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# NUCLEAR REGULATORY COMMISSION

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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BRIEFING ON TMI-1 STEAM GENERATOR

AND OTHER PLANT MATTERS

- - -

PUBLIC MEETING

Room 1130
1717 H Street, N.W.
Washington, D.C.

Wednesday, April 17, 1985

The Commission met, pursuant to notice, at 2:32 p.m.

COMMISSIONERS PRESENT:

NUNZIO PALLADINO, Chairman of the Commission
THOMAS ROBERTS, Commissioner
JAMES ASSELSTINE, Commissioner
FREDERICK BERNTHAL, Commissioner
LANDO ZECH, Commissioner

STAFF AND PRESENTERS SEATED AT COMMISSION TABLE:

J. HOYLE
B. JOHNSTON
T. MURLEY
J. ROE
H. THOMPSON
D. EISENHUT
R. STAROSTECKI
H. PLAINE

AUDIENCE SPEAKERS:

G. SHEA
R. CONTE
C. MCCRACKEN
B. SHERON
J. STOLZ
B. LAGRANGE
W. JENSEN

P R O C E E D I N G S

CHAIRMAN PALLADINO: Good afternoon, ladies and gentlement. The purpose of today's meeting is to receive a briefing from the NRC staff on the status of the steam generators at the Three Mile Island Unit 1 plant, as well as other aspects of the status of the Unit 1 plant.

Tomorrow, beginning at 9:30 a.m., we will hear the responses of other interested participants to the NRC staff comments on the steam generators.

I suggest that in view of the importance of the steam generator questions, the staff take them up first and address other questions after that. We have a limited amount of time so, without further delay, I would like to turn the meeting over to the NRC staff.

First, however, do other Commissioners have any opening remarks they would like to make?

COMMISSIONER ASSELSTINE: No.

CHAIRMAN PALLADINO: Okay. Jack?

MR. ROE: Thank you, Mr. Chairman.

We have six areas one of which will be, as you requested, focused on steam generator operability, tube plugging issue to address today. We will do them in summary fashion with the focus being on steam generators.

I will now turn the meeting over to Darrell Eisenhut who has some additional comments.

CHAIRMAN PALLADINO: Let me suggest that we do the steam generators and then open up for discussion on that and then pick up the other items.

MR. ROE: Fine.

MR. EISENHUT: Mr. Chairman, that is basically what we propose. As way of background, recall that the steam generator is one of the earliest that we briefed you on on several occasions. In the remaining portion, we will address what the general overall status is of the other issues on what we call the "Certification List," and other issues at the site, at the plant.

Obviously, we won't be coming down and recommending any action until we think all the aspects are resolved to our satisfaction. Today, we are going to be focusing on the few remaining issues and we try to keep it in the context that of the hundreds and hundreds of issues we looked at, we have a few we are focusing on, will go through today.

Hugh Thompson is going to be making the briefing, along with Tom Murley, the Region I Director, who is here with us today. With that, Hugh, why don't you go ahead?

MR. THOMPSON: Thank you, Darrell.

We will probably want to highlight just a few of the items that we that we would cover, as we talked about earlier. As a general overview, if we can have Slide 2, then.

Since TMI and sinc 1979 -- I think Slide 2, the next

slide -- we have completed a considerable number of multi-plan actions and TMI Action Plan items, as well as license amendments. Many things have occurred on this plant. For the multi-plan items such as the Salem ATWS issues, the plan is generally on scheduled. For the TMI Action Plan items, the plan is generally ahead of schedule, and we see that there are no open licensing actions that would remain prior to restart.

I would like to turn to the next slide, which is the TMI-1 steam generator chronology, and it really addressed the three major issues that we see with respect to the generators at TMI.

I would like to ask Dr. Bill Johnston, who is the Assistant Director for Materials, Chemistry, and Technology in the Division of Engineering to come to the table and give us a detailed briefing on those issues. At that time, we will be prepared to respond to any questions that the Commissioners may have. Bill?

MR. JOHNSTON: Thank you very much, Hugh.

I would like to talk to the issues that are on the slide, on the screen, and emphasize that there have been three areas of interest in that steam generator.

The first one, the kinetic expansion repair, I think, has been discussed fairly extensively with the Commission on previous occasions. The essence of it is that following hot functional tests at the end of 1981, they discovered a large

number of defects in the steam generators. Extensive study was done. They concluded that it was a corrosion problem occasioned apparently by thiosulfate coming into the system as it was cooling down and that, coupled with the stress on the steam generator tubes in that once through design as it cools down, contributed to cause the stress corrosion cracking, it was intergranular stress corrosion cracking.

Also identified at the time, there was some intergranular attack. It was not deep, it was relatively minor and relative to the stress corrosion cracking which were circumferential-type cracks whereas these were patches or small, pitted-type areas, less attention was paid to them.

But the repair, using the kinetic expansion method, proceeded. All of the tubes in the steam generator -- some 30,000 of them -- were subjected to the kinetic expansion repair. The only ones that were not, were those that had been previously plugged in its previous service.

COMMISSIONER ASSELSTINE: Bill, I'm sorry, did you say that you did recognize, did identify the intergranular attack at that time and recognize the connection with the sulfur --

MR. JOHNSTON: It was identified at the time and was in the reports.

COMMISSIONER ASSELSTINE: Okay.

MR. JOHNSTON: The difference, of course, between the

IGSCC and IGA is whether there is a stress component --

COMMISSIONER ASSELSTINE: Right.

MR. JOHNSTON: -- apparent, and it was readily easy to see when you look at the IGSCC that there was a crack, if you like, running right straight through.

COMMISSIONER ASSELSTINE: Okay.

MR. JOHNSTON: Whereas the morphology of the other type is a different morphology.

COMMISSIONER ASSELSTINE: So, in actuality, like when the staff responded to my questions on January 15 and said you had not ruled out the role of the sulfur in the inter-granular attack, it's even more than that. In fact, you know that there is a direct connection.

MR. JOHNSTON: Yes, we suspected that to be the case at the time we wrote you a letter, and that's why we said we suspected that was the case. That has been subsequently borne out. You know, we have just issued what I would like to say is a final SER on the matter which draws that conclusion.

It's not new attack, it's previously existing attack which has become more readily identifiable.

The rest of the first section of the slide simply indicates the process that was gone through in the adjudicatory sense of presenting this material to the Board, having it adjudicated. The tech spec amendment was issued. There was

an appeal and a motion to re-open the record to bring up the status of the kinetic expansion.

Later on, following some further operation of the -- not operation but further examination of the plant, there was discovered that some of the plugs that had been put in at the time of the kenetic expansion were missing. One was missing from the upper tube sheet and subsequent examination discovered that there were six missing from the lower tube sheet.

The investigation and subsequent SER that we issued indicated that in putting the plugs in, there is a certain amount of torque that is required on the roller switches which expand the plugs into the tube sheet. And because they were using a universal joint, the force that they put onto the plugs that were located near the outside edges of the steam generator, were not sufficient to firmly place the plugs in. So, they went back and went through all of the plugs that they had formerly put in, over a thousand of them, and discovered that several hundred of them were indeed loose and they re-torqued them with a device located right on the torquing device so they knew exactly what they were actually putting on the tube.

So, we felt that this issue was completed and --

CHAIRMAN PALLADINO: Though, they did find a number of them loose. Now, how do we know for sure or with reasonable assurance that what they did now will cause them not to be loose

again? I'm not sure we know why they got loose, or do we?

MR. JOHNSTON: Well, hes, we feel that we know they were loose because the torque was insufficient to hold them in place. They need a minimum of 90 pounds --

COMMISSIONER ASSELSTINE: So, they weren't installed properly.

