or the in-core detectors you are using to calculate this imbalance?

MR. CRIMMINS: Those inputs are from the ex-core detectors. The operator also has available the --

(Pause.)

MR. CRIMMINS: Sir, I just wanted to verify this.

For the purpose of the manual calculation the operator also has available to him the displays of the in-cores.

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DR. KERR: You do plan to make use of the information from the in-cores to verify power distribution in the core?

MR. CRIMMINS: That's correct.

MR. HERBEIN: We intend to do that. We intend to verify power distribution in the core using the in-core detectors. That is true.

DR. KERR: Thank you.

DR. ISBIN: Coming back to the alarms from the ex-core, do you need to go through the computer to provide the alarm?

MR. CRIMMINS: Yes, sir. This will be an alarm on the computer. That's correct.

DR. ISBIN: May I ask the Staff: is this what was envisioned for the other cases, too?

MR. BERNERO: Yes, indeed, it is. This is what we envision for the administrative alarms we spoke of in the shaded area, that they will be computer alarms, with the -- for those occasions where the computer may be down there is the so-called manual backup available.

DR. MANGELSDORF: Mike?

DR. BENDER: Can the Staff say what it has done to evaluate the adequacy of the operation -- of the operator training with respect to the understanding of alarms and rod programming, control rod programming?

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MR. BERNERO: The Staff, of course, licenses all of the operators. For this project they have not had their tests yet. They usually don't have the licensing tests until fairly late in the game, prior to full load, and they are tested extensively against the operating procedures, the technical specifications, the emergency procedures.

Our examination is actually composed from their procedures and their technical specifications.

DR. BENDER: They are prepared by whom for this reactor?

MR. BERNERO: The tech specs, of course, you are familiar with. But the operating procedures, depending on the equipment or systems involved, are prepared by contractors and, in draft form, and given to the station staff to detail, and to review and approve. But they are applicant-furnished procedures, these detailed operating procedures.

DR. BENDER: That has not been done yet, but you plan to do it?

MR. BERNERO: No. In fact Jack Herbein might know right off the top of his head what the scheduled date is. But I would suspect it is sometime this fall.

MR. HERBEIN: Make sure I understand you, sir. Are you interested in just when we will take our examinations for license?

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DR. BENDER: Yes, and the status of the procedures and the operating procedures and that sort of thing that are necessary in order to take the examinations.

Evidently you need a set of procedures for the purpose of examination.

MR. HERBEIN: That is true. Our operating procedures which consist of alarm responses, emergency procedures, normal start-up and shutdown for various components and also cover various emergencies, are approximately 80 percent complete.

We anticipate that our operation staff will take their examinations shortly after the first of the year.

DR. BENDER: Are these procedures being prepared by you or by B&W or by both?

MR. HERBEIN: Yes to all. In some cases the plant staff prepares the procedures. In other cases B&W makes an initial cut at the procedure and then we in turn modify it.

In all cases the plant staff has the final approval of the procedures.

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DR. BENDER: What kind of review procedure do you have for evaluating whether the procedures are right?

MR. HERBEIN: Essentially the procedures are initially reviewed by the on-site review committee. The comments taken by the author are incorporated into the procedure. If the comments were of significant nature such

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as to actually change the intent of the procedure from the initial draft, then it is re-reviewed by the operations committee prior to approval.

Once approved, then the procedure is utilized in the field.

If it becomes necessary to change the procedure due to operational considerations, it is again reviewed.

The change is again reviewed by the on-site review committee and again approved.

DR. BENDER: Does the nuclear steam supplier review those procedures that affect the management of the control rods and that type of thing?

MR. HERBEIN: Those types of procedures are currently being reviewed by B&W site representatives, and we have given them a list of the procedures that we want them to review, and they are basically all the systems that are associated with the NSS.

DR. BENDER: What if you decide to change? What mechanism have you got, for example, for determining whether the nuclear systems' response is appropriate to the design intent as planned by -- in your procedural controls?

MR. HERBEIN: Let me see if I understand your question. You are asking if --

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DR. BENDER: I am saying there is a nuclear physicist that has designed this reactor essentially and

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planned some kind of management program for it based on some kind of rod program. It has some set of controls in it and some set of alarms for determining whether things are okay.

I am trying to find out how that guy or whatever he is knows that your procedures correspond to what he intended.

MR. HERBEIN: Well, addressing ourselves strictly to the imbalance question which is what I think brought this subject up --

DR. BENDER: That is one of the things.

MR. HERBEIN: All right. Certainly we are going to work closely with Babcock & Wilcox in developing the actual computer programs that will alarm this particular parameter. Certainly before we change anything that they had originally given us or we hadn't formally agreed to.

DR. BENDER: Will the procedures for this plant be very much like that of previous plants that are presently being put into operation by other --

MR. HERBEIN: I think that with the nuclear safety related systems that would be a true statement and true assumption.

DR. BENDER: Do you have any plans to take advantage of that operational experience that has been obtained on other plants?

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MR. HERBEIN: Yes, we do. We have got one of our engineers actually assigned to the staff of Oconee

Unit 1 and he is continually bringing back procedures which reflect the operating experience at Duke.

We also utilize his input in our test programs, brought back numerous test procedures we have incorporated into our program.

DR. BENDER: Thank you.

DR. MANGELSDORF: Herb, will you check your mike? Go ahead.

DR. ISBIN: With reference to the alarms, if for example you are successful in operating at zero imbalance, is it only administrative procedures which prevent the power level from possibly drifting upwards?

You have a trip set at 105.5, I guess, plus instrument error which might bring you flux error up to 112 percent, but are there any measures other than administrative which would indicate that you are in excess of 100 percent power?

MR. HERBEIN: Just a minute, sir.

(Pause.)

Sir, we have a computer alarm. I envision it will be set below the actual trip set point of 105.5. We are currently talking of setting it in the neighborhood of 102 percent. That is on reactor power.

DR. MANGELSDORF: Herb, does that finish yours?

DR. ISBIN: Yes.

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DR. MANGELSDORF: Dave, go ahead.

DR. OKRENT: In the general area of this -- I guess what has been called the shaded area, I guess, I would like to find out something from the Staff.

I have heard mention of the possibility of a hand calculation being used in the event a computer is not available. What is your state of knowledge of what is required with regard to calculations and what kind of a hand calculation would be done? Could it be done? What is all involved? Have you looked into this?

MR. BERNERO: Let me first answer that I, myself, have not looked into this in any detail. I know of the requirement of a minimum of in-core detectors in order to be at high power, and the recorders which are available to record or present the output of these in-core detectors, if the computer is not available.

I would rather defer to the Applicant to explain the nature of what we call the clipboard or hand calculation.

DR. OKRENT: But I am trying to ascertain whether the Staff has reviewed this matter enough, or has it well enough in hand that I need to explore it in depth today or another time as it were.

So I would like to continue with you a bit.

If that is all you have in that area, could I ask a different area?

With regard to the alarms that we have heard mentioned that would give an indication that you were exceeding the limits of this shaded area, how many alarms are there? Are they of any particular grade, safety grade, or however you want to put it? What kind of error do you anticipate could occur in these? Could you tell me a little of the Staff's understanding of that area?

MR. BERNERO: Well, implicit in the statement by the Staff that a computer alarm for this purpose is considered acceptable is the position that this is not what we would call an IEEE 279 100 percent available and so forth redundant and all the appropriate terms that go with that, that type of alarm.

This is an administrative limit and this is -- to ensure that the plant is operated within the tech specs so that the operator does not turn away or miss a dial movement.

As far as the errors associated with the alarms, the individual cuircuits which are used in them, I am not at all qualified to address that.

DR. OKRENT: Well, if I can go, then, to the next question. 1411 055

You just mentioned that this is an administrative aid and in fact, if I understand correctly, there is a considerable reliance on administration in the process of making sure you are within this shaded area, or at least what you hoped was the shaded area.

Again, if I understand correctly, if you are outside the shaded area for any extended period of time then in fact you will have more stored heat in the fuel than meets the interim acceptance criteria, if indeed you were at the 2300 point, just at the border of the shaded area. Is that correct?

MR. BERNERO: Yes, that is correct.

DR. OKRENT: Okay. Then why is the Staff satisfied that -- well, to me, at the moment, appear to be undefined alarms. I don't have a knowledge of their accuracy, and also an undefined kind of administrative control. Why are they satisfied that this is adequate to see that the Applicant's reactor has less than the limiting amount of stored heat in the reactor when, in fact, the stored heat is such a vital parameter in all of your accident analyses?

MR. BERNERO: The -- actually I think there is perhaps a bit of confusion here. The Staff in its review sets two types of limits. The one is the limiting safety system settings. We associate with these such things as reactor trips and the outer envelopes which we are not currently discussing here; these power flow and flux balance limits upon which the reactor trips are those which we associate with unacceptable operating conditions, that we must have a reliable, redundant system to stop the reactor

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operating if we reach any setting of that nature.

Within those bounds we have other operating positions, and we have a preferred normal operating band, the so-called cross-hatched area, up to 102 percent of power nad up to those lateral limits defined by approximately 5 percent imbalance and so forth.

Now, these are administrative requirements. We do not consider them with the same severity. We do not consider them as serious a deviation from the nominal as those limits which are the settings for trips.

So we have administrative controls on these.

In that context, getting away from flux and power for the moment, there are many plant operating modes or conditions, water level and steam generators, things of that nature, which are left to administrative control because their ordinary plant operatirg experience and procedures will keep them there.

It is prudent for them to know when they deviate from these nominal levels, but we do not consider it have a sufficient severity to immediately stop the operation of the plant.

So an administrative control has associated with it the possibility of what we might call an administrative grade alarm.

The computer alarm is just that. It is an

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operating aid to the plant just as the integrated control system which in truth operates the plant is an administrative aid. It enables this plant to operate smoothly and efficiently at nominal levels and provides the operators with sufficient time and relief of burden of operation to pay attention to safety-related things.

But we do not require it to be safety grade in the hard sense that we require high flux trip or something like that.

DR. OKRENT: But I wasn't --

DR. KERR: I think we ought to correct something I think is in error. That has to do with the statement that the margin of the shaded area was the 2300 degree limit. I do not believe that is the case, and I would like to ask B&W for clarification.

DR. OKRENT: That is important.

DR. KERR: Because I think -- I do not think if you go over the margin of the shaded area you go over the 2300 degree limit. But I would like verification.

There is still margin between the shaded area and the 2300 degree limit, is there not?

DR. STRATTON: I believe this was established yesterday, was it not?

DR. OKRENT: In the vertical direction.

DR. KERR: Dave asked the question and I think the

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statement was made that one did go over the 2300 degree limit. I think it is important to establish that.

MR. MALLAY: In our discussions yesterday we established that the area between the shaded area and the imbalance area was subject to exceeding the LOCA limit under the conditions of the maximum allowable quadrant tilt.

DR. KERR: No, Jim. My question is: if you go outside the shaded area, do you immediately exceed 2300?

MR. STEINKE: If you recall, the curve we showed, I believe we showed it again yesterday. We have the LOCA, locus of points, and we also had a -- had another curve which showed the maximum kilowatts per foot which the plant would be allowed to operate at, and there was some margin between that black line and the red dots.

DR. ISBIN: That is not the question.

MR. STEINKE: Just a moment, please.

If you stay within the shaded area you will stay on that black line, not on the red dots.

DR. ISBIN: Black line represents only a very special power transient. It is only one case.

MR. STEINKE: We considered that, I grant, that it was one specific case, but we consider that to be the design case, one of the worst cases.

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DR. STRATTON: Let me try --

MR. STEINKE: I don't think we intend to operate

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right up to the red dots, is what I am trying to say, so there is some margin.

DR. STRATTON: I think the question is still not answered. Let me try to sharpen it again. Assume the power, reactor power is, say, 60 percent, and the imbalance is plus .6, 6 percent, and you have at that instant loss of coolant accident, does the fuel pin anywhere in the core exceed 2300 degrees?

MR. STEINKE: No.

DR. ISBIN: I agree with that. But suppose you are at now the operating conditions which might be 100 or 102 percent power?

DR. STRATTON: The question was for the vertical part of the shaded area.

DR. ISBIN: I am not sure what the question was.

DR. OKRENT: My original question to the Staff was does that shaded area bound the 2300 and they nodded yes. And I pursue my questioning along the lines, if that was the case, need one not know that he is within it and that the measures that are available keep you within that limit?

Now, if, indeed, you have a margin of whatever it is, you can measure it 100 degrees or half a kilowatt per foot, whatever it is, to spare, then that says you have that much leeway in your control.

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I was pursuing it along the lines of their answer, and I would still -- I am still interested in the approach of the Staff.

Their approach, as I understood it, was that this in fact reflected the limit and that they were willing to go along with what appears to be an undefined error and a not completely specified error that might be introduced from the administrative control point of view, and to repeat, I was not talking about for something in the framework that, if you exceeded this, you would scram the reactor.

It seems to me the point is that you want to know you are within whatever is the acceptable peak kilowatts per foot. It was in that intent.

MR. BERNERO: Dr. Okrent, I am a poor spokesman on this specialized subject area, but my understanding is that the Staff understands or believes that the shaded area defines that bound of operating power wherein you can withstand the worst transient without exceeding the 2300 F ECCS fuel pin limit, or the centerline melting limit, whatever may prevail.

It is, therefore, the bound of that -- those operating conditions where you are not vulnerable to that transient. That outside that shaded area one can postulate the transient that will reach one of those limits.

DR. BUSH: You are really saying you may be potentially vulnerable outside the area, but not necessarily.

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MR. BERNERO: Yes, that is fair.

DR. STRATTON: No, this was established yesterday or the day before. The proper bound would be a trapezoidal shaped thing. I believe this is one of the points Mr. Ross --

MR. BERNERO: Yes. Dennis Ross did mention that -- this was somewhat arbitrarily slashed down to be vertical lines.

DR. STRATTON: That is the point. He will attempt to find the bound.

MR. BERNERO: Yes, if feasible he intends to bring it out to the regular trapezoids he mentioned.

DR. OKRENT: To make it clear, when I said in the vertical dimension I meant you didn't get to a higher kilowatts per foot. I wasn't talking about the lines straight up and down. This is particularly affected by an error, for example, in your measure of imbalance or so forth, and listening again to your answer I feel that my line of questioning remains as to why, if that is your interpretation of the limit, or whatever limit is established, whatever shape it has, why an unknown deviation from this, except that it won't presumably exceed scram limits, why an unknown deviation from this is acceptable to the Staff.