MR. JOHNSTON: They weren't installed properly. So, they went back, you might say, and re-installed them properly, knowing the torque that was actually applied to the plugs rather than --

CHAIRMAN PALLADINO: You mean they didn't measure the torque the first time?

MR. JOHNSTON: They measured the torque that was applied to the torquing device, but that was on the outside of the universal joint, and where they were working with the outside edges --

CHAIRMAN PALLADINO: Were all the loose ones on the outside edges?

MR. JOHNSTON: That's my understanding, they tended to be there. It was because of the angle of the universal joint.

COMMISSIONER BERNTHAL: So, how do you know that there aren't others that are --

MR. JOHNSTON: Well, a thousand of them are re-done.

COMMISSIONER BERNTHAL: Oh, they were all redone.

MR. JOHNSTON: Yes.

CHAIRMAN PALLADINO: And I gather any new plugging will take advantage of whatever they learned from the old.

MR. JOHNSTON: Yes.

COMMISSIONER BERNTHAL: What is the distribution of the plug tubes, are they sort of randomly distributed throughout the generator, or is there a --

MR. JOHNSTON: It's my understanding, and I'll ask Conrad McCracken who is our expert in this area to verify what I say. But it's my understanding that they are relatively random. But I would -- he says they tend to be more in the outer circumference.

MR. MCCRACKEN: They are primarily in the outer circumference because the outer tubes are in more tension than the inner tubes at the center of the tube sheet where you get a slight amount of bowing. So, there is more tension there.

COMMISSIONER ASSELSTINE: That's what they found.

MR. MCCRACKEN: Yes.

CHAIRMAN PALLADINO: How many plugs are in the system loops, six?

MR. JOHNSTON: Approximately six.

COMMISSIONER ZECH: Are those the missing plugs you are talking about?

MR. JOHNSTON: Yes.

COMMISSIONER ROBERTS: Where are they?

MR. JOHNSTON: They are probably sitting in the bottom of the reactor vessel. Now, when we talk about plugs, we are talking about an item that is about three and-a-half inches long, about the size of this pencil, 6/10 of an inch, and they weight just about an ounce and-a-half. So, we are talking a small piece, light.

COMMISSIONER ZECH: Have you analyzed that to see whether that would do any harm during operation?

MR. JOHNSTON: That was analyzed as part of the SER that was written at that time by the technical branches involved and they concluded that there was no problem.

CHAIRMAN PALLADINO: They couldn't get anywhere and carried up.

MR. JOHNSTON: They considered that possibility, including the possibility they might get up into the bottom of the control rod drive tubing and things of that sort. But the conclusion in the SER was that that would not interfere with the operation.

CHAIRMAN PALLADINO: Could they get in and block any flow passages, block the flow around fuel elements?

MR. JOHNSTON: That was, as I understand it, also included and because it's a PWR, it has the opportunity for cross-flow. So, that there is a small location that readily moves around behind it and doesn't result in any volume that

is significant.

COMMISSIONER ZECH: But you did a good analysis, and your analysis shows that even though you have some of these missing plugs in the bottom of the vessel, I guess, right?

MR. JOHNSTON: That's where we think they are, we don't know.

COMMISSIONER ZECH: That that's not a problem. Is that what your analysis shows?

MR. JOHNSTON: That's the conclusion of the analysis.

COMMISSIONER ZECH: Okay.

CHAIRMAN PALLADINO: I presume you looked at the possibility of things just beating around the area and possibly damaging some other flow passage?

MR. JOHNSTON: I'm not sure that person -- I think I would like to ask the person behind me that knows more about that than I do.

CHAIRMAN PALLADINO: What is the likelihood that they just bang around in the flow?

MR. JOHNSTON: I think my first -- I'm going to get somebody to answer that. Brian Sheron or Gene Shea? Gene, why don't you come to the microphone?

CHAIRMAN PALLADINO: And repeat your name for the transcriber.

MR. SHEA: This is Gene Shea from the Core Performance Branch.

MR. SHEA: This is Gene Shea.

We analyzed that the plug, there is a blockage -- the partial blockage would not affect the DNB because the configuration of the fuel is -- so the diverging cross-flow will result in fore flow within a short period of distance up to the blockage.

And also, if there is a small fragment that gets into the core, we may have -- it might wedge it at the fuel. As a result of that, the worst condition is, they might have a fuel -- and the freezing gas release would be gradual because you don't expect to have -- and the tech spec has a surveillance requirement that will monitor the activity.

So, we think the effect on safety is not significant.

CHAIRMAN PALLADINO: Okay, thank you.

MR. JOHNSTON: There was a tech spec requirement that they do a periodic eddy current examination of all of the tubes in the steam generator, and this time period came up late last summer. So that they did begin to do an examination using eddy current techniques last fall and late summer. In the course of that eddy current examination, they discovered another 300-some tubes which had defects through the wall or defects in the wall which were greater than 40 percent of the wall thickness.

This was identified as the IGA component that we had talked about previously. The bottom line is that all of the

tubes have been plugged that exceeded the 40-percent limit which is the tech spec requirement. The steam generator has now been put back into its licensed condition. The indication is that the leak rate is less than one and-a-half gallons per hour, which is a very small leak rate, and it's been declared operable.

Altogether, there are now 1,542 tubes that have been plugged.

COMMISSIONER ASSELSTINE: How accurate is the eddy current testing for identifying these kinds of defects as opposed to the intergranular stress cracks?

MR. JOHNSTON: It's more difficult to find the IGA defects because -- I guess the best way to describe it, that the eddy current technique looks at -- it's a volumetric thing and if there is no loss of volume, in other words, if a crack is very tight it will not see it.

When we do see it is when the -- we get what we call a grain fallout because this type of attack essentially isolates the grains. So that if you get an operating condition which puts a strain -- thermal or mechanical -- that tends to open things up a little bit, grains can fall out and we then see the -- well, then the eddy current device sees the lack of the grain and says there is a volumetric loss there.

COMMISSIONER ASSELSTINE: Why didn't you find these

things, say, back in -- or the licensee find these things back in what, '81 to '82?

MR. JOHNSTON: They did detect them, as I indicated previously. I have a backup viewgraph that shows what was actually seen back in that time. It might be instructive if I show that. I believe it's back-up Slide No. 5.

I Want to show back-up Slide Nos. 5, 6 and 7.

COMMISSIONER ASSELSTINE: Also, did these things get worse?

MR. JOHNSTON: No. Our conclusion is that they did not get worse. We have run in parallel a corrosion program that uses fresh tubes which uses tubes that were in the steam generator at the time of the first set of defects. They have been running through a similar water chemistry and they have shown no changes.

The tubes that were not plugged which had some defects in them, in other words, there were less than 40, had been monitored both then and at the more recent, and they have seen no change in the depth there.

So, the conclusion is that the corrosion mechanism is not presently active and these are pre-existent defects which have now become visible.

COMMISSIONWER ASSELSTINE: Okay. Why weren't these plugged earlier on, then, if you knew about them at the time?

MR. JOHNSTON: The depth was indicated, I'll show that

in the next two slides after this one.

COMMISSIONER ASSELSTINE: Okay.

MR. JOHNSTON: But it was just in the grass.

COMMISSIONER ASSELSTINE: Okay.

MR. JOHNSTON: What I would like to show here first is an example of the integranular IGSCC, intergranular stress corrosion cracking. That crack goes all -- that's the actual wall of the -- steam generator tube and that crack goes all the way through the sample. That's relatively easy to be seen by the eddy current device. Yes, it shows on there.

And the next one, then, is what was also --

COMMISSIONER ASSELSTINE: Is that the outside of the tube, or is that a cross-section?

MR. JOHNSTON: The upper is the inner, is the inside, and the bottom of it is the outer.

COMMISSIONER ASSELSTINE: Okay.

MR. JOHNSTON: You notice if you look at the inner, you see a little more broader band, and if you'll focus on that in the next viewgraph, you'll see the IGA.

CHAIRMAN PALLADINO: Are we looking at a cut through --

MR. JOHNSTON: You are looking at a cross-section through the wall of a steam generator tube at 100 X magnification

Look at the bottom rather than the upper, and you note that region that is roughly where the pencil is, you see

the region where some grain boundaries are outlined in the dark, and that is the region of IGA. You notice it does not have the same kind of orientation through the wall that the previous viewgraph, previous slide had.

But that is the kind of indication that one would get from a cross-sectional examination. Now, if we did eddy current on that tube, you'll notice that there is no loss of volume and, consequently, it doesn't show up well in the eddy current examination. The black spots that you see are grains that fell out during the metallurgical preparation. So, it wouldn't be that way in the actual tube.

The next one, I believe, will show a little bit of what would have been seen at the time. If you look at the one at the top, you will see where -- the dark stuff up at the top -- that there have been some grain fall-outs and that would be detected by the eddy current as less than a full thickness of the wall. That would trigger in general a more detailed examination.

Now, after this more recent episode, they went back and looked at all of the data that was taken during the previous examination and after the fact, knowing it's there, they could see indications in the background, a scatter of the data, that would say, "Yes," there was something there. But the indication was not indicating the kinds of depths and so forth that would have necessitated taking any action at that

time.

CHAIRMAN PALLADINO: Bill, can I ask a question on a different subject? Are you through, Jim?

COMMISSIONER ASSELSTINE: I guess the only other question I had on this was, to what extent, given the fact that it's tougher to spot this kind of corrosion as opposed to the cracking, how confident are you that this latest round of eddy current tests has identified all of these kinds of areas, particularly given where they are located. I gather this is in a tougher part to spot this than the kind of cracking you normally see in the tube sheets.

MR. JOHNSTON: Well, this is in the span part of the tubing, it's not -- in itself it's not particularly difficult to get to to do the examination. I think one can never say that there will be no further evidence of this sort.

The reason that we think we got so many of them this time is that as a part of the checking out of the kinetic expansion work the steam generator was given a special rapid cooldown to put a maximum amount of stress on the tubing to make -- essentially to continue to verify that the expansion process was successful and no tubes would be pulled out under what would be a rather extreme stress condition.

That mechanical and thermal stress did put these portions of the tube on tension and make it possible, more

possible, for the grains to drop out than would happen in a normal cooldown or a normal situation. So, we think we found most of them this way. But we would guess that there -- we would anticipate that there will probably be some more that would come about later.

The point, I think, I should that I hadn't made yet, and that is that the intergranular stress corrosion cracking is of the nature of a crack which tends to run circumferentially and it's essentially like pulling down on my pencil and getting that type of a defect.

This is a -- because it's a patchy type of defect is not prone to run in a circumferential sense. And the eddy current devices that they have now, it's called an 8 x 1, but what it really means is that they have essentially eight little coils, each acting independently. So, they can break up the circumference into eight pieces and determine then when they see a defect how much of the circumference it is, and the ones that we were examining here which had been plugged, they were all either once segment or two segments which is, they were less than 2/8 or 25 percent of the circumference. So, most all of them were then a matter of, I think, less than ten, were all just one segment wide which meant they were twelve and-a-half degrees -- I'm sorry, what is it, 45 degrees? No, 22 and-a-half degrees, just 1/8 of the circumference of the tube. So, they are short.

If we missed some, then the consequence is only a very small leak and there are several other safeguards that we have built into the SER and the licensing requirements that will ensure better control of the water chemistry, better control of the contaminants, and an examination after a very short running period which will get us another chance to see if anything has changed.

COMMISSIONER ASSELSTINE: Is there a possibility for the same kind of intergranular attack on any other parts of the primary system? Are the tubes the only things that were susceptible or are susceptible to this kind of attack from the sulfur, or could the sulfur have affected anything else?

MR. JOHNSTON: No. At the time it was first identified, an extensive examination was made of the whole primary system. The places that are most susceptible are those places that would be at an air-water interface.

COMMISSIONER ASSELSTINE: Okay.

MR. JOHNSTON: It was portions of the plant which might have been exposed to air when the steam generator was open. So, it's basically air-water interface and slightly above it.

COMMISSIONER ASSELSTINE: So, anything submerged would not have been --

MR. JOHNSTON: Those things submerged are not so much

of a problem. The whole plant was gone over, all of the internal structure and the core itself, and so forth, was examined at the time. Recalling, there were one or two places where they found it. There were some safety valves, I think, which the bonnet hat some indications of attack on it which were replaced. But generally speaking, it was all concentrated in the steam generator.

MR. THOMPSON: But I would say where we are right now, it's the staff's position that the TMI-1 steam generators have been repaired to their original licensing condition.

CHAIRMAN PALLADINO: That's my question.

MR. THOMPSON: And that these repairs were done consistent with criteria approved and used for the repairs in other steam generators. So, we see that there is no licensing problem with the steam generators at this time.

CHAIRMAN PALLADINO: Let me ask you a question. I just want to make sure that I understand the situation right. There had been a request by GPU to operate without plugging some of these tubes that were at the 40 percent limit.

MR. THOMPSON: That's right. There was a --

CHAIRMAN PALLADINO: But he staff did not act on that.

MR. THOMPSON: That's right.

CHAIRMAN PALLADINO: But GPU came back and said, "Well, we might as well go plug it," and they plugged them, and they

did; is that right?

MR. THOMPSON: That is correct, they have plugged those steam generators which the revised tech spec plugging criteria would have applied to. So, they do intend to proceed with that. We have indicated that that will require a license amendment, be noticed --

CHAIRMAN PALLADINO: What will require a license amendment?

MR. THOMPSON: Their request to modify the tech specs, those will require a normal licensing.

CHAIRMAN PALLADINO: What requests are they making to modify the tech specs?

MR. THOMPSON: They will request a revision to the plugging criteria based on their ability to identify this intergranular attack, such that there is a different plugging criterion from the one they presently have.

MR. EISENHUT: For future, is the key.

MR. THOMPSON: For future, you know, that is a process. Their current plugging criterion is the one that was previously developed, originally, for the plugging of tubes and their tubes have been plugged. If they did not meet their criteria.

MR. JOHNSTON: It applies to all plants.

CHAIRMAN PALLADINO: What sort of criteria are they going to change?

MR. THOMPSON: Well, they have requested the capability to have a more focused -- rather than the 40 percent, I think there is a 70-percent corrosion identification, indication of the 70-percent through wall where we normally expect 40 percent to 360 degree.

Now, our staff has not agreed with that, that's a process that is under review and we are still evaluating that. I think they have not even formally submitted their licensing --

COMMISSIONER ZECH: But do I understand that doesn't have anything to do with the current status, that's something that is planned for the future?

MR. THOMPSON: That is for the future, has nothing to do with the current license and tech specs.

CHAIRMAN PALLADINO: Now, we plug more tubes, and I don't know how many tubes have been plugged. Must there be an evaluation made on the capability of this steam generator to handle full load, or any other evaluation?

MR. THOMPSON: The previous evaluation with the effect of the plugged tubes was made assuming 1,500 tubes were plugged. Currently, they plugged a few more than that. I believe the number is 1,542, is approximately that number. We have asked the utility to provide us an analysis on the effects of transient accident response with more than 1,500 tubes plugged. We expect to receive that late this week or early next week, and we will evaluate that in early May.

COMMISSIONER ASSELSTINE: What's the plugging limit for this plant?

MR. THOMPSON: There is no plugging limit per se. That is, what you have to evaluate, the impact that it may have on flow set points or any of the type set points, or your power limitations --

COMMISSIONER ASSELSTINE: Okay.