1411 062

MR. DE YOUNG: I don't think it is acceptable, Dr. Okrent. I think by the time the Staff gets through with its review of the proposed alarm limits and safety settings on this plant, they will be more than adequately conservative.

I think if the committee is concerned about this, and we can have the experts return within an hour or so --

DR. STRATTON: Careful about more than adequately conservative. Adequate is sufficient.

(Laughter.)

DR. MANGELSDORF: Dave?

DR. MOELLER: Changing the subject, going back to one we were discussing --

MR. BERNERO: Mr. Chairman?

DR. MANGELSDORF: Go ahead, Dave.

MR. BERNERO: Mr. Chairman?

DR. MANGELSDORF: Yes?

MR. BERNERO: Shall I call the experts? It takes them time to get down.

DR. MANGELSDORF: On this subject I think not. I believe that this last answer clarifies the situation enough that we will accept your position that it is something that needs further development which you intend to do.

Is that about right?

MR. DE YOUNG: Exactly right.

DR. MANGELSDORF: And I think that at least Dave and I think some others will be willing to accept that understanding.

1411 063

Now, Dave, you wanted to change the subject. Go ahead.

DR. MOELLER: I wanted to extend the discussion for a moment of the qualifications of the personnel responsible for various programs at the plant.

As I understand it, there would be radiation protection people, of course, on site, and then I gather that there is a top level health physics man at your home office. Regulatory Guide 8.8 suggests or recommends that the individual responsible for recommending and implementing the radiation control program -- and I assume this is your chief health physicist or chief radiation protection man, should be a professional of recognized competence in the field. And they suggest that one way of measuring this person's competence or meeting the qualifications is whether or not he meets the qualifications for certification by the American Board of Health Physics.

I wonder if the Applicant would tell me the name of the chief health physicist in the home office and whether or not he possesses such qualifications.

(Pause.)

MR. ARNOLD: The certification part is kind of what caught us off guard in that that is a relatively recent guide and our staffing requirements have not been completely reviewed in regards to that.

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Now, at the plant staff we have a man who is not certified by the National Association, but he has had extensive technical training in radiation health physics area. He has been involved in this discipline for approximately ten years.

In addition to that individual we have people on the GPU Service Corporation staff with extensive experience and training in the health physics area.

I don't know if it was misunderstood earlier, but the home office staff position is not yet filled. We are actively recruiting for it now, and in fact have an offer out for it.

That gentleman, if he accepts, will have a Ph.D. in radiation science.

I think that the intent of the guide to ensure that we have professional competence brought to bear and supervision and development and direction of the health physics program will be met.

DR. MOELLER: I think you have answered the question.

DR. MANGELSDORF: Other questions?

We have not covered the R&D, I think.

MR. CRIMMINS: Yes, sir.

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DR. MANGELSDORF: Is this a good time to bring that up, or are there other things you would sooner cover in developing your presentation?

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MR. CRIMMINS: It is your choice, sir. It is a very short presentation.

DR. MANGELSDORF: Go right ahead.

MR. CRIMMINS: Pardon me.

DR. MANGELSDORF: Go right ahead.

MR. CRIMMINS: Yes, sir. At the subcommittee meeting there was a question concerning TPUs and Met Ed's participation in R&D programs associated with ECCS and fuel densification.

Yesterday Mr. Montgomery of B&W outlined what R&D was being performed on these topics by Babcock & Wilcox Company.

In addition, GPU is involved with several other reactor vendors who are conducting experiments and research programs on these subjects.

GPU and its subsidiaries have been active in initating supporting research programs on these subjects.

GPU retained -- recently GPU retained the Exxon Nuclear Corporation to examine the irradiated fuel from our operating reactor by gamma scanning methods to determine pellet-to-pellet gapping. This data was subsequently used as the input to a power spoke model which was developed by GPU and submitted to the AEC in the Oyster Creek docket, 50-219, and the results of the inspection were also submitted at that time.

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Additionally, irradiated fuel has been supplied to GE for examination and the facilities have been made available to them and GPU has supported their examination of irradiated fuel from the Oyster Creek reactor.

GPU has also been actively involved in all phases of the recently initiated Edison Institute study on densification.

GPU representatives are actively participating in both the sterring committee and the working groups in this program.

The goal of this program is to achieve understanding of densification and to provide a capability to design fuel types with suitable reactor stability.

There is also materials investigations associated with this program.

Irradiations will start in early September. Basic hot cell data on density changes should be available by April of '74.

That completes my presentation.

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DR. MANGELSDORF: Any questions?

Let's proceed with the aircraft subject.

MR. CRIMMINS: Sir, as a result of the specific interests discussed at the subcommittee meeting we have prepared three presentations, first by Mr. Nodland of GAI discussing the hardening that has taken place on the plant structures. Secondly, Mr. Brannen to discuss the fire protection aspects of the aircraft protection systems, and Mr. Ballance of Pickard-Lowe Associates to discuss the probabilities of aircraft crashes.

Mr. Nodland.

MR. NODLAND: I will briefly go through what was done on aircraft hardening on Three Mile Island. The criteria that was adopted was, first, to protect the reactor coolant boundary. Second, to provide safe shutdown in case of an accident, and three, to prevent release of radioactive gases.

The buildings at the facilities that was designed for this condition were a reactor building, fuel handling, intermediate building, control building, auxiliary building, and water intake structure.

1411 068

This resulted in concrete,reinforced concrete structure, heavily reinforced at the thickness of five to six feet. Five to six feet, yes. The significant structural modifications for the reactor building as was -- was protection of the vertical tendon for use in a parapet wall of reinforced

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concrete to prevent she--ing of these tendons in case of the impact. Also protection of equipment access and personnel access. And also relocate penetrations into the reactor building within aircraft hardened structures.

The control building was provided with vibration isolation in case of an impact on the vertical wall. The framing, structural steel framing of the floors are mounted on neoprene pads, so they can move with respect to the wall. And Mr. Brannen will talk about the air intake structure into the control building and instrumentation has been done to prevent smoke drawn into this building through the air intake.

Intermediate building, the main steam line was protected up to the first isolation valve, and emergency feed water system is also in that part of the intermediate building. The spent fuel pool within the fuel handling building. The basic loading criteria was studied for a considerable time, and eventually went up to a 200,000 pound aircraft traveling at the velocity of 200 knots, which represent characteristics from a Boeing 720.

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We evaluated the structural characteristics of the aircraft, fuselage, mass distribution within the fuselage, buckling capability of fuselage and the deceleration during impact into a rigid barrier. We ha(some data, actual data of deceleration of a C-119 full scale aircraft running into a rigid barrier. These data were used to generate the similar

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characteristic for the Boeing 720 aircraft. Based on these data we then constructed a reaction time curve. This was generated also with and without wings, the engines and fuel, attached and detached. And the most conservative of these two reaction versus time curves were used.

The characteristic of this reaction versus time is of a significant influence on the design of the structures. Utilizing this load criterion on an undamped linear elastic one degree of freedom system, dynamic load factor was determined in terms of natural period. We could then perform a static analysis using the peak response value, determined from the reaction versus time curve.

The reactor building was analyzed for impact at grade impact below the ring girder, above the ring girder at the dome and at the apex of the dome. The slaps, roofs and walls were analyzed similarly using a finite method for analyzing the roof and the walls, and the peak values as I discussed, then determined maximum movement and shear for impact in different locations on these slabs with respect to support.

1411 070

The dynamic load factor was later challenged by the AEC staff. And we then made a check analysis using the yield line theory. This indicated there was considerable reserve capacity by the fine element method approach based on the elastic method that was adopted.

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We could then verify in this check analysis that the structures were stable. The peak, the force used in this check analysis was generated by multiplying the peak value with the maximum dynamic load factor. In addition, studies were made on bearing failures and shear of tendon anchors for both hoop tendons and also the vertical tendons, and also spalling.

This concludes this aircraft hardened design.

DR. MANGELSDORF: Thank you. Does the Staff have any comments on the aircraft protection problem?

MR. BERNERO: Well, as you may know I had some extensive comments during the subcommittee meeting on the basis of our evaluation. Do you think it worthwhile for me to review these again?

DR. MANGELSDORF: Only if you can summarize the conclusions.

MR. BERNERO: I am sensitive to my verbosity.

(Laughter)

1411 071

Our conclusion in this case was that we calculated an acceptably low probability, that is, less than one in a million per year for the impact of a damaging type aircraft using traffic density on the order of six to seven movements per day. And the aircraft of concern, of course, are the Boeing 707's size and on up from that. We have established independently that the current level of traffic at the airport

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is about five to six movements per day, not all that far below the basis of our evaluation.

We have therefore concluded and so informed the Applicant that a technical specification monitoring this heavy aircraft traffic will be necessary on an annual basis so that we can be assured that our basis of evaluation continues to be rational.

We noted in the Safety Evaluation Report the features of the evaluation which lend a sufficient conservatism that permits us to say that an order of magnitude increase in the traffic would be of the order necessary to cause us concern to re-review, or to reconsider the matters.

And we feel that it is appropriate to take a long term licensing action in this case on this basis because we don't expect this sort of traffic increase to take place at that airport. However, the technical specifications will equip both the Applicant and the Staff to catch the growth, if it does ever reach that point.

DR. MANGELSDORF: Dave?

1411 072

DR. OKRENT: If I can translate what you said into numbers, the limit which you stated of ten to the minus six and which I think is the number given in the paper presented by Eisenhut, ---

MR. BERNERO: Yes, the recent one at ANS ---

DR. OKRENT: Would in fact be less than what you

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would get if you took your number of five times ten to the minus seven, multiplied it by ten which is an order of magnitude, at least that is what I usually mean by an order of magnitude.

MR. BERNERO: That is true you would theoretically have five times ten to the minus six.

DR. OKRENT: You are proposing it would be acceptable to get to your -- a calculated number of five times ten to the minus six before you would take action here although your own limit is ten to the minus six as stated in the Eisenhut paper.

MR. BERNERO: The annual tech spec enables us to gather information on a sufficiently frequent basis that we can take action at any point prior to an order of magnitude increase. It is not rational that the heavy traffic would go up in an order of magnitude in one year.

Ten percent change, 20 percent change, it would have to double to reach the ten to the minus six level so that there is more than adequate time for the staff to react to traffic increases.

1411 073

The allusion to an order of magnitude, a factor of ten increase, is based principally on the known conservatisms in the calculation as presented in the paper by Eisenhut. If you look in our safety evaluation report or in that paper, you detect a number of things, the impact or target

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area of the plant is point 01 square miles per unit for the Three Mile Island Station.

By the way, all of this is based on the station 2 units, point 02 square miles. That is a very large area for the plant. As I recall, 280,000 square feet. If you took it in reactor buildings it would be quite a few of them. The assumption of movements is such that we assumed all takeoffs are toward the plant and all landings are from the plant's direction.

And the way we treated the crash probability, we ignored the angular distribution off the center line of the runway. We calculated the crash probability per unit area independently of the angle of deviation from the flight path, and in essence said there is a constant crash probability at that radius, that radial distance from the end of the runway.

And we therefore assumed that all aircraft traveled directly over the plant. Getting back to one point in the target area I should mention, the impact or critical impact points are limited. We assume not only a relatively large area for the plant, but we assumed that any impact on a plant by an aircraft of that size is indeed a potentially damaging impact, whereas our threshold of analysis is an impact of that size on a critical point, the apex of the dome, or so forth. So it is these conservatisms in the analysis that suggest to us that the -- a more realistically calculated

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probability would not indeed exceed one times ten to the minus six which is our nominal assessment level.

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DR. SEISS: Is it correct that only the structural design of the containment is limited to the 200,000 pound aircraft and that the provisions for fire protection would be protection against a larger aircraft hitting somewhere on the site?

MR. BERNERO: Yes, this is the Staff's position, that we accept that the provisions for fire protection and air shock and so forth are adequate for the aircraft landing elsewhere. The threshold of concern is the impact of the larger aircraft on a structural consideration, a penetration question.

DR. MANGELSDORF: Other questions?

(Pause.)

DR. MANGELSDORF: The subcommittee chairman, having heard the other two sections of the discussion on aircraft protection suggests that we might delete those for this session, assuming that the members of the committee of no exception. Now, approximately what is the length of this post-LOCA presentation?

MR. CRIMMINS: Sir, under that topic we had planned to address at your request the paragraph in the TMI 2, original construction permit ACRS letter, and that is just a few minutes.

1411 076

DR. MANGELSDORF: Go right ahead.

MR. CRIMMINS: Mr. Gilbert of -- excuse me, Mr.

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Sailer will address that from Gilbert Associates.

MR. SAILER: Thank you for that promotion, Tommy. I won't have to work next week.

I am William Sailer; I am Gilbert Associates project manager for Three Mile Unit 1. Tom has asked me to give a brief presentation on a paragraph which was contained in a July 17 letter on TMI Unit 2, which is the same as Unit 1. It asks us to discuss the potentially abrasive slurries that may be inside the containment building in the sump when we go into the post-LOCA mode. We recirculate the water through the reactor building sprays. This system has been looked at. The letter addressed pH, and we do have pH control. We have remote sampling in the control room and we can adjust the pH by admitting sodium hydroxide into the suction side of the decay heat pumps. So that should the sample take and indicate we need pH control, we have the capability to adjust it.

1411 077

It asks us to address temperatures and we have done that. Design temperature of the equipment is 300 degrees F and 350 pounds, and the peak temperature of the fluid coming out of the sump is 218 degrees F. And you can find this number in Table 6-11 of the FSAR. You can also find the equipment specifications in Table 6-3 of the FSAR. Another question in this paragraph is the compatibility of materials, and we have no dissimilar metals. It is all

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stainless steel 304, including the pump casings. We expect no kind of abrasive slurry in this building because we do not to the best of our knowledge have any materials in there that are going to form a slurry. We have used all reflective metal insulation inside containment, which does not dissolve or mix with the spray solution to become a slurry. We have screens over the sump which have a one-eighth inch pole diameter, and the pumps themselves will pass a particle up to a quarter of an inch. So we believe we have adequately protected the suction side of the pumps. That concludes our presentation.

DR. MANGELSDORF: Any comments you care to make? Any questions from the committee?

DR. BUSH: One quick question.