MR. THOMPSON: -- on just heat transfer with the number -- accident conditions with the number of tubes plugged. We anticipate they may be coming in with a bounding analysis that would identify some larger number than the current number. It may be 2,000 or 2,500, or 3,000 tubes plugged and be able to identify the additional margin that the plant has built into it with the anticipation of some tubes plugged.

CHAIRMAN PALLADINO: That's one of the questions -- maybe you are going to cover this later. Have we put, or have they committed to making more frequent inspections than usual as a result of the experience with these particular steam generator tubes?

MR. JOHNSTON: At the present time, there is a license condition that after the initial period of operation, something like 90 to 120 days, there will be a complete re-inspection of all of the steam generator, all portions of it. That is presently a license condition.



What kind of inspection would be required after that

is not determined yet because it will hinge in part upon the results of that inspection. They do have also the requirement for a very small -- they are permitted only a very small increment in leakage rate before they have to shut down and do an examination as well. It's 1/10 of a gallon per minute, which is very sensitive.

COMMISSIONER BERNTHAL: Yes, I had one question. We have roughly five percent, I guess, of the tubes plugged now. Is that extraordinary as compared with other PWRs and BWRs -- not that it matters, I guess? San Onofre-1, I guess, is derated because of tube pluggings. Where does this fall in the spectrum of plugged tubes?

MR. JOHNSTON: We have some plants that are up as high, I think, as ten percent of their tubes plugged. We have many that have less than one percent. So, these people are in the middle.

COMMISSIONER BERNTHAL: How many plants have been derated for tube plugs?

MR. JOHNSTON: To my knowledge, none.

MR. EISENHUT: Well, there were actually brought down in power. Recall, there were several plants that replaced the steam generators. I think the first one was the Surry facility where the net effect is, you can keep plugging tubes.

COMMISSIONER BERNTHAL: Right.

MR. EISENHUT: And to stay within the safety limit, what you eventually do is start bringing down the power.

As I recall, the Surry plant, as I remember a few years ago, was actually in the 90-some percent power. The Turkey Point plants were getting close.

MR. JOHNSTON: Robinson.

MR. EISENHUT: Robinson may have gotten close. So, there were several plants. And I think if you look at the overall approach here, it's been to, when the tube gets in question you remove it from service by plugging. So, you in effect maintain the integrity of the steam generator.

The second thing that's here is, on this plant we are keeping the same plugging limit in terms of criteria. The utility is preserving his option and wants to come back in for a longer-term approach for when not to plug things.

The third thing is, we think it looks like not outside the realm of what we have seen in other steam generators in terms of numbers of tubes that are plugged.

So, I'm not sure it's actually a license condition yet or one of the proposed license conditions. I forget who is taking action on which ones. But we would put on this plant the condition for shorter-term inspections to ensure that there is a good understanding of what's happened in the steam generator -- or rather what is happening in the future.

So, we think it's this set of these things that gives

us confidence that the tubes in service are in fact going to be adequately safe and not significantly degraded as we would go forth with operation of the facility.

COMMISSIONER BERNTHAL: But just on the face of it -- I'm sure it isn't this simple -- but you would say that five-percent of the heat exchanger tubes are plugged, then unless there is a significant margin you would derate the plant five percent?

MR. EISENHUT: That's right. And in fact, you can generally sharpen your pencil on an ECCS-type evaluation and show that you can tolerate more tubes plugged, up to some limit, and then at some point what you would do is drop the power level a couple of percent so you get a power flow consideration.

So, I guess it would be our approach to -- we would set the limits and if that means the plant comes down eventually to 95, 93, 92 or whatever power level, so be it.

But as long as we maintain these limits, we think the steam generators are adequately safe.

CHAIRMAN PALLADINO: Commissioner Zech?

COMMISSIONER ZECH: Just another question on the missing plugs. Have there been any other plants that we have had the same problem with in the past, and do you have any history or any analysis that has been gotten, or is this unique?

MR. EISENHUT: Bill, do you want to --

MR. JOHNSTON: Yes, I want to think about that for just a minute. To answer the question directly, whether you mean plugs as such or whether you mean operation of plants with other small pieces --

COMMISSIONER ZECH: Loose parts.

MR. JOHNSTON: The loose parts, definitely, plants have been operating with loose parts.

MR. EISENHUT: Yes, I think it has actually been both.

MR. JOHNSTON: Oh, yes.

MR. EISENHUT: Conrad, you probably can remember the details. But there were actually plants where plugs had fallen out previously, that is, they weren't properly inserted when they were explosive plugs or mechanical plugs. As Bill Johnston said, there were numbers of cases where there were actually loose parts which were significantly bigger than these very small steam plugs, that were in plants. And albeit, if you go back to the Ginna event, that in fact was a very large hunk of steel, a loose part, that vibrated.

COMMISSIONER ASSELSTINE: Yes.

MR. EISENHUT: So, what we look for is the kinds of things that Bill mentioned earlier. We look at, where can it get lodged; can it affect some hydraulic considerations; can it vibrate to the point where it would cause a problem. But

you basically go through that consideration. And again, that kind of evaluation is not unique, we have done that on a number of other plants.

COMMISSIONER ZECH: Thank you.

CHAIRMAN PALLADINO: You want to go ahead?

COMMISSIONER ASSELSTINE: I had a couple of others on steam generators.

CHAIRMAN PALLADINO: He is not leaving steam generators.

COMMISSIONER ASSELSTINE: Okay, go ahead, then.

MR. THOMPSON: No, the only other thing I was going to say, that there is one other item that we have, the April 5 letter from UCS which has been directed to the staff for response. We have that under review right now. Generally, they cover areas that we have looked at before, but we want to prepare a detailed response back to you and we have that response under preparation at this time.

CHAIRMAN PALLADINO: When might we expect that response? Should I not ask any questions about the letter?

MR. THOMPSON: We have some individuals in the audience who can probably respond to the details. We would anticipate completing that by early May.

CHAIRMAN PALLADINO: Let me just ask one about the letter, since you brought it up.

(Laughter)

CHAIRMAN PALLADINO: It says, "Based on the information

available to us, UCS has concluded that a safety evaluation of the steam generator tube rupture accident at TMI-1 has not been performed in accordance with the Commission's safety requirements for the design basis accidents."

Is that true or not?

MR. THOMPSON: I think I'd like to ask Dr. Sheron, Brian Sheron, to respond to that. Maybe if you could identify the page for us.

CHAIRMAN PALLADINO: It was the last page. There are others along the way.

MR. SHERON: Brian Sheron, Chief of the Reactor Systems Branch.

The steam generator tube rupture analysis that was performed by GPU for TMI-1 was done back in the FSAR when the plant was licensed. This plant was licensed, I think, right at the time the general design criteria were being promulgated and, I believe, it was not necessarily required to meet the general design criteria.

The staff did do a review at that time, which was around 1971, and concluded that analysis -- I'm sorry, that the plant design did meet the intent of the general design criteria.

Since that time, obviously the staff interpretation of the regulations and alike has led to analyses for steam generator tube ruptures being done differently than they were

at that time. We have not gone back and asked TMI to re-do their entire steam generator tube rupture analysis according to assumptions that are made today.

The issue would be generic since it would affect a lot of plants, and we would treat it on a generic basis for that reason.

CHAIRMAN PALLADINO: I don't know what to get from that. It means that either a) you don't think it's necessary to do it or, b) it takes too much trouble to do it or, c) we ought to do it?

COMMISSIONER ASSELSTINE: Why couldn't you do an up-to-date analysis for this plant now, recognizing that you may want to approach it generically for everything else. But why couldn't you do one for this one now, using current assumptions?

MR. SHERON: When you say "we," you mean the staff do one, or to ask GPU to do one?

CHAIRMAN PALLADINO: Well, whoever would normally do it.

COMMISSIONER ASSELSTINE: I guess the licensee --

MR. SHERON: We would normally ask a licensee or an applicant to do an analysis if one was required.

CHAIRMAN PALLADINO: And I don't have an appreciation of why that's so difficult to do or why it shouldn't be done.

MR. EISENHUT: Well, just a couple of comments on it.

One is, a lot of these older plants do not have a complete Chapter 15 analysis of a lot of accidents like we would do today.

Number one, it's an extensive evaluation to be done to re-do the -- basically, you re-do a number of the accident evaluations.

Number two, we have not adopted that as a generic requirement and it would be just as easy if we tried to treat this as any other operating plant. We thought that was basically the Commission's guidance which would say we would not levy that kind of a requirement on the plant unless there is a reason to do it, or the Commission chose to do it.

So, it is certainly something that could be done.

CHAIRMAN PALLADINO: Is it a big thing to do? For the steam generator, just let's take the steam generator.

MR. EISENHUT: The steam generator? We'd have to get an estimate.

CHAIRMAN PALLADINO: Maybe tomorrow we might get such an estimate from GPU. Okay.

The reason I ask is, this steam generator -- these steam generators had sodium thiosulfate, I believe, introduced and so they are not the normal kinds of steam generator problems. If there is any contemplation that plants start up, any kind of a significant event such as even a single tube rupture would be viewed with great consternations in a lot of areas, including here.

So, a little bit of extra care on the physical hardware, it seems to me, would be prudent. And I don't know what the balance against that prudence.

MR. EISENHUT: Yes, and I didn't mean to be argumentative, except we tried to follow the Commission's guidance and treat them like every other operating plant. Which meant we went in the direction of ensuring the tubes' integrity was up to the standard which we would maintain at every other plant, such that you would not be led to require an additional different evaluation, different analysis.

It is something that certainly could be done.

MR. MURLEY: Darrell, could I add a point there? We are going to talk in just a moment about the training of the operators. But they all have had training on the new procedures down at the Lynchburg simulator, B&W simulator.

And one of the accidents that they are trained on is a steam generator tube rupture accident. We have observed some of those training cases. I am certain that B&W has done an updated analysis using the latest --

MR. EISENHUT: Yes, they have.

MR. MURLEY: -- criteria. So, I'm certain that the accident has been analyzed by B&W and that these operators have been trained using the latest analysis. Basically, I think we are talking about GDC-17, aren't we, whether you require loss of off-site power at the same time as you have a tube

rupture accident.

CHAIRMAN PALLADINO: Well, I have some questions that were raised by this letter with regard to training.

MR. MURLEY: We will get to that in a minute.

MR. EISENHUT: I think there is a generic evaluation that was done by B&W.

MR. MURLEY: Yes.

MR. EISENHUT: That has been factored into the B&W program and in fact factored into the emergency procedures, I believe, and all operators have now been trained on it, that generic evaluation.

CHAIRMAN PALLADINO: Well, I want to come back to the training later. Okay, thank you.

MR. THOMPSON: If there are any other specific questions on the steam generator, we can entertain those now. If not, I guess I'd like to turn it over to Dr. Murley to give you an up-to-date status on --

CHAIRMAN PALLADINO: I have two questions, and then others may have questions as well.

With regard to training, I think UCS says in here that at the hearings they asked questions -- I forgot the statistics of who didn't know what. But I think there were in the order of four of them quizzed and only one knew one condition and none of them knew the other condition, implying that maybe the training isn't all that effective.

MR. MURLEY: We'll talk about that, if we could, later.

CHAIRMAN PALLADINO: All right.

MR. MURLEY: We've got a presentation on training.

CHAIRMAN PALLADINO: All right. Oh, I thought you were through with steam generators.

MR. THOMPSON: Well, they are talking about the operators and the operator readiness. That is one of the issues that is going to be covered by Dr. Murley.

CHAIRMAN PALLADINO: -- another one, improvisation that I presume you will cover because they say these things are complex and I am sure they are complex. But it was not apparent to me that improvisation was such an important aspect.

(Commissioner Bernthal leaves meeting.)

MR. MURLEY: Yes. The general answer to that, Mr. Chairman, is that these people are going to have procedures and these procedures have been -- oh, yes. And they have been well thought out. I have seen the procedures myself in the control room and they are not going to be operating blind.

CHAIRMAN PALLADINO: The impression on improvisation is that there comes a point where the procedures run out of guidance and you are on your own.

COMMISSIONER ASSELSTINE: Yes.

MR. THOMPSTON: There is a point in any of these

emergency operating procedures, and that's the whole basis for the new operating procedures, that they allow you the freedom to use what equipment and hardware is available in an analyzed way so that the operator is not flying blind like he had been in the previous where he only had one set of steps to address a particular transient or emergency operation.

That's what you make use of, any available equipment and it's analyzed, and that is part of the whole basis for moving to the symptom-based procedures.

CHAIRMAN PALLADINO: But that's an option sort of program and not an improvisation.

MR. THOMPSON: That's correct. That is an intended approach to provide that flexibility.

CHAIRMAN PALLADINO: All right, other questions?

COMMISSIONER ZECH: No.

COMMISSIONER ASSELSTINE: I had just a couple. You talked about the license condition for an additional inspection within what, 90 or 120 days, however it finally comes out.

What was the motivation for that extra license condition, the extra inspections? Was it questions about the effectiveness of the tube plugging program, or continued questions about this intergranular attack?

MR. JOHNSTON: That was added or put in at the time of the kinetic expansion program and was simply to give us additional assurance that after a period of operation the

kinetic expansion remains effective.

COMMISSIONER ASSELSTINE: Okay.

MR. JOHNSTON: And indeed, it would pick up any continuation of any corrosive attack that might still be going on. It's an added measure of assurance and margin, if you like. It's our conclusion that the plant meets its licensing basis now and it is no more likely to have these kinds of events than any other plant that meets its license condition.

COMMISSIONER ASSELSTINE: You mentioned that the tube plugging level is about five percent now. Can you give me a feel for what the tube plugging level was at, say, Surry and Turkey Point when those utilities decided to replace?

MR. JOHNSTON: I'm guessing it's 10 or 12 percent because I don't have the book back here that tells us.

MR. EISENHUT: As I recall, it was a lot higher. If it interpreted Conrad's saying it was something over 20 percent and was told it got actually up to maybe 25 percent on those plants.

MR. JOHNSTON: Okay, 25 percent.

MR. EISENHUT: But it went through, again, like it did here. As I recall, we went through step-wise more and more ECCS evaluations in more depth, higher priced evaluations to show that it was acceptable up to that level. And at some point, it got to the point it actually started impacting power operation. But it's some quite high number.

COMMISSIONER ASSELSTINE: Have there been any indications that GPU is considering replacing the steam generators? Are they talking to anybody about finding steam generators or looking in any way, any signs at all that that's under consideration?

MR. JOHNSTON: Not on the record, not any.

MR. EISENHUT: Not that I am aware of.

COMMISSIONER ASSELSTINE: Okay. The only other question I had, had to do with the UCS letter that the Chairman mentioned.

Bill, you said that the objective here was to bring the conditions of these tubes up to the original licensing basis so that they are in as good a shape as the tubes at any other plant. And yet, the sense I get from reading the UCS letter is that because of the degraded condition of the tubes there have to be a number of changes to the emergency procedures, changes that would complicate what is already a response to a very complicated transient and would make it more difficult to handle a tube rupture at this plant than at other plants. There is a whole variety of things that are described in the letter, some of which sound pretty serious to me.

But am I missing the point of the letter?