DR. MANGELSDORF: Yes.

DR. BUSH: You say you control your pH by sodium hydroxide additions. What is the storage technique for your sodium hydroxide?

1411 078

MR. SAILER: The sodium hydroxide is stored in a chemical tank in what we call the chemical addition area. If you need any more detail than that, I would like to call on my nuclear engineer to address whatever other question you may have.

DR. BUSH: The question really is, is it a pumped system, in other words, to get it into control, the pH you

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pump out, is it a gravity feed or what? Somebody, I suspect, knows --

MR. LARSON: Archie Larson, Gilbert Associates. It is a pump system. We have a positive displacement pump which we normally use to meter sodium hydroxide to the tank where we neutralize the regeneration slugs from the spent resins, and this same pump and tank are utilized to pump sodium hydroxide into the suction side of the KE pumps.

DR. BUSH: So the probability of getting slugs into the system is pretty remote.

MR. LARSON: Right. I think it is a 10-gallon per power pump. We don't anticipate having to add at any great rate, bring the pH back into the desired range.

DR. BUSH: Primarily it goes into the one tank and you don't have much chance for hideout then?

MR. LARSON: That's right.

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DR. BUSH: Thank you.

DR. MANGELSDORF: Any other questions on this subject? We have one on another subject.

DR. OKRENT: Could I ask the Staff a question? On page 6-4 of the safety evaluation there is some discussion of net positive suction test. I couldn't tell whether this plant meets regulatory guide one point --

MR. BERNERO: No.

DR. OKRENT: Over what period of time does it not meet

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regulatory guide 1.1, postulating an accident at time T equal zero?

MR. BERNERO: I believe the peak sump temperature was mentioned just a few moments ago. It is a number of the order of 220 degrees Fahrenheit. And the regulatory guide one is applied in a calculation at the postulated time of transfer from the direct injection to the recirculation mode of operation. And the sump temperature at that time is taken. Now, if you go into the FSAR, Section 14 there, or 15 in this -- 14 in this case, you find that the sump temperature curve for the design basis accident is relatively steep. I am just estimating from memory, but I would say that the slope of that curve is such that the time during which regulatory guide one requirements would not be met are -- that time is of the order of minutes, something I would just guess it is on the order or 10 to 20 minutes at the most.

1411 080

Assuming there is no mechanism for the reactor building pressure to get -- well, actually, the substance of the question with respect to regulatory guide number 1.1 is, should you assume the initial pressure, namely atmospheric pressure for this containment, and use that against the vapor pressure existing at the time of peak sump temperature, which is the vapor pressure associated with whatever that number is, 218 degrees Fahrenheit. So it is the discrepancy of six or eight or whatever it is degrees Fahrenheit. I just

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don't believe the condition exists for more than a few minutes.

DR. OKRENT: Could I ask the Applicant, over what period of time he doesn't meet regulatory guide 1.1 if he does not meet regulatory guide 1.1?

MR. CRIMMINS: We will have to check our FSAR on that point. We don't have that available.

DR. OKRENT: If I understand correctly, if it were a matter of many minutes, you would -- and there were an opening in the containment, then in fact would you -- would it -- a large opening?

MR. DE YOUNG: A large opening.

DR. OKRENT: Yes, indeed. Would you lose your ability to cool the core?

1411 081

MR. BERNERO: No, I think if you postulate a -- the mechanism associated with regulatory guide 1.1, you have hot water in the sump that is in equilibrium with the pressure above it at, let's say, 218 degrees Fahrenheit. Opening a large venting area through the wall of the containment would cause momentary flashing, and the limiting case here would be one of the time it takes for the sump to achieve a new equilibrium with the new now atmospheric pressure. It would not be some calculated value out of that curve of how long it would take in the model for the sump to cool from 218 to 212. If you have ever worked with a condensate pump or something

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like that and get a steam bubble in it, there would be a moment of cavitation, but I envision and can see no risk of loss of cooling in a meaningful sense of the word. There would be a momentary instability in the system. The sump would achieve its new equilibrium at 212 degrees Fahrenheit by the simple mechanism of flashing. Then the system would then again be pumping at atmospheric pressure and a saturated 212 F sump.

DR. OKRENT: I guess I can't tell that it would flash, you know, in a matter of seconds as compared to minutes. But I will not pursue it any more.

DR. BUSH: New area. First a question, then I will follow up. With regard to your base line inspection, have you documented this so -- I couldn't find the documentation. I realize you only require partial base line inspection in this plant.

MR. HEWARD: Would you please explain whether you mean the results of the inspection or whether the commitment --

DR. BUSH: Oh, no, I know you made the commitment. You have no option. I presume you have done the inspection by now, and I am just asking whether it's been documented.

MR. HEWARD: I believe the answer is that the inspection is in process and --

DR. BUSH: It is not complete yet, in other words?

MR. HEWARD: Yes.

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DR. BUSH: I am surprised this late in the game -- does anybody know the results to date?

MR. HEWARD: I know of no problems to date.

DR. BUSH: Nothing you have heard, had nothing reported as untold?

MR. HEWARD: That's correct. No, it might make you feel more at ease to know we did some preliminary inspections where we actually got to our base line inspection. But we don't really feel we are going to have a problem.

DR. MANGELSDORF: Does that come close enough to answering your question?

DR. BUSH: Well, the answer is that there isn't an answer right now. But I guess that's okay. I know what the commitment is.

DR. MANGELSDORF: I guess it is not surprising that it isn't completely written up. Are there any other questions? Dave?

DR. MOELLER: One of the Staff. You allow in terms of the assessment of a fuel handling accident, you allow 99 percent for the removal of the iodine in the spent fuel pool. That is, the water uptake. What is the chemical composition of the water in the fuel pool, that is, you know, why does it take out 99 percent of the release?

MR. BERNERO: A moment, please.

(Pause.)

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MR. BERNERO: The removal capability of the water in the spent fuel pool which is merely boric acid, you know just borated water, is based on test data, measured data. It is a solution phenomena.

DR. MOELLER: That answers it. Thank you.

DR. MANGELSDORF: Any others? I am going to suggest that the committee recess for lunch and reconvene in caucus, which means that we will reconvene in another room and rejoin the Applicant after our caucus. We will be reconvening at 3:00 o'clock.

The committee will be reconvening at 3:00 o'clock in caucus and would expect to -- I need to recalculate the time here. 2:30 we will be reconvening in caucus, and would hope to join the Applicant not too long after that.

(Whereupon, at 1:45 p.m., the meeting was recessed, to reconvene in caucus at 2:30 p.m., this same day.)

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AFTERNOON SESSION

(3:00 p.m.)

DR. MANGELSDORF: Mr. Miller, you don't have to stand. This is not a sentencing.

(Laughter.)

Recognizing the fact that we spent yesterday, as you or some of your people may know, in reviewing some of the generic items having to do with B&W reactors and having reviewed plants similar to the one that you have presented an application for, and recognizing that we have not separately reviewed all of the features of your plant that we would have reviewed if we hadn't had such a generic general discussion, the committee believes it is prepared or thinks it can write a letter to Three Mile Island at this meeting. You have the last word.

MR. MILLER: Thank you. We appreciate your consideration.

DR. MANGELSDORF: Very good. Thank you very much.

(The hearing was recessed, and reconvened at 4:45 p.m.)

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DR. MANGELSDORF: Gentlemen, can we come to order?

This is an open meeting of the Advisory Committee on Reactor Safeguards for a preliminary consideration of an application by -- pre-application site review, I should

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say. This is a limited review of a project being considered by Public Service Company of New Jersey for the Atlantic Nuclear Generating Station. This meeting is conducted in accordance with provisions of the Federal Advisory Act and in attendance at this meeting is Mr. Ray Fraley, who is designated as the federal employee for this meeting.

The rules of conduct for the meeting were distributed with the notice of the meeting. They provide for presentation as could be scheduled by members of public upon due notice and meeting the requirements and qualifications to make a presentation.

Mr. Fred Walton has qualified, has asked for permission to make brief remarks, and we will ask him to go ahead now.

MR. WALTON: My name is Kenneth B. Walton of Brigantine, New Jersey, which is the city closest to the proposed site for the ACRS.

As a long-time member of the American Nuclear Society, now emeritus, I have been -- I am here retained by the city of Brigantine, the mayor, the city commissioners and through them the people, to advise and report on the public hearings on this project which -- in which we are very much interested.

1411 086

My statement is only to express the continuing interest of the city of Brigantine in this proposal and to --

in fact I might go a little further and say that among some people in Brigantine this interest is a little bit more intense. It goes to the point of being concern, in some cases, fearful concern. And we hope that the facts as they are unfolded will do much to allay this fear.

I wanted to make the request that we may continue to be kept in touch with the facts about and plans for this station as they are unfolded through your procedures.

Thank you very much for giving me this opportunity, Mr. Chairman.

DR. MANGELSDORF: Thank you, Mr. Walton.

We, of course, are concerned mightily in our deliberations here with the safety of the public, adjoining and located in all areas adjoining sites of projects that are considered before us. The health and safety of the public is of utmost consideration in our deliberations.

We will then proceed with presentations by Public Service, as planned. And I will call on Mr. Kehnemuyi to make what introductory remarks he would like to, and then proceed to introduce the speakers. 1411 087

I should say also that there will be a transcript of this meeting made available, and in order for the reporter to properly record the meeting, I will ask that each of you, as you rise to make a presentation, introduce yourselves and that you then proceed to speak clearly into the microphone because the acoustics in this room are somewhat less than perfect, and it is necessary to use the microphones effectively in order that all those present and the recorder can hear your remarks.

You may proceed.

MR. KEHNEMUYI: Thank you.

Good afternoon, Mr. Chairman, members of the committee, ladies and gentlemen:

My name is Mr. Kehnemuyi. I am project manager for the first commercial offshore nuclear generating station, the Atlantic Generating Station of Public Service Electric and Gas Company.

On December 14, 1972, we submitted to the Atomic Energy Commission our preliminary site description report for this project. We requested from the Directorate of Licensing Staff, and the Advisory Committee on Reactor Safeguards that they conduct an informal review of this document.

The purpose of this request was to solicit your comments, suggestions, and advice to assist us to prepare and submit an adequate and complete Preliminary Safety Analysis Report.

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We felt, and still strongly do so, that this kind of review and resulting feedback is of utmost importance in the licensing of a new, unique and novel concept of

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placing a nuclear power plant offshore. We are hoping that in conclusion of these preliminary review hearings, the committee will issue a letter stating its views on the concept, and comments on which subjects should be covered and highlighted in our formal application for a construction permit, the Preliminary Safety Analysis Report.

The committee on November 15, 1972 had issued a similar letter covering the platform-mounted nuclear plant concept following a series of hearings with offshore power systems. We, Public Service Electric and Gas Company, had also participated in these meetings. Following our submission of the preliminary site description report, six meetings were held with the Directorate of Licensing Staff. And three with the ACRS subcommittee, five of them, meetings with DOL Staff were held in Bethesda, on January 9th, 1973, when we discussed the content of the preliminary site description report, on February 6th, the break-water design; and on March 21st, and May 6th, the mooring system was reviewed and on March 13, the water levels for storm and hurricane conditions were reviewed.

The sixth meeting with the Staff was held at the Coastal Engineering Research Laboratory in Gainesville, Florida, last Friday, August the 3rd, 1973. Our meetings with the committees shown on this view graph --

(Slide.)

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We had a subcommittee -- excuse me. We had a subcommittee meeting at Waterways Experiment Station in Vicksburg, Mississippi, where two members of the committee were present, and your consultants on March the 2nd, 1973. I have listed the Staff meeting which I mentioned at the Coastal Engineering Research Laboratory, University of Florida, which was held last Friday along with these, because one member of the ACRS was present at that meeting.

The first subcommittee meeting held in Washington was May 23rd, 1973. And the second one, on June the 20th, 1973. And, of course, today's meeting on August the 10th, 1973.

I would like to review with you the schedule of the Atlantic Generating Station licensing process.

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As you know, these reviews are somewhat unique compared to a land based plant. There would be two parts to it, the plant reviews and the site reviews.

DR. PALLADINO: Excuse me. I wonder if I could make a correction for the record.

That first meeting at Vicksburg was not a subcommittee meeting. It was a meeting of the Staff in which two of the members of the subcommittee went.

MR. KEHNEMUYI: Oh.

DR. MANGELSDORF: There is a difference.

MR. KEHNEMUYI: Therefore, there were seven subcommittee -- there were seven Staff meetings rather than six.

DR. MANGELSDORF: Just a technicality. We need to have it reported properly. Thank you.

MR. KEHNEMUYI: For the record, then, there were seven DOL Staff meetings, and only two subcommittee meetings, altogether.

The off-shore power systems made a pre-application of the -- for review of the platform-mounted nuclear plant on April 26, 1972.

The -- after several meetings with the Staff and the ACRS subcommittee, and full Committee, the AEC Staff comments were received for this pre application review on October 20, 1972, followed by other meetings with your

Committee resulting in an ACRS leetter for the platform-mounted plant review, the concept review only, November 15, 1972.

This letter indeed outlined your thoughts about what should be included in the formal application by offshore power systems.

We, as the first utility who will be placing these plants out in the ocean, made a pre-application request -- request for pre-application review on December the 14th, 1972.

We have received, following the number of Staff meetings I mentioned, we have received the DOL Staff comments for the pre-application made on June the 8th, 1973, quite a document, which also lists their thoughts and guidance to us as to what they would like to see in a formal application, which is, by the way, of great help to us in our preparing the formal application.

We are hoping that in conclusion of the meetings with your Committee we may, if you think you have heard us tell you all about the site, receive a letter from you this month, August, 1973.

The offshore power systems submitted their plant description report for review on January 23rd, 1973. These documents were docketed or accepted for docketing on June the 8th, 1973.

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We, as Public Service Electric and Gas, hope to submit or will submit a preliminary safety analysis report on about the last week of September, September 24, 1973.

This is what our schedule is.

Now, the question why the schedule. There is a reason for this. The construction of breakwater and other site-related items take approximately four years for construction. The -- it is anticipated, or it is our schedule that we will receive the first unit of these floating plants on the site on July 1979.

In order to do this we must start or complete our site construction June of 1969. Just about that time. And to do this, working backwards with a four year lead, we must start our site construction June of 1975, and, therefore, we really need a site construction license at that time.