MR. EISENHUT: Two comments. I'm not sure I said up to the original level, someone may have. Obviously, up to the

original level they are brand-new, virgin tubes, undegraded. But we think it was up to a level where we think the tubes were adequately safe, they are not significantly degraded and you don't really, of course, bring the tubes up. What you do is, any tube that is in question you remove from service by plugging it.

COMMISSIONER ASSELSTINE: Right.

(Commissioner Bernthal rejoins meeting.)

MR. EISENHUT: So that only the tubes that are left, only tubes that are acceptable are left and by "acceptable" we maintain the plugging limit for waste -- tube material removal. That has been used in many, many plants; has been shown to be a reliable plugging limit. It is one that gives you an adequate margin. It gives you adequate margin even for degradation through a fuel cycle was the way it was designed, for a degradation mechanism. You plug at the beginning of the cycle, you have degradation through the end. So, even at the end of the cycle with various degradation means at work, you still have an adequate margin on the tube.

Bill, would you care to elaborate? Basically, we think the tubes are maintained at an adequately safe level with this kind of an approach in place, as I see it.

MR. JOHNSTON: Yes. There is an assumption, I guess, that the UCS letter contains which would be contrary to the record that has been established over the last several

years. The staff has supplied substantive information. We have issued several NUREGs. We have had several hearings before the Boards. We have issued summary disposition motions, pre-filed testimony. There is a hearing record, all of which at the end concluded that the steam generator was indeed brought back to the licensing, the original licensing basis. That's what the substance of the staff position is, thatwe believe that that's the case.

I just looked up and got some additional information that deals with what percentage of tubes are plugged in some other operating plants.

We have one plant that's running with 22 percent of the tubes plugged, and two others that have more than ten percent that are currently operating plants. And that is not including the Robinsons, or Surrys, and the ones that have actually -- and the Point Beach which have actually changed out their steam generators.

So that these people are not in that ball park yet.

COMMISSIONER ASSELSTINE: Let me ask you on the comparison, though, with other plants. If the tubes are not degraded below what is provided at other plants, first of all, is UCS right in saying that the ~~shelter~~ shell-to- tube temperature difference for this plant is lower than for others, and that they are asking to use a lower sub-cooling margin.

And if so, if they are right on that, if these tubes

are just as good as at other plants, why are they proposing using both of those numbers in those two areas?

MR. JOHNSTON: Well, those are choices, those are prudent choices which the utility makes. The design basis is still 150 degrees in this plant as it is in the other B&W plants. Some of the B&W plant owners have chosen, on their own decision, to use lower numbers.

COMMISSIONER ASSELSTINE: And why did they do that?

MR. JOHNSTON: A&O-1 is using 50 degrees.

COMMISSIONER ASSELSTINE: And why did they do that?

MR. JOHNSTON: Because any time that you cool down a B&W plant, you do indeed put the tubes under tension, and prudent operation would say, let's put out tubes under less stress than, you know, just operate them in a more conservative manner. And this plant has chosen to do that, too. But they are not the only one. It is not something, at least as we understand it, is something that they had to do. It is something a prudent operator might choose to do and some others have, indeed, also done.

But the design is still 150.

CHAIRMAN PALLADINO: But there is the implication in the UCS letter that this is dissimilar from other similar plants.

COMMISSIONER ASSELSTINE: That's right.

CHAIRMAN PALLADINO: And you are saying it really

isn't.

MR. JOHNSTON: Well, it's their prerogative to make that claim.

MR. EISENHUT: No, he is saying the design is the same.

MR. JOHNSTON: I'm saying the design --

MR. EISENHUT: The design for 150 degree temperature differential in an emergency. You can therefore -- you can cool it down slower which puts less stress on the tubes.

CHAIRMAN PALLADINO: But the implication was that here the situation is different because something is different from other PWR systems.

MR. MURLEY: The allowable sub-cooling margin, Darrell, they have chosen to go to 25 degrees.

MR. JOHNSTON: Again, that was an arbitrary choice which they had. They could choose it. We reviewed it, as we understand it, we accepted it.

Other plants -- I'm not sure -- may be using the same number.

MR. THOMPSON: But we were going to, in essence, try to address these types of details, you know, in the response. We got the letter and met briefly on it yesterday when it was assigned to us and I think if you want to get in specifics on the 20 degrees versus 50, I think we can have someone who can address that in a kind of generic sense.

But I think I would prefer, if you want to rely on a response for us, that we abe able to provide it.

COMMISSIONER ASSELSTINE: Yes, maybe we should give you the chance to look at it, yes.

But I think from my standpoint, that's one of the things that I had a particular concern about. When I read it, the sense I got was, this plant is different. It's different because of the degradation to the tubes, and you are taking a complex transient and difficult emergency procedures and making them substantially more so because of the condition of the plant, and that's --

MR. THOMPSTON: I certainly think that's the tone of the letter. Certainly, we have looked at the ATOC procedures, the crew training. When I was with the Division of Human Factors Safety, we had a group go down and walk them through the training in Lynchburg on the simulator there to get our level of comfort that in fact in particular on the steam generator tube emergency operation procedure, that that was one which was viable; was one that the operators could follow.

We came back with the feeling that, yes, indeed it was. The crews are trained on it, they are licensed on it, and I think Dr. Murley or Rich Starostecky may be addressing part of what they are doing as a follow-up to this.

So, it is something that we have not in our audits in oversight been led to believe is a particularly difficult

response for the operators to do.

COMMISSIONER ASSELSTINE: I mean, this whole area is a tricky transient anyway. It is a pretty difficult one to deal with the path out to the environment.

MR. EISENHUT: Well, I'm not sure it's that much -- it's certainly one that you have to be trained in.

COMMISSIONER ASSELSTINE: Yes.

MR. EISENHUT: Other accidents are also tricky when you look into them.

MR. THOMPSON: Actually, steam generator tubes was one that people fairly well understand and identify fairely frequently, and drill on it probably more than any others.

MR. EISENHUT: Well, that is true. But also, the risk of a steam generator tube rupture, we have all sat around this very table and discussed, is extremely low also.

So, you have to keep these things in mind. But, as Hugh said, we just got the letter for action. We will be going through it in some depth, we will be looking at the pros and cons. But the differences themselves are not necessarily bad. So, we will have to take a look at that.

CHAIRMAN PALLADINO: Why don't we proceed on another item, proceed according to your agenda?

MR. THOMPSON: Okay, Dr. Murley?

MR. MURLEY: Whenever we have a plant ready to start up after a long outage in the region, we do some special

inspections and readiness evaluations to assure ourselves that the plant and the operators are ready to restart the plant. We have done this on Pilgrim, on Oyster Creek, on Salem. We will do it on Peach Bottom-2 when it comes out of a long outage to replace pipes.

We have also done it for TMI-1 and, in fact, we have gone well beyond our normal inspections. We are going to talk about the results of some of those things.

The most comprehensive analysis we do is the SALP report. Could I have Chart 6, please?

We have just completed a SALP appraisal. The Board met in March. It was chaired by Rich Starostecki who is to my left. It included senior menagers from NRR and I&E, as well as the region, and also the senior resident inspector, Rich Conte, who is with me here today also.

So, therefore the SALP represents an assessment of the broad range of NRC staff. This latest SALP points out some weaknesses in the operations, but by and large the picture that emerges is one of a good operating team and strong management involvement and control of plant activities.

We have to keep in mind, though, that the plant has been in a shutdown mode for several years, and one would expect that the operations staff would be familiar with their jobs and not make mistakes.



There is nowhere near the number of challenges to the

operators in a plant like this that has been shut down than an operating plant would represent.

COMMISSIONER ASSELSTINE: It's sort of tough to get a comparison for how much confidence to put in the large number of Category I otems for a plant that has been essentially shut down for several years.

MR. MURLEY: Yes.

COMMISSIONER ROBERTS: When was the previous SALP done?

MR. MURLEY: The previous one was just about a year ago.

COMMISSIONER ROBERTS: (Inaudible)

MR. MURLEY: On TMI-1? This one was slightly better. We see, for example, fewer procedural errors. But again, they ae both for the same shutdown mode.

COMMISSIONER ASSELSTINE: In fact, they haven't had one, have they, for operation?

MR. MURLEY: No.

So, with that caveat, one has to keep in mind what we look for in SALPs like this, are there any fundamental underlying problems and again, as I said, we don't really see any. We see strong management involvement and control of the operators and the plant activities. That's the kind of thing you would look for.

Our experience in Region I is that when a plant returns to operation after a long outage, there in fact may be

equipment errors and personnel errors. So, that's the kind of thing we will be looking for.

One general comment on the SALP is that there are only a few allegations that we have had on this plant. There are none, to my knowledge, that are outstanding now. That is usually a question that the Commission is interested in.

Recent information we have gotten on some possible irregularities in a general employment training testing program -- this is not an allegation but is something that we routinely will look into -- I just learned about that today so I don't know anything more about it.

That's all I planned to say on SALP. A major effort that we have looked into on TMI-1 is their training program and their operator readiness.

COMMISSIONER ASSELSTINE: Before you leave SALP, let me ask you one question. I notice that one of the areas where they got a "2" was licensing activities. As I recall, the staff said this was the worst plant in the country on environmental qualification of electrical equipment, and they got a "2."

How do you square that?

CHAIRMAN PALLADINO: In terms of --

COMMISSIONER ASSELSTINE: In terms of performance and documentation. How do you square that with the "2" rating for licensing activities?

MR. MURLEY: The licensing activities, those analyses are done by NRR and I guess I'll --

COMMISSIONER ASSELSTINE: How do you square it?

MR. MURLEY: Can I turn to Hugh Thompson?

COMMISSIONER ASSELSTINE: I notice, there is some brief discussion --

MR. THOMPSON: Let me ask John Stolz who was the NRR manager there. I know we focused on the environmental qualification issue and the response to that over the past year. If my memory serves me right, it was a while back that it was a major concern. John?

MR. STOLZ: I think you have to recall that the previous assessment reflected very unfavorably on the environmental qualification, and that was in fact reflected in the previous SALP review.

COMMISSIONER ASSELSTINE: Did they get a "3"?

MR. STOLZ: For that one issue they did. But for overall --

COMMISSIONER ASSELSTINE: On licensing activities?

MR. STOLZ: But the overall, I think that came also out to "2."

COMMISSIONER ASSELSTINE: Okay.

MR. STOLZ: Due to the innumerable audits that we held during the course of this period, if you recall, especially on the aux feedwater system, the licensee's performance obviously

improved and in fact, we regard the environmental qualification of this licensee to be above average now.

But it's due to this so-called remedial action that went on during this period that the licensee turned out okay. So, that's the result of this.

COMMISSIONER ASSELSTINE: All right, so the "2" reflects improvement.

MR. STOLZ: Yes. Not only that, but the "2" largely is based on the fact that the licensee's performance in so-called "non-critical" areas, those areas that were not immediately needed for restart, we reflected a "2" to account for the fact that the licensee's attention wasn't devoted as much to those areas as it was to the restart issues.

COMMISSIONER ASSELSTINE: Yes.

MR. EISENHUT: Yes, the point I was going to make, the assessment is all licensing activities.

COMMISSIONER ASSELSTINE: Yes.

MR. EISENHUT: That is, in this case all licensing requirements, environmental qualification being one of those.

COMMISSIONER ASSELSTINE: One of them.

MR. EISENHUT: And then it largely fell in the previous rating.

COMMISSIONER ASSELSTINE: Okay.

CHAIRMAN PALLADINO: Okay, you want to go on?

MR. MURLEY: The major effort that we have done in

looking for the readiness to restart is to evaluate the operators and their capability.

I would like to ask Rich Starostecki to talk about what we have done and what we found.

MR. STAROSTECKI: In late 1983, in the fall and winter of '83, there came the question of TMI-1 being shut down so long, and we had a concern as to what is it the operators really knew. And at that point in time, after consultation with NRR, the ATOC procedures were being implemented at several plants, including Three Mile Island.

So, we came up with the unique effort to orally examine and conduct plant walk-throughs for as many of the operators as we could. And in February of 1984, we had a team of people made up of the prior senior resident, an examiner and a senior resident from B&W plant in Region V; an instructor from the Chattanooga Training Center; a supervisor from the Region I office in charge of operator licensing, and they interviewed 26, the available 26 people that were on site, with the view of trying to understand what level of knowledge they had and what skills they possessed.

The effort did identify that people were able to communicate and demonstrate to us that they could handle casualties, and we came up with a number of deficiencies that we documented. These deficiencies led us to conclude that people got rusty, and it was the routine operations that one

would expect the operators to be able to handle that were posing a lot of difficulty, things such as -- and I'll list the two items that dragged on the longest.

The two items were understanding the detailed functional controls of what one refers to as the electro-hydraulic control system, which is the system used to control the main turbine. They need a lot of training on that and we said that's a concern. Now, that is not a safety-related system but that is something we expect the operators to be familiar with.

The other problem that we noticed was the ability to properly estimate the approach to criticality. And again, in hindsight, we see a flaw in that the training devices used for the operators werenot equipped to do that. Everybody does training after you reach criticality. So, it is the approach to criticality that needed some more training.

COMMISSIONER ASSELSTINE: The simulators can't simulate that, the B&W simulators?

MR. STAROSTECKI: I don't believe they had B&W training for all the people on that approach to criticality in estimating the critical position.

COMMISSIONER ASSELSTINE: I mean, that has to be something --

MR. STAROSTECKI: I would turn to GPU and ask them more details. But again, my answer to that is, when you look at

how much time these operators spend on the simulator, is that where you put your attention. And I would expect them to put more attention on coping with more severe transients and accidents.

COMMISSIONER ASSELSTINE: Yes.

MR. STAROSTECKI: So, GPU in fact does have a basic principles trainer right there near the site --

COMMISSIONER ASSELSTINE: Yes --

MR. STAROSTECKI: -- but it doesn't model this very event.

COMMISSIONER ASSELSTINE: That's right.

MR. STAROSTECKI: So, therein lies -- it didn't at the time model the event, and that was the problem. It does now.

COMMISSIONER ASSELSTINE: Yes. If you had a plant reference simulator, you would presumably put your people right back into that pretty quickly and run them through it, bring them up to speed.

MR. STAROSTECKI: Yes, I agree.

CHAIRMAN PALLADINO: You said they now have the capability?

MR. STAROSTECKI: The basic principle trainer does now afford them the opportunity to do that. But it's still --

COMMISSIONER ASSELSTINE: But that's not a simulator.

MR. STAROSTECKI: The lesson we have learned in Region I from it is, it's hard to get operators to be familiar

with an operating plant unless you have a basic principles or plant-specific simulator, or are operating a plant.

COMMISSIONER ASSELSTINE: Yes.

MR. STAROSTECKI: The findings are as indicated on the slide. I don't mean to present a bleak picture. In fact, it was farily encouraging. The people were well motivated, there has been good morale.

We have conducted follow-up interviews. NRR, as Hugh Thompson has indicated in, I think it was March of 1984, sent their people to specifically observe the same people we interviewed, how they performed on the Lynchburg simulator.

Since then, August of '84 and just this April, we have gone back and examined individuals and looked at records and observed the training to see how they coped with these deficiencies.

And furthermore, in my mind, I look at operator readiness, and we have also spent an awful lot of time observing performance during hot functional testing. Hot functional testing has been performed almost every year, and it was August-September of '83 that they had an awful lot of hot functional testing where we had some problems. And the last time we briefed the Commission, that was a point and a subject of escalated enforcement.