The commercial operation of Number 1 Unit is May 1, 1980, and this is our schedule, and I hope that we will be able to meet these.

Just a brief word about the site. We are going to cover this more in detail with other speakers, but I would like to touch a few highlights here, if I may.

By the way, there are handouts of all the schedules that I have shown on the screen. They are available. They are printed.

(Slide.)

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The site is located some approximately three miles off the New Jersey coast. Just for clear definition of what that means in that area, we draw a line between the sou h end of Long Beach Island, and Brigantine area here, and it is measured from there out to the point of the -- to the site.

The line is drawn through here and the measure is made from that line out to the plant.

To be exact, the center of the plant, the center point of the plant, is 2.8 nautical miles. The toe of the breakwater happens to be some 200 feet away from the three nautical mile line. So we are just about at the three mile limit.

The site is located some twelve miles northeast of Atlantic City, and seventy miles from New York City.

The south area will be 186 acres.

This is the application we have made to the State of New Jersey for riparian rights to place this plant on.

The actual area that this plant covers is quite small. It is about 70 acres. If it were squared out, if one didn't follow the ins and outs of the thing, it would only cover 105 acres.

So it is, indeed, not a large area.

(Slide.) 1411 094

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The plant configuration which you have seen before in our presentations to you in the offshore power systems pre-application review is still the same.

We have a breakwater that is curved, horse-shoed manner, facing the ocean side, and there are two units, 1150 megawatts net electrical output each, located within this breakwater.

There is a straight portion to the breakwater which looks at the land side, the shore of New Jersey being right here at the bottom of the screen.

We will describe the breakwater in more detail as we go along today.

(Slide.)

The cross-section of the breakwater still remains the same. The caisson, the rubble mound with the dolos as the armored section on top.

There will be more descriptions of this again.

(Slide.)

I should mention some dimensions here. The break-water stands 64 feet above the mean low water level. It is indeed a very high structure and, of course, the depth of water at the site is approximately 40 feet. So, therefore, the height of the breakwater from the bottom of the ocean is some 104, 105 feet, and the breakwater measures over 300 feet across the bottom.

(Slide.)

We have built a 1-to-64 scale model of the breakwater and the plants within it, properly modeled, to give us the motions of the plant when it is subjected to the waves of probable maximum hurricane or the design basis, I mean the operating basis storms.

This picture shows the basin at the University of Florida in Gainesville where we had the meeting last Friday where we are now starting the measurements on the motions of the plant and the sizes of waves.

There will be more about this again later today by some other speaker.

That concludes my statements. If there are any questions I would like to answer them now and then we will go to the next speaker.

DR. MANGELSDORF: Any questions of Mr. Kehnemuyi?

(No response.)

Why don't you then proceed with your next item?

MR. KEHNEMUYI: The next speaker is Mr. Joseph Fischer of Dames and Moore who is going to describe the site in more detail than I did in something like five or six minutes.

MR. FISCHER: I am Joseph Fischer, a partner in the firm of Dames and Moore. I will try to start with the population, and I am sorry, but could I view the viewgraphs and then switch to the slides and then go back to the viewgraph and then back to the slides.

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We have taken a look at the present-day population out there and attempted to extrapolate it by fairly standard means up to the period of 2000 and 2020.

A few numbers that go with this. In the zero to ten mile radius at the present time, 1970 census, there are about 12,000 to 13,000 people.

(Slide.)

The year 2000 this would increase to about 40,000 people. In the year 2020 it would increase to about 50,000 people.

There is a seasonal resident population that we have also looked into. For the year 1970 this is about 32,000 people. Year 2000, about 96,000 people. And for the year 2020, about 114,000 people.

This does not include the Labor Day crowd, but this is a recreation area and there are more people who live there during the summer than during most of the year.

For comparison's sake we have plotted the population of people, people and population, miles from the site, which you can't see up her e, zero, 10, 20, 30, 40, 50, and the number of people as you go out.

Our site is essentially this line here, and, as you can see, it is much lower than a number of the other sites.

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This is Calvert Cliffs, Oyster Creek, Susquehanna, Salem, Ginna.

So certainly for comparison purposes we are in an area of low population.

The physio -- physiographically the -- oh, incidentally, this graph is in the PSAR and it is Figure 7.7-7 if anybody wishes to take a look at it.

Physiographically we are in the inter portion of the Atlantic continental plain. We are about 50 miles southeast of the fall zone. The continental shelf is a continuation of the Atlantic coastal plain.

(Slide.)

We have taken a look at the regional picture. The site is essentially in an area that is pretty much the same for the entire coastline. The site lies up the inlet here.

We have the edge of Long Island. New York City up here.

The symmetry of the whole coast essentially goes in this direction with the grain lying along in that general direction.

Atlantic City about here. Cape May is here.

This will give you a rough idea.

The Piedmont, edge of the Piedmont plain is roughly in through here.

Now, the nearby land use -- and by nearby I mean roughly in here, zero to ten miles, for example, you have

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primarily wetlands which are now protected by New Jersey law, a wildlife refuse and small beach type communities such as Brigantine.

I think it is very typical of the area lying around the coast.

Geologically -- and can I go back to the transparency again?

(Slide.)

Geologically what we have in this area of New Jersey is essentially a layer cake with everything dipping from the Piedmont plateau down toward the coast. Series of soils which have been deposited under marine and non-marine conditions, sloping this way at roughly 25 feet per mile.

This is exaggerated, obviously.

They are essentially inter-bedded sands and clays continuing down to rock at a depth in the site area of about 5000 feet.

Hydraulically, this results in a sloping surface that you can see. And this slide is essentially in -- let's see Figure 2.5.1-7.

The cross-section is good from a hydrologic condition.

1411 099

As you can see, if you have a series of aquifers and aquaclude -- by aquaclude I mean water barriers -- that there will be no possibility of influencing any wells that

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might be along the shore.

Water will flow essentially down to an aquaclude and then go laterally without penetrating upgradient.

So hydraulically there seems to be no way in which the plant site could affect any nearby community's water supply.

The rock is a continuation of the piedmont plain to the west. The structure is generally northeast-southwest. And the last period of tectonic activity is about 200 million years ago, roughly what we call the triassic period.

The nearest map fault is the Cream Valley-Huntington fault which is roughly 50 miles to the west-northwest. This is a strong fault running roughly northeast-southwest.

A slightly anomalous feature we have to the north of the site roughly 60 miles is the Calvin Cornwell structure. That has been postulated, hasn't necessarily been proven to exist.

Aside from these two features there is nothing of any significance anywhere near the site geologically. It is a relatively featureless coastal plain.

So look at the seismicity of the area. We have taken into account all the earthquake activity. The major shocks that have occurred are at Asbury Park, intensity 7; and Wilmington, Delaware, intensity 7.

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The two larger shocks were both 50 to 60 miles

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from the site.

We have assumed that either of these shocks, for purposes of design, could occur at the site, with resulting accelerations on the range of 10 to 15 percent G.

However, the plant will be designed to surface accelerations of 20 percent G in the foundation soils.

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(Slide.)

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The local site conditions compares very well with the regional picture that we gained through primarily a use of the available information. Investigations performed at the site --

(Slide.)

-- consisted of a series of test borings, vibra cores, seismic reflections, aerial "mag" and down-hole logging. The site lies here.

What we find is the same typical bi-symmetry, lying this way, the swale lies over here, so the site fits in geographically and logically with what you would expect from the regional picture.

The soils we found on the basis of the work done at the site -- incidentally, that last slide was Figure 2.5.1-13.

(Slide.)

1411 102

The next slide is 2. --

DR. BENDER: What are your references?

MR. FISCHER: The PDSR -- PSDR.

This slide is pretty much the information on 2.5.1-14(b).

What we have are a series of medium dense sands, medium stiff clays, dense sands and clays, and this continues to the depth of the borings. The deepest hole we drilled was about 285 feet. The breakwater and mooring caissons

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are being designed with the knowledge of what exists out there. There has been a continuous interplay between Dames & Moore, the people who have done the field investigations, and Frederick R. Harris, the people who are doing the design and Public Service. So that the work includes -- the design work includes the effects of the soil conditions and everything works together.

On the basis of the work that we have done, I think that we can say that geologically the site appears to be pretty good. Essentially typical of the area. And from a land-use and population-use, is also good, probably atypical of New Jersey.

Are there any questions?

DR. MANGELSDORF: Any questions?

Does that complete your --

Joe, were you about to make a comment?

DR. PALLADINO: I was going to ask if consultants, I think one of our consultants has some questions.

DR. MANGELSDORF: All right. I was going to suggest that we have the Staff comment. Is that order satisfactory to you?

1411 103

Are there any comments from the Staff at this point?

MR. BIRKEL: We would like -- Mr. Chairman, we would like to make an introductory summary with regard to our review of the application at this time, or at the appropriate time that the Chairman would like.

DR. MANGELSDORF: As far as I know, this would be an appropriate time.

DR. PALLADINO: I was going to suggest if we have questions on this specific topic, why don't we cover those?

DR. MANGELSDORF: All right. Are there questions on this topic? On the presentation as we have just heard? There will be opportunity also after we have heard the other comments on this topic. Any questions on this topic?

MR. PHILBRICK: I would like to inquire, on the right-hand side of your slide, this last one, you show a slightly different type of material than you have on the left-hand side of the slide. You have really a two-layer system on the right and a multi-layer system on the left.

(Slide.) 1411 104

As I read that slide, the dotted materials forming a major part of the foundation is sand; is that right, Joe?

MR. FISCHER: Yes, this here is the medium -- fine to medium sand, primarily, some small amount of travel.

MR. PHILBRICK: The stuff diagonally hashed to the left above that, what is that?

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MR. FISCHER: A silty clay.

MR. PHILBRICK: Where is the site itself?

MR. FISCHER: The site would be right in through here. The breakwater covers a pretty good sized area.

MR. PHILBRICK: So the breakwater is sitting on top of some silty clay?

MR. FISCHER: Right.

MR. PHILBRICK: Below which is some sand?

MR. FISCHER: Right.

MR. PHILBRICK: Which is the last subject to deformation under seismic activity?

MR. FISCHER: The less --

MR. PHILBRICK: The less subject to deformation?

MR. FISCHER: Okay. I guess the sand will be. Am I right on that one? I am trying to figure out, the clay is closer to the load. The whole thing responds as a unit. And we will have some greater deformations in the sand during -- I mean in the clay during dynamic load. 1411 105

MR. PHILBRICK: All right, then, the foundation change, the settlement, is primarily in the clay, isn't it?

MR. FISCHER: Static settlement. There would be virtually no settlement on the dynamic loads.

MR. PHILBRICK: All right. Why has there been a concern about liquefaction?

MR. FISCHER: There are some thin layers of sand

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on top.

MR. PHILBRICK: How thick are they?

MR. FISCHER: They range up to a maximum of about 15, 18 feet.

MR. PHILBRICK: Do they extend below the level of dredging?

MR. FISCHER: Yes.

MR. PHILBRICK: They do?

MR. FISCHER: In some cases, yes.

MR. PHILBRICK: You say some cases. Do you mean, then, that these are not continuous layers over the entire foundation of the breakwater?

MR. FISCHER: Right. Yes, we are down to some places almost no sand on top.

MR. PHILBRICK: Would you improve your position with respect to stability as a seismic Class A, Category A structure, if you stripped off the upper materials and founded your structure on the clay?

MR. FISCHER: No, I think under the present design that we would get essentially the same performance if we did that.

1411 106

MR. PHILBRICK: Supposing you stripped off the clay down to the top of the basal sand there, what would be the condition with respect to the Category A design?

MR. FISCHER: Dynamically?

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MR. PHILBRICK: Yes. Would you be better off or worse off?

MR. FISCHER: I guess you would be a little bit better off.

MR. PHILBRICK: Now if you looked at any other part of the site area, would you be free of the necessity of stripping in order to found the breakwater on the sand?

MR. FISCHER: Oh, yes, there are general areas around there which have less clay than we have right here.

MR. PHILBRICK: Is the sand at a higher elevation, the top of the sand, than shown here in those other areas?

MR. FISCHER: There are some sands. This sand right here is pretty uniform in depth. There are others in filling materials through here which are combinations of sands and clays.

MR. PHILBRICK: If you were looking for essentially uniform foundation, homogenous structure base, would you get it anywhere else with less excavation than you would here?

MR. FISCHER: No. You would be roughly the same. The only completely uniform material that we are seeing is once you get down somewhere in here. And you might save a few feet. But you are talking about essentially something that has relatively uniform depth across here.

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MR. PHILBRICK: Where is the proposed foundation of the breakwater?

MR. FISCHER: We are putting it right on top.

MR. PHILBRICK: Right on top. What difference in elevations between the foundation of the breakwater and the foundation of the dredged area, or the base of the dredged area?

MR. FISCHER: Base of the dredged area, do you have that number? The base of the dredged area is minus 47. And so we are talking about in here, that is roughly 10 feet.

MR. KEHNEMUYI: May I interrupt, Joe, a minute? The minus 47 is a local situation. It is under two caissons that are not backed by the mooring caissons inside the basin. It would require a sketch to show this, if I may draw on the board.

MR. PHILBRICK: Well, the only problem that I have got here is whether when you build this breakwater, are you then excavating, dredging to the land side of it, or have you got that done beforehand?

MR. FISCHER: Oh, we are not dredging after the breakwater is built. There will be some dredging initially in the central part of the area, and then that's it, as far as dredging goes.

1411 108

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MR. PHILBRICK: Okay. This is the -- let me ask you a question on material. Then I will be off your back.

Where are you getting the breakwater stone? What material will it be, how will you schedule it in so that the breakwater will be completed in time to put the plant in position, on schedule?

MR. FISCHER: Okay. I cannot answer all those questions.

The material is going to be a good, sound, solid rock with a high friction angle. We have -- "we" meaning a group of people including Frederick R. Harris, Public Service, have come up with a set of specifications for the rock which are going -- is going out for bid, which has just gone out for bid. The contractor that will -- will find a place for the material will be then inspected by various representatives of the owner.

But as far as selecting a location, a positive location for the rock, we have not done that except to indicate in the specs that the rock has got to be pretty good material.

Scheduling will be up to the contractor to do that.

MR. PHILBRICK: You are specifying abrasion-resistant rock?

MR. FISCHER: Yes.

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MR. PHILBRICK: And you are specifying rate of delivery?

MR. FISCHER: What we are specifying from an engineering sense is how much rock you can put on at any one particular time. I guess that is rate. But we are not talking about, we are not controlling them to the "nth" degree. We will say you can't put on more than this over a particular length of time.

MR. PHILBRICK: Are you giving him a minimum rate of placement?

MR. FISCHER: No.

MR. PHILBRICK: Then how do you know the job will be done when you have to have it?

MR. FISCHER: The contractor will be selected on the ability -- and I am getting out of my field now -- to do a job in the time necessary.

MR. PHILBRICK: The question is, does he have sufficient plan to do it? That is all.

MR. KEHNEMUYI: May I answer that question?

We have, as Joe pointed out, Public Service Electric and Gas has gone out for bids for building this breakwater with a provision that the contractor supply the stone. So we did this in the past one week. So we will not know until the end of this year where the sources of these materials will be. We have a specification that will

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bind the contractor to do certain things, the materials must meet certain criteria. We are quite confident that there will be enough materials on this, talking to the various contractors who have been invited to bid. If I may say, we just did not mail a letter to these people and say, "Please build a breakwater or tell us how much you would charge us to build a breakwater." We had several conferences with them, and they are very confident that there will be enough materials.

MR. FISCHER: As an independent check on the contractor, we have looked at a number of possible quarry sites that had both the type of rock, we believe, without going into major testing, and also sufficient quantity. So we are not asking for something that is impossible to produce. We know that there are a number of places that do have the material, and now it is up to the contractor to select the place that is most economical for his operation.

MR. PHILBRICK: That's all.

Thank you, Joe.

DR. MANGELSDORF: Any other comments than the Regulatory Staff? I will call on them in a minute again.

Any other comments or discussion, questions of Mr. Fischer?

Now for the Staff. Do you have some comments to make at this point?

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MR. BIRKEL: Not on the discussion that we have just heard, Mr. Chairman. We would like to make an introductory summary, if we could, from the Staff's position.

DR. MANGELSDORF: That would be fine.

MR. BIRKEL: At this time?

DR. MANGELSDORF: Yes.

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MR. BIRKEL: Thank you.

My name is Ralph Birkel and I am the licensing project manager for the Atlatnic generating station.

Mr. Chairman and members of the Committee: our meeting with you today is a continuation of discussions that we have held with the Subcommittee on May the 23rd and June the 20th, 1973, relating to the pre-application review of the proposed site for the Atlantic generating station.

The Staff review was completed and a summary of our findings presented in our report dated June 8, 1973.

This review was performed in response to the December 14, 19[illegible] request by Public Service Electric and Gas for a Commission and an ACRS pre-application site review for the intended purpose of determining the general adequacy of the site upon which to locate two floating nuclear power stations.

1411 113

This request by Public Service and Electric and Gas was made in the hope that it would help enable Public Service to prepare a prelminary safety analysis report which will be adequate and complete for the formal review.

In keeping with this intent we met with you -- we meet with you today with the objective of obtaining from the Committee in a letter report its comments, review and obtaining guidance in preparing a complete and acceptable Atlantic generating station site safety analysis report from

Public Service.

Based on the information provided by Public Service the Staff was unable to establish the suitability of the site for the location of two floating nuclear plants.

However, our review of that information did not identify any reasons why this site should not be suitable for the location of such plants.

Considerable further evaluation and demonstration by Public Service and Electric and Gas will be required to conclusively accept the proposed site.

This should occur subject, then, to receipt of a site preliminary safety analysis report which we understand is now scheduled for September of 1973.

In keeping with this September schedule we feel that our June report will help enable Public Service to prepare a preliminary safety analysis report which would be adequate and complete.

We have identified in Section 1.3 of our report areas of major deficiencies which require significant recognition in the preliminary safety analysis report in order to determine the acceptability of the site and the structures and components to be constructed under a site construction permit.

1411 114

I should point out at this time that the offshore nuclear power plant concept in light of proposed Appendix M to 10 CFR Part 50 will require two separate applications and licensing reviews associated with each facility. One for the manufacture of the plants and one for each proposed site.

We performed a pre-application review with the former aspects with offshore power systems and issued a report on their floating nuclear plant on July the 21st, 1972.

In our June 1973 pre-application review of the latter site aspect we remained convinced that the site design involved approaches of paramount importance in such a split licensing approach. This is one of the reasons that our review of the offshore power system application for a license to manufacture which was docketed on July the 5th this year must be complete and a license to manufacture issued before we will issue a site construction permit.

That concludes our introductory comments to the Committee, Mr. Chairman.

DR. MANGELSDORF: Thank you.

Any questions by the Committee of the Staff at this point?

Yes, Mike?

DR. BENDER: What is your present position on what you intend to require in the way of information regarding the sinking of the plant?

1411 115

MR. BIRKEL: In our review with the OPS people we had indicated that we must recognize that sinking should be

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included as a design basis requirement for the platform, for the floating nuclear plant.

We have indicated that in our July report of last year.

DR. BENDER: This means what, that the whole power plant must be submerged?

MR. BIRKEL: The power plant must be capable of being shut down and maintained under shutdown conditions under all emergency conditions and this would include total bottoming of the floating nuclear plant.

DR. PALLADINO: With regard to this envelope you are speaking about, have you established acceptable values of probabilities for various kinds of events which you perceive?

MR. BIRKEL: No, at this time we have not. We have recognized the importance of developing such a design envelope, and we have discussed that with the OPS people, Offshore Power Systems people, during our review of their pre-application report.

At this time, however, we cannot say that we have developed such probabilities.

1411 116

DR. MANGELSDORF: Mike?

DR. BENDER: Could I ask one question of the Applicant with respect to the matter of sinking, or the sunk power plant? Do you plan to deal with that in your PSAR?

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MR. KEHNEMUYI: Yes, OPS has already done that in their plant descriptive report. Tbe sinking is taken care of.

DR. BENDER: It will be dealt with in the context of the site in which we are --

MR. KEHNEMUYI: May I add that neither they nor we believe this plant will ever sink. It is designed that it will bottom-seat.

DR. BENDER: None of us suspect it to, but that doesn't prevent us from thinking about it.

DR. MANGELSDORF: Any other comments from the ACRS consultants at this point?

MR. KEHNEMUYI: Why don't you go ahead with the next item on your agenda?

MR. KEHNEMUYI: Yes, sir. This next item is the uniqueness of this review. It points out the uniqueness of this review. There are two applications, as was pointed out, and it is the comparison of these applications or comparison of the design envelope with what a site meets.

In this specific case what our site fulfills in that envelope. It will be covered by Joseph Ashworth of Public Service Electric and Gas.

1411 117

(Slide.)

MR. ASHWORTH: Good evening. My name is Joseph Ashworth, for Public Service. I am assistant to the project manager for the Atlantic generating station.

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I have fourteen transparencies to go through. I will try to go as quickly as I can. These are a summary of the values that have been obtained for the envelope, both in the plant design report which has been submitted and docketed from OPS and the preliminary site description report which has been submitted for a pre-application review.

We have summarized the values and we have indexed the areas in those two reports where the development of these values can be found.

To attempt to go deeply into the development of each one of these values in the time available would be less than rewarding a task, but we have people available that can answer any specific questions.

(Slide.)

The first area of interest is meteorology. The atmospheric diffusion conditions felt to be minimum acceptable are shown in the plant design report, Sec . 2.7.

By the way, all of this material has been submitted previously for review by the DOL and the ACRS.

Our predicted K over Q values are better than the reference plant; that is, the plant that is designed by Offshore Power Systems by a factor of 2.

1411 118

It remains to verify these conditions in the meteorological test program.

In the matter of rainfall, the plant is designed

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for a maximum of 7 inches per hour, and the monthly precipitation measured at Atlantic City, which is the closest point for which records are available, has never exceeded five inches per day. That is referenced in PSDR Table 2.1-1.

However, we have been digging in the meantime and we discovered that if you can believe the record, in 1903 at Atlantic City they claim they got 9.21 inches in 24 hours. Rather than one hour.

We think we are still in good shape.

(Slide.)

Continuing with meteorology. The minimum air temperature used as a design value for the plant is minus five degrees, and going back to Atlantic City records again the minimum for the last nine years for which the best data is available is plus five degrees.

We believe that the sea condition -- or the site conditions near the sea surface will be warmer than this plus five degrees, but we must verify this in our meteorological test program.

The water temperature extremes, 30 degrees and 85 degrees, design points.

At the time of the preparation of this slide we had values spanning January and August, and was 37.2 and 75.7 degrees respectively for tho two months.

So we fall within the site envelope. 1411 119

All of these reference tables and information items in the PSDR --

DR. KERR: Excuse me. I don't know this much about sea water. Is the implication of what is typical of January 1973 typical of all Januaries?

MR. ASHWORTH: Well, let me answer the question by saying that we took a number of measurements during January and this was the minimum temperature that we found.

Now, when the test program has been running for a full year, at maximum efficiency, we will have a larger number of readings, but we don't feel we are going to find anything that would fall below thirty degrees.

Now, this data that -- referring to PSDR -- will be included also in our PSAR when submitted in September.

(Slide.)

We are concerned, of course, with the wind and wave loadings upon the plant. The wave conditions within the basin, limiting wave conditions, are stated by Offshore Power Systems such that they will not cause greater than three degrees pitch and roll.

1411 120

By the way, this is a double amplitude three degrees. And the preliminary limits or values for those waves are less than twenty feet in height, or the heights that are defined in the figure 2.4-1 in the PDR.

This figure recognizes that waves of different

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periods will have different effects upon the plant.

Now, we have calculated the waves in the bain to be below the allowable limits. This will be confirmed by the model tests at the University of Florida, Gainesville.

Our preliminary results indicate that we are well within this envelope of three degrees single amplitude.

The operating basins wind is 180 miles per hour. This is the point at which the plant is designed to continue operation, and the predicted maximum, or predicted operating basis wind which is the one in a hundred probability storm is 156 miles per hour.

DR. OKRENT: What does operating basis wind mean again?

MR. ASHWORTH: The operating basis and design basis are the two terms we are using. Operating basis generally conforms to a meteorological condition with a probability of occurrence of one in one hundred. The design basis corresponds to, in the case of waves, to the probable maximum hurricane. But in the case of wind, the next slide I --

DR. PALLADINO: Before you take that slide off, I thought you ought to indicate a little bit more about your assumptions on this Atlantic generating station calculated to be below allowable limits.

1411 121

I think perhaps Mr. Wilson has some questions that ought to come up at this time. What is the basis on --

MR. ASHWORTH: The basis for the allowable limit statement initially was testing an analysis done at Stevens University in their wave tank. It has been confirmed to date by the testing done at the University of Florida. But it ultimately, and I think the -- at a later point we will have more of a discussion on model testing. It ultimately must be confirmed by model testing.

DR. PALLADINO: I was thinking more about the magnitude or conditions which you finally will test. I agree that you can confirm it by test, but you won't confirm any more than you test.

MR. ASHWORTH: You mean the condition of the wave outside the basin?

DR. PALLADINO: What are the circumstances under which you are going to have your calculated conditions, assumed conditions?

MR. ASHWORTH: If we are going to discuss the characteristics of the probable maximum hurricane, which is the governing condition for waves, I would rather refer that question to one of our consultants.

1411 122

Before I do, I would like to continue my answer to the question on the wind, however. The question was where did we get the 156 miles per hour or the 180 miles per hour. And is that the worst that can happen.

The answer is no. The tornado is the worst wind

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that can occur.

My next slide shows that.

DR. SIESS: Those wave conditions within the basin, are those design basis conditions or operating basis conditions?

MR. ASHWORTH: The wave conditions for three degrees single amplitude are design basis conditions.

DR. SIESS: That is the maximum the plant can take?

MR. ASHWORTH: Be able to maintain safe shutdown during that condition. Shutdown and maintain safe shutdown.

DR. BENDER: Is there some lapse time associated with that? Or does that make any difference?

MR. ASHWORTH: No, that would be a continuous thing. The operating basis condition that corresponds to this is on the order of two degrees. And when plant motion starts to reach that point we will have to have operating procedures which will start to secure the plant.

DR. SIESS: That three degrees, that figure has been fixed by OPS?

MR. ASHWORTH: That's correct.

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DR. SEISS: Do you have any idea whether the Staff agrees with OPS, that three degrees is indeed the pitch and roll that this plant can withstand and still be safe shut down? Staff has not yet reviewed the OPS site envelopes, that I know of. The Staff said they hadn't reviewed it.

MR. BIRKEL: That's correct.

DR. SEISS: That means they don't know. I raise this question because I think it may apply to other things. Certainly, your plant must stay within the limits that the plant manufacturer has said he is designing for, but I think that at some point along the line you have got to find out whether the Staff is in agreement with his criteria as to what constitutes safe shut-down. If it is operating basis, I don't think that gives any particular problem. You have to stop operating when you exceed his limits. And even if they get lowered, you still stop operating. But on a design basis, if you exceed his limits or whatever limits are finally decided upon, you can't build it. Not a question of just shutting down.

Do you know of your own knowledge the basis for that three degrees, or have you just simply taken what OPS gave you?

1411 124

MR. ASHWORTH: Is this question directed to Public Service or the Staff?

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DR. SEISS: Public Service.

MR. ASHWORTH: The three degrees, I believe, corresponds to or is developed from an analysis of the accelerations that the plant can withstand. There is also a period of this three degree oscillation. If you want to pursue this further, I would like to pass this one over to one of the people from Offshore Power Systems that can give us a more concise explanation.

DR. SEISS: No, I don't. But what I -- and I don't know whether I want to pursue further the question as to what you are going to do if this ends up at two degrees instead of three. I have noticed over a period of time that frequently the requirements that we end up with after the Staff gets through with their review are not quite as liberal as those that were proposed in the PSAR or the permit to manufacture, or whatever document might be called. It seems to me you are hanging your site approval, not approval in this case, but your site criteria on some unreviewed criteria.

MR. KEHNEMUYI: Dr. Seiss, may I answer that question?

1411 125

DR. SEISS: Yes, sir.

MR. KEHNEMUYI: From our point of view, we have a target number to hit which happens to be three degrees. But we have conducted these preliminary tests at Gainesville,

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and they indicate that as Joe Ashworth pointed out, they are going to be well below these numbers. We are very confident that we are not going to reach the three degree single amplitude in the probable maximum hurricane condition. We would, if we were not this confident, we certainly would not pursue this thing as we are. We feel there is even a margin in there.

DR. SEISS: Is that true of all the site envelope criteria?

MR. KEHNEMUYI: No, sir, it does not have to be. For example, if you take the wind situation, if Offshore Power Systems designs the plant for 180 miles per hour and indeed we find our site to have 179, I am exaggerating to get too close to it, we would feel that that is a point that we can go in for an application for the site, feel confident, and pursue this thing. These are things that we have gone through this kind of exercise, or if I may call it an exercise on land base plants. The novel things are this pitch and roll and things like that. And we certainly would not pursue this matter if we did not feel confident in it. And we do feel confident in this.

1411 126

DR. SEISS: I think there are two categories. Pitch and roll are what I would call secondary criterion. Primary criterion is safe shutdown. OPS has defined three degrees as being the pitch and roll that corresponds to

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safe shutdown presumably with some margin. I don't know. Now 180 miles per hour wind is a primary criterion. If you meet that, I don't see how there can be much argument. But there are several others in the same category as the pitch and roll. I don't know as we have gotten to them yet. Go ahead. If you do, I will --

(Slide.)

MR. ASHWORTH: Continuing with the wind. The design basis wind during which the plant must be capable of being shut down and kept in a shutdown condition corresponds to the maximum tornado. We don't believe there is going to be such a maximum tornado at the Atlantic site, but this is the standard for analysis.

(Slide.)

MR. KEHNEMUYI: Maybe this is a good illustration, if I may add, Dr. Seiss, the site envelope in the case of the tornado was exactly equal to our design.

DR. SEISS: Oh, yes. That is primary, I think.

MR. ASHWORTH: Now certain site hazards are capable of being withstood by the plant, and it has to be shown that the site will not produce hazards which exceed these hazards for the plant design. In terms of ship collision, the breakwater must prevent colliding ships or displaced portions of the breakwater from contacting the plant.

Now the analysis shows that contact will be

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prevented, and this will be confirmed again in University of Florida at Gainesville by model testing using a scale model of the 1 to 64 scale of a very large tanker. This is felt to be the largest or most injurious type of ship collision that could occur in this particular site. Hazardous cargoes, such as munitions ships, require that the plant be sited in an area where the probability of collision, subsequent explosion, be less than 10 to the minus 6th per year. And we calculate that the probability of collision and explosion of the munitions ship is approximately seven times 10 to the minus 10th per year. And during peak traffic or wartime years, would rise only to 1.5 times 10 to the minus 9th.

DR. OKRENT: I would like to ask some questions on this slide, if I could. First with regard to the ship collision on the size of the tanker you chose, did it depend on the existence of a shoal or did you choose something that was larger than could actually get by that shoal?

MR. ASHWORTH: The shoal doesn't protect the entire breakwater.

MR. KEHNEMUYI: The answer to your question, Dr. Okrent, is we have not assumed that this shoal will stop the ship. The ship will come through if the depth of water was 40 feet at mean low water. The shoal happens to be 26 feet down. We are going to leave the shoal there, but we are saying that it is not there.

DR. OKRENT: I see. How big was this tanker, then?

MR. ASHWORTH: 326,000 dead weight tons, 46-foot draft.

DR. OKRENT: Fine. I see it there now.

Now, the question I am more interested in is on the bottom of that slide. Looking at the site envelope value, I don't want to discuss what is the actual condition there. There is a proposed site envelope value of 10 to the minus 6th per year, less than 10 to the minus 6th per year for hazardous cargoes.

MR. ASHWORTH: For munitions ship collision and explosion, not all hazardous cargoes.

DR. OKRENT: Right. Does Public Service of New Jersey endorse this figure as an appropriate site envelope value?

MR. ASHWORTH: I think that would be presumptious of Public Service to attempt to answer. The committee has in the past evaluated proposals of this order of magnitude, or possibilities of this order of magnitude and has passed on the plants. I am sure that they will continue to look at the submissions from OPS and continue to evaluate them. We're saying that in our particular instance we calculate that probability to be seven times 10 to the minus 10th.

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DR. OKRENT: Let me try another tack at the same question.

Does Public Service have a probability per year of a worse than Part 100 accident due to all possible causes that they think should not be exceeded at the Atlantic generating site if reactors are built at this site?

MR. ASHWORTH: Would you please state that question once again?

DR. OKRENT: Yes.

(Laughter.)

DR. OKRENT: Does Public Service of New Jersey have a probability per year of a worse than Part 100 accident that should not be exceeded due to all possible causes for reactors at this site, assuming reactor is built at this site?

MR. ASHWORTH: I am really going to have to re-interpret that to make sure I get it right.

DR. MANGELSDORF: Let me try rephrasing it and see if Dr. Okrent agrees. Do you have a figure of probability of a worse than Part 100 accident that Public Service regards as good enough?

Is that the question?

1411 130

DR. OKRENT: Yes.

MR. ASHWORTH: If that is the question, I do not have an answer for it. Perhaps someone would like to help

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out.

MR. KEHNEMUYI: I am not too --

DR. MANGELSDORF: Let me say that it would be somewhat surprising to me personally if you did have an answer for that, because I know a lot of other people that don't.

MR. KEHNEMUYI: I was going to answer the question by saying that it may sound facetious to say this, but we are indeed not setting up the speed limits. We are living within them.

DR. SEISS: Well, the site envelope value for this particular accident, it says less than 10 to the minus 6th. If your probabilities, which now say seven times 10 to the minus 10th come out to be nine times 10 to the minus 7th, would you consider that acceptable?

MR. KEHNEMUYI: Yes, if, again, if the acceptable number were 10 to the minus 6th --

DR. SEISS: I didn't say the acceptable number. I said this number is 10 to the minus 6th. Neither you nor I nor the Staff yet knows whether that, nor OPS yet knows, whether that is an acceptable value.

1411 131

MR. KEHNEMUYI: Okay, let me answer your question this way: In a case like this, I personally would feel very comfortable if someone said the acceptable number is 10 to the minus 6th and I had nothing to do with it. My

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number came out to be seven times 10 to the minus 10th, I certainly would sleep better at night.

DR. SEISS: How do you feel now about 10 to the minus 7th?

MR. KEHNEMUYI: I would feel it is within it, but quite close.

DR. BUSH: I am intrigued with the unique way of phraseology here, because I can visualize a rather large number of cargoes that from an explosion magnitude point of view, fertilizer cargoes, LNG cargoes, et cetera, all of which have potential of doing as much damage as a munitions ship. I know. But that is why the seven times 10 to the minus 10th figure --

MR. ASHWORTH: Let me proceed to the next slide. We have considered some of the other possibilities. In addition on the agenda for today is a more detailed discussion of ship collision. I am sure that the person presenting that can perhaps allay some of your fears regarding different types of cargo.

(Slide.)

But other cargoes that we do have concern for are LNG tankers, as was mentioned. We calculate that the probability at Atlantic generating station for collision and fire from an LNG tanker is 2.2 times 10 to the minus 9th, approximately.

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The next hazardous cargo we have considered is the anhydrous ammonia tanker. We are now studying the probability of the collision and rupture of such a tanker. If the probability of it is unacceptably high, it is practical for us to supply emergency breathing apparatus. The fires from any fuel spill other than LNG must be prevented from approaching closer than 100 feet from the plant. We have provided an oil boom within the breakwater to prevent that fuel spill from getting any closer than 100 feet.

DR. OKRENT: Could I ask why the numbers for anhydrous ammonia might be larger than 10 to the minus 6th per year in view of the very small numbers you are calculating for LNG tankers?

MR. ASHWORTH: I believe you are concluding that because we have not put a number down that the number is larger. The actual reason is that we have not yet done the study.

1411 133

DR. OKRENT: Thank you.

DR. PALLADINO: Why do you say fuel spills other than LNG?

MR. ASHWORTH: LNG is a fuel spill we don't feel we can handle. WE feel we must eliminate that on probability bases. But fuel spills other than LNG can be handled by the firefighting equipment provided at the site, providing that they are kept 100 feet away from the plant.

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DR. BUSH: I would think an equally interesting one in your second category there would be chlorine. I don't know what the movement is on the coast. I know it is fairly extensive on the Mississippi. Do you have any idea?

MR. ASHWORTH: I believe that was examined. And I think when we get into ship collision presentation, we can probably give you some more about it. I am not the right man to do that.

DR. BENDER: What is the proximity of the LNG tanker accident?

MR. ASHWORTH: I am sorry, the proximity?

DR. BENDER: Yes. The probability which you have of a collision is what, the assumption that it would run into the breakwater? Or what?

MR. ASHWORTH: The effects of the ensuing fire, and I do not yet know whether we have decided whether or not there would be an explosion, but the effects of the ensuing fire and possible explosion are not tolerable to the plant.

1411 134

DR. BENDER: I think I haven't expressed my question clearly. I am wondering whether that is a collision with the breakwater or would it might also include, say, a collision between an LNG tanker and another ship in the vicinity?

MR. ASHWORTH: That is based on a collision with

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the breakwater. If the ship were hard up against the breakwater, then the calculations would be just as valid. If the ship were some distance away from the breakwater, we would have to look at it again to see what the effects would be.

DR. BENDER: Do you plan to deal with that possibility of an LNG tanker running into another ship?

MR. AHSWORTH: I guess we do now.

DR. KERR: Excuse me. Is the chlorine calculation about which the question was asked not a part of the envelope, and therefore you did not include it?

MR. ASHWORTH: That's correct. It is not a part of the envelope, and I believe that to determine why it is not a part of the envelope, the presentation on ship collision will be the one to ask the question.

DR. KERR: Thank you.

(Slide.)

1411 135

MR. ASHWORTH: All right. To complete our study of collisions, we have one that is common to the land base plant, and that is the probability of aircraft collision. And we have calculated that the probability of a fixed-wing aircraft colliding with the plant is approximately three times 10 to the minus 7th per year. The qualification of fixed-wing is there due to the fact that the plant can withstand a hit from a helicopter of the size that would

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normally be used for travel to and from the plant in service.

DR. OKRENT: By the way, in looking at the effects of aircraft, do you include the whole breakwater as a target area, or only the plant?

MR. ASHWORTH: Only the vital areas of the plant.

DR. OKRENT: The assumption is that a fire that arose from a plane crashing within the breakwater could be handled?

MR. ASHWORTH: That's correct. That is more than an assumption. In the fire portion of the site design accidents, I think that will be gone into, see what the fire-fighting capability is of the plant.

DR. PALLADINO: With regard to LNG, I am surprised OPS didn't say one of the site envelopes is that you must keep LNG ships away. That sounds to me like something they could have said. I don't know but that sounds like a good site envelope if I were OPS.

(Slide.)

1411 136

MR. ASHWORTH: Now site water depths are the next area of concern. The minimum water depth is a criteria that is required to prevent contact between the bottom of the plant and the ocean floor. And it is given as 44 feet which is 31 foot draft plus 13 foot possible maximum motion of the plant during a tornado. And this slide is not up to date. This number is, I believe, 47 feet right now.

ar14

MR. KEHNEMUYI: That's correct, it is 47.

MR. ASHWORTH: 47. The maximum water depth is determined by the postulated sinking emergency that was questioned before. And that is considered to occur simultaneously with the operating basis storm or with the design basis tsunami, which is a very, very small number for this site. That is 76 feet. At this level of water, the plant can be safely shut down and kept in a shut-down position. At the Atlantic generating station site, we have 66.3 feet. That should also be corrected by subtracting three feet.

DR. BENDER: Do you have a definition of safe shut-down at this stage?

MR. ASHWORTH: I think OPS could probably give a better answer to that than I could.

MR. KEHNEMUYI: Blair, would you? 1411 137

mr. bruce: I am Bob Bruce. I am manager of nuclear systems engineering for Offshore Power Systems.

Our definition of safe shutdown and sinking is when we have reduced the core temperatures and pressures until the plant is operating on residual heat removal loop. The heat is dissipated via residual heat removal and auxiliary cooling water systems to the sea. That is ultimately our safe shutdown condition. Initially right at the beginning when the plant is to be placed in safe shutdown, the operator would, of course, trip the control rods. He would then borate the cold to a hot borated condition. This would occur on a time scale of a matter of minutes, certainly within half an hour. The plant would essentially be safe in the hot borated condition, but we would proceed to the long-term condition of residual heat removal.

DR. BENDER: And this would mean that the plant was shut down from a nuclear standpoint, but there is some device there that is taking away the afterheat for whatever time it is submerged?

MR. BRUCE: Yes, it would be shut down from the nuclear standpoint within a matter of seconds, as soon as the operator scrammed the reactor.

DR. BENDER: How long do you visualize it would stay submerged?

MR. BRUCE: We are designing for submergence of one year.

1411 138

DR. BENDER: After which you intend to recover it or what?

MR. BRUCE: We would expect to recover the plant within a time scale of one year.

DR. BENDER: Thank you.

DR. PALLADINO: What was your basis for a one foot tsunami under your assumptions?

MR. ASHWORTH: Joe Fischer would like to answer

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that, from Dames & Moore.

MR. FISCHER: The maximum tsunami that's ever been recorded in the area was on the order of less than a foot, six inches or so. Even postulating something that has never occurred before, the worst possible condition, something going on in Puerto Rico or Portugal, we still are on the order of several feet. But the one foot is based upon essentially history.

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1411 139

DR. PALLADINO: Dr. Wilson, one of our consultants, came up with numbers on this side of the ocean that appeared quite higher. Maybe I ought to turn it over to him.

MR. ASHWORTH: Could I point out at this point that even if we are off by a factor of five that we would still be well under the 76 feet which is a limiting condition. The depth of the tsunami, not including the crest of the tsunami, would be 52.3 feet. The maximum depth is 76 feet.

So, we have all the difference between those two numbers in which to accept a larger postulated tsunami and still be within design conditions.

MR. SEISS: In considering tsunami, what consequences have you considered?

MR. WILLIAMSON: I would like to make an observation on that, on the aspect of the tsunami that I had brought up earlier to the Committee. And this was that there is -- there might be a good possibility of the concurrence of a tsunami with the conditions of extreme high tide near the full moon, and possibly with the occurrence of a major storm, the reason being that there seems to be a tie-up between earthquakes, major earthquakes and the full moon event. The apparent cause of it is not definitely established yet, but it seems to be that the earth tide effect can be a triggering aspect for causing earthquakes, major earthquakes.

Several major earthquakes have in fact occurred at

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the full moon. The great Alaska Earthquake was a case in point, the great Elizabethan Earthquake was a case in point. There are several others that one could quote. Even our California earthquake of February, February 9, 1971 occurred at the full moon.

At any rate, the point here is that it is conceivable that you could get a general concurrence of all these effects together. And I would like to put that to the Committee, Mr. Chairman, and to the applicants as something that should be at least considered as a possible overall design event.

MR. KEHNEMUYI: May I make a comment on that, if I may?

The -- as the highest astronomical tide addition to the mean low water is something of the order of 5. --

DR. MANGELSDORF: I wonder if your microphone is on? We are not quite getting you.

MR. KEHNEMUYI: Is it on now?

DR. MANGELSDORF: Yes, it is; thank you.

MR. KEHNEMUYI: The addition of the astronomical tide to the mean low water level is something of the order of five-point-some number which I don't remember, if we call that six feet, and add that to the mean low water, there is six feet more onto there, and if we did add the waves that we would encounter inside the basin, which are at the most, and I don't quite agree with the statement that we ought to combine PMH with a tsunami because then we are combining disaster with disaster -- the addition would be another 12 feet, and onto that the tsunami of a few feet is, I believe, still less than that differential between 55.3 and the 76 feet.

We will look into this but I think we are adding things that we ought not to.

MR. FISCHER: Let me add one thing.

One, we don't have tsunamis on the East Coast that are appreciable.

Two, we can correlate earthquakes with almost anything we want, as long as you only take a couple earthquakes. I have seen correlations with sunspots, full moon, and the San Fernando Earthquake I saw a beautiful expose, classical situation of using computer data to come out with why the opposition of the sun and the moon caused a set of forces which made the San Andreas Fault break for the San Fernando Earthquake. Unfortunately, the man who wrote that didn't realize that it wasn't the San Adreas that had broken; it was another fault and the sense was roughly perpendicular to the sense he showed with his mathematic.

1411 142

Earthquakes occur. And I think the probability of an earthquake occurring with a probability of a storm, major storm which we have never seen yet occurring at the same time, those two phenomena would be rather spectacular to see them occur at the same time.

We are going to add an astronomical tide to them, then we add another possibility or probability on top of that. Then we add to that the fact we don't see the ground breakage on East Coast earthquakes which cause the tsunamis. And I don't know how to add that probability in.

MR. ASHWORTH: Before leaving the slide, I would like to add that this is all to take care of the postulated single emergency which we will design for, but which we do not believe will happen.

(Slide.)

The geology and seismology criteria are concerned with two areas, supporting the breakwater and supporting the plant if it should sink. And the site requirement, or the requirement imposed by the plant, of course, is that if a breakwater is used as it is in our design, that the seabed must support the required breakwater under static and dynamic conditions. And the studies by our consultants indicate that after the initial deformation, that the seabed will adequately support the breakwater.

1411 143

The 10,000 PSF figure is the maximum that would be expected at the heaviest loaded portion of the breakwater to support a sunken plant; the seabed must support a static load of 1600 pounds per square foot.

And again after the initial deformation, it would appear that the seabed will support the plant with a factor of safety in excess of five.

(Slide.)

Now, the mooring -- no, I guess I have got one more item on geology and seismology, that is, seismic response. The site envelope requirements are that the characteristics should not exceed certain response spectra shown in the reference figures in the PSR.

At Atlantic Generating Station, the characterizations are shown in the PSR, Figure 2.5.2-4. And they fall within the requirements specified for the offshore power systems plant.

MR. PHILBRICK: Does that consider liquefaction in that thing or not?

MR. ASHWORTH: I refer again to Dames and Moore.

MR. FISCHER: The breakwater will be so designed and the subsurface conditions so taken care of that there will not be liquefaction during an earthquake.

(Slide.)

DR. MANGELSDORF: Do you have a further comment?

MR. PHILBRICK: One question.

1411 144

DR. MANGELSDORF: Question.

MR. PHILBRICK: Is there an agreement with the Staff as to what such a design will be?

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MR. FISCHER: I don't think the final design has been submitted with enough supporting data on what the subsurface conditions are to the Staff yet.

However, an agreement will be reached with them.

MR. PHILBRICK: With respect to the criteria to prevent liquefaction?

MR. FISCHER: Yes.

DR. MANGELSDORF: Mike?

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

MR. ASHWORTH: Certainly.

(Slide.)

DR. BENDER: That is not the one. I am looking for the one that shows the maximum strength of the --

DR. KERR: Mike, we need the mike.

DR. BENDER: Oh. The seabed static loading.

(Slide.)

DR. BENDER: Is that 1600 pounds per square foot based on the -- some point of the sunk structure hitting the seabed first, or do you allow for some angle of penetration?

MR. ASHWORTH: Let me refer that question to offshore power systems.

MR. ORR: I am Richard Orr. This 1600 pounds per square foot is an average bearing pressure underneath the plant.

1411 145

DR. BENDER: How is that interpreted in terms of the sinking mechanism. Do you assume that the plant will settle vertically?

MR. ORR: The sinking is a nonmechanistic condition. We are designing for it to be safe sitting level on the bottom.

DR. BENDER: Is that realistic?

MR. ORR: There is no realistic mechanism that will cause it to sink.

DR. BENDER: Well, okay; thank you.

(Laughter.)

DR. OKRENT: Let me see what you mean by the word, realistic. If the mooring were to break in this maximum probable hurricane, could the barge sink?

MR. ORR: May --

MR. KEHNEMUYI: If the -- yes. The answer is yes, nonmechanistically, if -- the barge itself, by the way, is compartmented. When we say that we do not see any mechanistic way how this barge could sink, our statement is based on the fact that if a condition like that occurred, a certain number of compartments would be punctured. There would be water in them. But the plant would still not sink. So, therefore, we cannot reason ourselves to a situation where we say, well, this thing will happen and therefore all of the compartments will be broken up so that this thing will sink. 1411 146

So, we drop that kind of reasoning, and say we cannot follow that; therefore we say it will sink. It will

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sink for the design basis.

MR. ORR: Well, I think it would be perhaps not a description of physical, possible -- physically possible mechanisms to imply that there was no way by which, or no set of sequences that could lead to the barge sinking. And I gave one; if you wished, I could suggest several more which would lead to sinking. And I don't think it takes all of the compartments, actually, to be punctured for it to sink.

So, I just don't want to leave the impression that it is a physically impossible situation. I assume you are not trying to, either.

MR. KEHNEMUYI: But quite a few of these compartments are double-bottomed, for example.

DR. OKRENT: Yes.

MR. KEHNEMUYI: It would have to puncture the two hulls before it would ever get there. The chances of this happening are not there, is what we believe.

DR. MANGELSDORF: I don't want to be unkind, but the designer of the Titanic went down with it expressing the sentiments that it couldn't possibly.

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MR. ASHWORTH: Requirements for the mooring system, will be presented in considerably more detail in one of the upcoming presentations, are that the -- really relate to the plant motion.

Plant motion requirements say that the pitch and roll accelerations must not exceed those due to a motion having an amplitude of three degrees in a period of thirteen seconds.

(Slide.)

Now, the accelerations are determined by the wave conditions within the basin which we have already said we believed to fall within those margins and, in fact, as a result of the preliminary tests fall well within those margins. And the mooring system design will not amplify the accelerations from those waves.

In terms of the wave motion, vertical accelerations must not exceed .03 G and, once again, the accelerations are determined by wave conditions within the basin and the mooring system will not amplify those accelerations.

MR. RAICHLEN: I have noticed on this site envelope that there is no reference to any conditions in sway or in surge. Could you explain to me why there are no considerations of this?

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MR. ASHWORTH: The overall acceleration due to plant motion is the one that is of concern. This acceleration can be

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due to a combination of motions.

MR. RAICHLEN: Well, let me put it another way.

Is it my understanding that you assume that any surge and sway can be brought within reasonable limits by a redesign of the mooring system if you indeed find this to be so from the test at Gainesville?

MR. ASHWORTH: I would like to direct that question to the mooring system experts --

MR. RAICHLEN: Maybe this is a question that should be held until the mooring system is presented.

MR. KEHNEMUYI: Maybe we can answer it now.

Mr. Harlow?

MR. HARLOW: I am Eugene Harlow from Frederick R. Harris. I think the question really deals with the -- an explanation as to whether the site envelope itself sets limitations on surge and sway. That I think might be better answered by Offshore Power Systems representatives.

MR. KEHNEMUYI: Let me attempt to answer this.

The sway -- let's take the sway, for example. We have certain structures in the basin such as the discharge canal receptical, the box we discharge into. Certainly if the sway of the plant were such that it touched this box, we place the box in such a position in this basin, and the sway were such with our design of the mooring system that it touched this box at every PMH, we would then redesign the mooring system to take care of this or move the b[illegible] away.

This could be taken care of. It is a basic engineering design matter.

Similarly, with the surge, it -- I believe it is not in the design envelope for one purpose because one utility might design its basin somewhat different than the other. There is that option.

It is the standard plant that is important here rather than the standard basin.

The utility must make it so that with its breakwater configuration, with the depth of water, with its specific mooring system, the sway surge, and it happens to be roll and pitch which is defined over there, is such that his other interface structures are not affected by the motions of this plant.

MR. RAICHLEN: Well, isn't it possible, though, that if you are concerned with accelerations and pitch and rolls that because of excessive motion -- well, let's just say that a natural period in sway or surge may be within the range of the waves that are -- to which the plant is exposed. Isn't it possible that your accelerations then, because of excessive motions, may be as great or greater in surge and sway than they are in pitch and roll?

So doesn't it then become something that is -- that should be in the site envelope?

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MR. ASHWORTH: Richard Orr, would you like to answer that one?

MR. ORR: I would like to answer that one if I may.

The basic plant envelope is based on the acceleration magnitudes rather than these pitch and rolls.

As Joe Ashworth said to start with, it is the total plant motion which we are specifying must be within our acceleration envelope. So if indeed the surge and sway accelerations were high, then the accelerations due to pitch and roll would have to be significantly lower to be within our envelope.

As far as the plant is concerned we are worried purely about acceleration. We are not concerned with total plant motion.

MR. RAICHLEN: Well, just to finish up, I appreciate that, and the fact, then, that you are putting on a three degree amplitude in thirteen seconds which, with the length of the plant, is going to give you some acceleration, but what I am saying is then if you are doing that and you are getting down to acceleration, shouldn't you also be considering other directions of acceleration such as in sway and surge?

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MR. ORR: We are defining it in terms of sort of -- of horizontal accelerations at two different elevations so that we take up -- we pick up all components of motion. The

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reason for basing it on accelerations is we have specified typically two and three degrees of motion and a thirteen second period corresponds to the accelerations that we are permitting.

However, at different periods, obviously, we can commit different accelerations. Different amplitudes of pitch and roll. It is the acceleration that is limiting.

MR. RAICHLEN: That I realize, but I still say that if it is -- that if acceleration is limiting, it seems there should be on this chart, on-site envelope comparison one should also be talking about other degrees of motion.

MR. ORR: I believe what should happen is that the chart should show the acceleration magnitudes rather than the pitch and roll magnitudes. Then it would be clear.

MR. ASHWORTH: Were this to be rephrased to accelerations must not exceed those due to pitch and roll motions having amplitudes of three degrees, I think everyone would be satisfied and we would still have the same meaning which is -- no, we wouldnot be satisfied. All right.

MR. KEHNEMUYI: If it said including sway.

DR. SIESS: I have heard Offshore Power Systems say that their site envelope, plant envelope, is expressed in terms of accelerations. Horizontal accelerations at two different levels.

MR. ORR: That's correct.

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DR. SIESS: The interpretation we see on the screen in the lefthand column simply is an interpretation of your criteria in two particular motions; is that correct?

MR. ORR: It is an example that we have given in the interface document.

DR. SIESS: You gave it as the example?

MR. ORR: Correct.

DR. SIESS: Sway and surge would be other examples.

MR. ORR: They would indeed. We do not expect, however, with typical mooring systems, that surge and sway would have significant acceleration magnitudes. The significant component is pitch and roll.

DR. SIESS: All right.

(Slide.)

MR. ASHWORTH: To continue with mooring system requirements, the mooring system must prevent the plant and breakwater contact. It will do so as will be explained in the breakwater or the mooring system presentation.

We have just pointed out that the contact between the plant and the seabed is prevented by the minimum water depth which is another one of the criteria.

DR. PALLADINO: You would also like to prevent one plant from touching another, also.

MR. ASHWORTH: That is implicit, but we haven't spelled it out. That is quite correct.

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DR. OKRENT: Could I ask in connection with meeting the first of those two whether you have considered more than one mooring system, it being in effect concurrently, or, in other words -- diverse, yes.

MR. ASHWORTH: Have we considered more than one system?

DR. OKRENT: In other words, as part of your consideration of accomplishing mooring, have you considered the possibility that you would use two mooring systems, either of which could do the job?

I am just trying to ask whether this has been a part of your design consideration.

MR. KEHNEMUYI: May I answer that?

DR. OKRENT: Yes.

MR. KEHNEMUYI: I don't mean to be funny, but we had a very difficult time, Dr. Okrent, coming up with one mooring system, and I mean that.

Nobody has ever designed a vessel moored with a tornado load, to our knowledge, and this was something new. The loads were just -- are just tremendous. And in effect we must design a mooring system that does not -- not being not absolute, does not transmit the earthquake load through itself.

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Indeed, it is very difficult to say that we could come up with a second system. We did come up with one.

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If I may interpret your question, is there some redundancy in this mooring system. If I may answer it what a shorter word: yes. And we will discuss that when we get to the mooring system.

DR. OKRENT: Well, the word redundancy was yours, but I will wait.

(Laughter.)

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MR. ASHWORTH: The mooring system must not transmit seismic forces such that the response spectra in the platform is in excess of those shown in figures to be supplied by offshore power systems. These were not included in the original submission of the PDR. The response spectra of the seabed is shown in RPSDR, and the mooring systems being developed by Frederic R. Harris will produce spectra which fall within the site envelope of the response spectra. They will not amplify the seabed response spectra.

(Slide.)

This is the last slide. The mooring system must maintain or limit plant motion such that the integrity of the transmission lines is assured. This is the safety-related function. There is no safety-related function associated with the circulating water discharge structures, but for our own selfish reasons of not wanting to have to repair them, we would like to have those also remain intact. In an analysis of the mooring system that we have, it shows that if all worse plant motions occur simultaneously in the worst additive manner, that the maximum motion of any point on the platform will be 8.2 feet in a horizontal direction.

And this motion is sufficiently small so that neither interference with the discharge structures, nor breakage of the transmission lines is expected to occur. And that concludes the presentation.

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DR. MANGELSDORF: Thank you very much.

Are there any comments from the Staff on this overall presentation or on any parts of the slide that you didn't comment on as we were going along?

MR. BIRKEL: We would like to make a comment or two with regards to the overall topic of plant design envelope and the site interface and conformance with it. In particular, to answer Dr. Seiss' question and comment earlier, the advent of the floating nuclear plant concept requires two separate license applications and licensing reviews for each facility, one for the floating nuclear plant manufacture and one for the proposed site.

When this licensing approach was being developed, the objective was to allow the maximum possible independence of the reviews. It was obvious, however, that this was not possible, that is to completely separate the floating nuclear plant review from the site review, as we are seeing again today. We, therefore, suggested the use of a site design envelope of site conditions and parameters that should be developed in designing the floating nuclear plant. The site design envelope would identify the criteria and maximum and/or minimum site related characteristics that have to be satisfied by any site for a floating nuclear plant for it to be acceptable. This site design envelope approach was in the preliminary stages of development when the Public Service

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Electric and Gas Company preliminary site description report was being prepared. So it does not address this subject directly. Public Service only recently has prepared a site design envelope which Mr. Ashworth presented to us today. Copies of a similar comparison was made available to the subcommittee in June.

The Staff, I should emphasize, has not evaluated this site envelope, nor the comparison presented today, as well as the comparison presented in tabular form to the subcommittee in June. This comparison provides the floating nuclear plant site value and compares it with the Atlantic generating station safety values for plant wind and wave loads and the various other loadings th[illegible] Mr. Ashworth discusses.

We feel that the design envelope is of very significant and paramount importance in the overall floating nuclear plant concept, but will require considerable detail and justification in the site PSAR.

And I would like to add a direct comment with regard to again the dual licensing and dual review approach that the Staff has taken. We will not issue a construction permit for the Atlantic generating station until we are able to issue a manufacturing license to OPS. And this will involve detailed review of the design site envelope, the parameters, the criteria, and requirements therein, and only thereafter will we then be able to address the adequacy of the

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justification by Public Service in meeting these criteria and requirements.

DR. MANGELSDORF: Thank you very much. That, I think, introduces a subject that I was just about to introduce somewhat sadly, Mr. Kehnemuyi. And that is that some of us around the table here have been doing a little consulting among ourselves, and we are persuaded that we couldn't possibly finish this review and come out with conclusions yet today.

Then, of course, we couldn't do that without some at least preliminary analysis by the Staff which we have just learned will not be available. So that from completely practical standpoint, we are faced with the question of whether we should recess at about this point, or whether you would like to make some summarizing comments on where we stand, or whether you have a strong feeling of trying to present maybe one more of the topics on the agenda.

I am sorry to put you in that position, but I think that th practical aspects of it lead to that. Let me say that even though you will not be getting a letter of advice from this meeting, I judge that you have picked up some reactions of what the attitude of the members of the committee are on some of the individual questions.

Now, don't go too far in interpreting those, because they are, of course, the expressions and indication of the attitude of individual members. And the final report

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will be a concensus of the membership. There have been mistakes made in the past, one, maybe two or three, where the views of one individual at one meeting were over-interpreted as being an expression of the committee when it turned out that it was not. That is just incidental, accidental, but I am cautioning you in over-interpreting expressions of opinion in this meeting. But still, you must have gotten some guidance as to what some of the problems for further development will be.

Now, I come back to the practical question of would you --and don't pay any attention to that clock -- it quit long ago. Would you favor recessing at this time, or would you like, do you have a strong preference for presenting either a summary, which is one subject, some overall remarks that you may wish to make, which you may surely -- which will surely be carefully received, or do you wish to try to present one of the topics left on the agenda. I will leave it to you for the moment.

MR. KEHNEMUYI: If I may ask a question, would this mean that continuance of this meeting to next month?

DR. MANGELSDORF: I am sure that it would mean no less than that.

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MR. KEHNEMUYI: And, therefore, then we would go towards a letter next month, rather than this month?

DR. MANGELSDORF: At the earliest, in my opinion.

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MR. KEHNEMUYI: I think that we would very much like to present in detail what each item is. If, indeed, I got up now and summarily explained these things, I am going to miss the point. Therefore, I will not be able to convey the gist of the material to the committee. So I think we would prefer to wait and meet with you next month, if we can then cover the rest of the agenda.

DR. MANGELSDORF: I would say that I would hope that we could cover the rest of the agenda. And I heartily agree with your thought that an extemporaneous effort to condense or summarize might not serve your purpose awfully well at this time. And that a summary of your position based on further reflection might accomplish more in obtaining your ends. I am simply gesting.

MR. KEHNEMUYI: I would not want to leave this room without my understanding the fact that after these hearings, indeed we will get a letter of your thoughts and comments.

DR. MANGELSDORF: Well, we are hardly ever in a position to make such commitments. I can say that we will try. And after further discussion, we will -- our normal procedure is,after completing a discussion, we have a meeting of the committee to judge whether we will be able to write a letter at that meeting. And that is as far as we have ever been able to predict it usefully.

In other words, I wouldn't know as of now.

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MR. KEHNEMUYI: Therefore, we can hope that we are invited back at your next monthly meeting.

DR. MANGELSDORF: I would hope that we can arrange the schedule to do that. And that we might be successful in coming to some conclusion, that would be helpful to you. I would hope for that.

MR. KEHNEMUYI: Thank you. We thank you for giving us this hearing, and we hope to see you next month.

DR. MANGELSDORF: It certainly -- I will say this. It certainly has given those of us not having heard the subcommittee discussions a great deal of more understanding of the nature of the problem. And I think that this is a step of magnitude that benefits by reflection on the part of the committee over more than one meeting. This is a kind of problem that the committee will probably contribute more if it reflects on a body of material such as you have given us, and then has an opportunity to discuss that maybe some more, and then receive another body of information for reflection. This is a substantially different manufacture than we are accustomed to dealing with. That is no reflection upon the project. But it does require a great deal of deliberation on the part of the committee to arrive at a useful recommendation on the subject.

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MR. KEHNEMUYI: Therefore, we do feel that I should not summarize today. I think we have to spend time

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with you to tell you what we can about each item.

DR. MANGELSDORF: Unless some member of the committee has a different view of it, I think we would accept that as the better course. And that we adjourn this meeting, and hopefully arrange a schedule that comes as close to serving your purpose as it is possible for us to do. We will try --

MR. KEHNEMUYI: Thank you.

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DR. MANGELSDORF: We will try to do that.

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DR. OKRENT: Can I ask one question?

DR. MANGELSDORF: Yes.

DR. OKRENT: We do have a document which is called a study of the probability of an aircraft hitting the Atlantic generating station. Do we have one which treats the ship collision question in writing?

MR. KEHNEMUYI: Yes, there is. That happens to be, Dr. Okrent, part of the plant description report submitted by OPS. That happened to be the first submittal, and it is contained in there.

What we did is we separately submitted those pages to the Committee, and I believe they are available to you or they have been available.

DR. OKRENT: Thank you.

DR. SIESS: That was just for a ship collision.

DR. OKRENT: The one I have is aircraft.

DR. SIESS: I know, but I think Mr. Kehnemuyi was replying to a ship collision.

Were you concerned only with the ship or with explosions?

DR. OKRENT: The whole situation.

DR. SIESS: Has the analysis of the probability of explosions --

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MR. KEHNEMUYI: Yes, they are all in there.

DR. SIESS: Which one, the two volume one or the

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four volume one?

MR. KEHNEMUYI: We took that part and handled it separately for your review. That is a package in itself. It is also in the PDR, Volume 2.

DR. SIESS: I have three sets of things from OPS.

DR. KERR: That much.

DR. SIESS: The big one. I have one two-volume and two five-volumes.

MR. KEHNEMUYI: If I may add, it got to be that big because they answered all the thoughts and comments they obtained from the Committee and that is what we are looking for, too.

(Laughter.)

DR. MANGELSDORF: Joe, did you have a comment?

DR. PALLADINO: I thought we might make a comment that if there are any additional items over and above the agenda we would let them know.

DR. MANGELSDORF: Very good.

DR. PALLADINO: We will let you know the agenda items.

DR. MANGELSDORF: We will through normal contact be in touch with you during this intervening period, and any advice that we can offer you will be made available to you through those normal channels.

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We may suggest emphasis or subject matters to be covered, and some schedule of meeting will be established. And we will do the best we can.

Any other comments, gentlemen?

DR. BUSH: Maybe I will make one.

DR. MANGELSDORF: Yes?

DR. BUSH: One thing next month, I have -- am not convinced as to the conservatism of your material selection and design of your hull so far as the possibility -- in other words, your assumption you know of the hull holding together is not at all valid in the case of a running crack.

So I had questions on that. Next month.

DR. MANGELSDORF: This is Dr. Spens Bush. He doesn't have his nameplate in front of him. It is not Doctor -- I haven't seen it.

DR. BUSH: There it is.

DR. MANGELSDORF: Well, I wanted to be sure that you knew who he was. When he speaks of metallurgical problems, we pay attention.

Or anybody else.

MR. KEHNEMUYI: And we will when we are invited back, if we are invited back, we will address this problem. But if I may point out, that that indeed is the plant review rather than the site review. But we will be ready to answer any questions you pose on us. But it certainly falls in the review of the OPS application rather than ours.

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DR. MANGELSDORF: All right. You do have an expression of opinion of one qualified to comment in the area of the opinicn. I think it is fair to ask does anyone else wish to express a strong personal view at this time, as a personal view?

(No response.)

Not hearing any, I might ask the consultants, do they wish to make any substantial comments on how they view the project?

MR. PHILBRICK: I would --

DR. MANGELSDORF: From the standpoint of their speciality.

MR. PHILBRICK: I think, not speaking about my speciality, but speaking for Dr. Dablonyo who is not here, I think there ought to be a thorough relationship established between Applicant and Dr. Dablonyo with respect to the behavior of the foundation under seismic stress and of the loading of the breakwater.

DR. MANGELSDORF: All right.

You have heard an expression secondhand.

MR. PHILBRICK: That's right.

DR. MANGELSDORF: From a qualified --

MR. PHILBRICK: Secondhanded.

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DR. MANGELSDORF: Secondhanded. You are quite right. There is a distinction and I will accept it. From

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a qualified authority in the field of the comment.

Again I tell you that these are individual comments and trust that you will accept them as such. But they are from persons whose opinions we value when we deliberate on these projects.

Anyone else wish to make a suggestion toward bringing this project along to a suitable decision?

DR. PALLADINO: Dr. Wilson, I believe, had some comment.

DR. WILSON: Well, Mr. Chairman, I just want --

DR. MANGELSDORF: We need to turn it on.

DR. WILSON: Mr. Chairman, I just wanted to make personal observation on something that I had, a point I had raised at the meeting down in Gainesville which was in regard to the possible effects of high wind in the design storm being concurrent with storm tide and high waves. And it seems that from a design point of view these effects ought to be at least considered as to the possible high damaging effect that a jet spray from the high wind which might be over 200 miles an hour could have in peeling off dolos from the breakwater.

I appreciate our position as consultants to ACRS is to raise points like this even though they may seem ~advantageous from the point of view of the advancement of project. But this kind of matter, however, if -- it is seemingly very important because in these very severe hurricanes you simply cannot neglect the effect of the wind.

I think we are talking here of winds of a magnitude, speed value of over 200 miles an hour.

I have made a very rough estimate of the kind of force that might be developed from a jet spray that may have a density 50 percent perhaps that of pure water or sea water as against force developed by high waves which might have a density of 90 percent of sea water, and it looks like the forces could rise as much as three times that of the pure wave.

Hence, it seems to me that this situation should at least be looked at in terms of trying to assess what the effect of the -- the additional effect of the wind would be, and although the methodology of such a thing in a wind tunnel might be extremely difficult, it might be desirable to undertake some kind of test to see that -- to at least prove that this problem is not a serious one.

Thank you.

CHAIRMAN MANGELSDORF: Thank you, Dr. Wilson.

What I heard you to say was that this ought to be considered. I didn't hear you say that this was a condition for which the plant must be designed. But some exploration of the possibility of being confronted with these circumstances should be included in their consideration.

Did I understand you correctly?

DR. WILSON: Yes, that is what I would feel, that this aspect should be looked at as something to be considered for the design storm condition.

DR. MANGELSDORF: That is what I understood you to say.

Any other comments?

Yes?

MR. MC CLADY: Paul McClady. Some of the Subcommittee meetings I had some questions about the meteorological aspects, diffusion of categories and magnitudes.

DR. MANGELSDORF: It would help, I think, if you could bring the microphone up.

MR. MC CLADY: In looking at these further, I found myself less concerned about them, and my opinion at the moment would be that the calculations that have been made seem close enough to conservative that the diffusion aspects, the meteorology I found doesn't raise any questions or worries in my mind in comparison to various other things, and since you had heard some questioning on my part in previous meetings I thought I would volunteer that at this time.

DR. MANGELSDORF: Any other comments?

DR. WILSON: Mr. Chairman, I have one further point.

DR. MANGELSDORF: Yes?

DR. WILSON: That is in regard to the design criterion for the -- the maximum hurricane. I know that the tornado wind speed is given at 300 miles an hour. Now, it seems to me that the hurricane wind speed which might be something over 200 miles an hour might actually give a bigger force on the structure than the variable wind speed in the tornado. Hence, I wonder whether there is justification for specifying a maximum speed in the hurricane itself which has been done for the design basis storm.

DR. MANGELSDORF: I believe that we will terminate this unstructured discussion at the present time, hoping that some of the remarks that have been made by individuals will be useful to you in your deliberations. And I think perhaps we have gotten approximately as much good as we are going to get from them for this evening.

But I hope these individual comments which you may want to give consideration to in your further deliberations may be of some use to you.

The Committee stands adjourned until 8:30 tomorrow morning.

(Whereupon, at 7:12 p.m. the Committee meeting was adjourned, to reconvene at 8:30 a.m., 11 August 1973.)

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