Pardon me.

CHAIRMAN PALLADINO: No, go ahead.

MR. STAROSTECKI: We have subsequently seen them do some hot functional testing in 1984 and just recently, this past April, they finished some, including a repeat of the Krypton injection and testing.

Yes, some mistakes have been made in the past, but they have learned the lessons and the lessons were not repeated. Procedures were followed and adhered to.

CHAIRMAN PALLADINO: Steve, do you have a real concern on their capability to handle approach to criticality?

MR. STAROSTECKI: Not at all.

CHAIRMAN PALLADINO: Somehow, you generated that feeling in me that they may not be capable.

MR. MURLEY: We made them go back in those areas that they were rusty. You ought to mention, Rich, we asked them to go back and increase their training, which they did.

MR. STAROSTECKI: I'm sorry, I maybe mischaracterized it. I was trying to give you a flavor of the types of items, and I maybe ought to clarify that most of the deficiencies that we found by and large related to the reactor operators. Very few of the senior reactor operators had identified deficiencies.

In the examples I gave you, six reactor operators had a problem with that. So, in the real world am I concerned? No because the senior reactor operators did not have a problem. It's really a commentary, I think, on a fairly comprehensive training program and I don't want to

mislead you in saying that's a concern to me.

CHAIRMAN PALLADINO: Okay. Well, I'm glad I asked because somehow I had gotten that feeling. But I gather those that had some -- showed some inadequacies, have gone back for the training?

MR. STAROSTECKI: All the inadequacies that we identified resulted in retraining for all of the people, and we have gone back and followed up to see how well they were addressed for all the people. We have been satisfied that the training program has thoroughly addressed those.

COMMISSIONER ASSELSTINE: Did we give any requal exams to these operators?

MR. STAROSTECKI: We have not, to the best of my knowledge, given any of our own requal exams.

COMMISSIONER ASSELSTINE: Okay.

CHAIRMAN PALLADINO: But sort of like requalification.

MR. THOMPSON: We went and originally re-examined all of the TMI operators. So, to that extent we have had a check on all their operators.

COMMISSIONER ASSELSTINE: Yes, and then it's been their requal program since that.

MR. STAROSTECKI: Everybody has looked at the requal program. The only thing we haven't done in my mind in terms of requal is administered a written exam ourselves.

COMMISSIONER ASSELSTINE: Yes.

MR. STAROSTECKI: The oral exams and walk-throughs that we did in February of '84 were more comprehensive than we would do for requal today. We only do 20 percent of the licensed operators.

COMMISSIONER ASSELSTINE: Yes, that's why I was asking, did they fall in the 20 percent; yes.

MR. STAROSTECKI: We did more than 20 percent, we did 26 of some 35 operators, and we did the orals the way we would have done for a regular requal effort.

So, we have satisfied ourselves that, yes, we recognize there has been a shutdown condition but the underlying training, the underlying knowledge and skills seem to be there. But we still need to satisfy ourselves once the plant changes states that they can handle the new demands.

That raises the next question of the control room environment.

CHAIRMAN PALLADINO: Can I just make a comment? UCS did make some comments on a sampling where they asked questions. You might want to just look at that closely.

MR. MURLEY: Well, the short answer there is that they were testing someone's memory. But we are not going to rely on the operator's memory. He is going to have procedures in front of him that will address that very question. So, I don't --



CHAIRMAN PALLADINO: Well, look at it.

MR. MURLEY: Yes.

CHAIRMAN PALLADINO: It's one that you've got to be satisfied that it doesn't give you a clue to some other inadequacies.

MR. STAROSTECKI: The control room environment at Three Mile Island, in our view, was well controlled. There is very good discipline. There is a lot of control over access to the control room, and we think that's a very positive attribute.

On a number of occasions, Tom Murley and myself, we have been to that plant. I have been to that plant all hours of the day and night and have asked people without any preparation questions regarding their activities, and in all cases the operators have come forward, in response to our questions, with, I think, the correct answers.

Although we have not talked to the UCS, based on my reading, I would want to consider more what they are trying to say. I am aware that they administred written exams to those operators without any advance training. My examiners reviewed the records and from what I understand, nobody scored below 82 percent. So, in that regard they seem to be doing quite well on surprise tests.

In summary, I would just like to say from an operator readiness standpoint, we have had a number of different people from other regions, from the training center, help us

take a look at the quality of these operators and we are satisfied that they are as well prepared, if not better, than some of the other NTOL plants reaching this stage. That the senior reactor operators by and large have had, the shift supervisors have had prior operating experience. There are some expected weaknesses in the RO ranks and the training program has corrected them.

COMMISSIONER ASSELSTINE: Do they have at least one experienced SRO on each shift?

MR. STAROSTECKI: Yes, sir.

COMMISSIONER ASSELSTINE: Are the ROs mostly new?

MR. STAROSTECKI: ROs, as far as I am concerned, are all new. None of them have ever seen the plant operate.

COMMISSIONER ASSELSTINE: Okay.

MR. THOMPSON: There may have been an auxiliary operator or two in that group.

MR. STAROSTECKI: Well, there may have been, Hugh, but they did not necessarily operate as a reactor operator.

MR. THOMPSON: There were none that were previously licensed..

CHAIRMAN PALLADINO: Do you want to go on?

MR. MURLEY: With regard to plant hardware, Chart No. 7. I think the points I want to make here, that the plant has been maintained well during its shutdown phase. It should be No. 7, Mr. Chairman.

CHAIRMAN PALLADINO: Are they numbered?

COMMISSIONER ASSELSTINE: No.

MR. MURLEY: It's been maintained well. The equipment has been operated. They have gone through their surveillance tests during this period.

It's probably, in comparison with other plants after an extended outage, there are probably fewer open inspection items than in other average plants. We have about -- we keep a list, computerized list, of open inspection items. There are about 70-some for TMI-1. Some of those open items are, for example, things that we need to look at after Cycle 6, some regulatory requirements that we put on that are not due to be done until Cycle 6.

And then, the resident inspector keeps this list of items and it tells him that he's got to look at that.

A typical operating plant might have 100 such open inspection items. So, it's, as I said, slightly less.

I think that's a summary of all I wanted to say about plant hardware. It's in good shape, we think.

COMMISSIONER ASSELSTINE: Before you leave that, is the environmental qualification area now closed out for this plant, everything checked, documentation reviewed, the equipment all checked to make sure that what they asserted as qualified is in fact qualified? And do they have a maintenance program to make sure that the equipment stays qualified?

MR. MURLEY: Was that a licensing question?

MR. CONTE: Excuse me, Tom, maybe I can start off with that.

MR. MURLEY: This is Rich Conte, the senior resident.

MR. CONTE: Rich Conte, senior resident for TMI-1.

Right now, we are doing this week the certification item on small break LOCA EQ. The compliance with 50.49 is being handled like the other plants. There is no special inspection verification of the program right now.

Much of the equipment that is going in for the small break LOCA EQ rule is going to satisfy the 50.49. So, we are getting a double benefit there. The inspection this week is oriented towards the hardware installation, program review and adequacy of the program.

A little has been done with some of the Licensing Board issues with respect to small break LOCA radiation EQ, what have you. As far as I could see, there are programs in place for maintaining or keeping the equipment under environmental qualification.

But as far as I know, we are handling TMI-1 like all the other operating plants with respect to developing a special inspection for program adequacy.

COMMISSIONER ASSELSTINE: Okay. So, you get maybe some benefits in those two areas that you mentioned. I guess emergency feedwater was one, also.

MR. CONTE: That's correct, sir.

COMMISSIONER ASSELSTINE: And the small break LOCA one. But essentially, the EQ area would be handled like any others which is, you will get to it at some point down the road when those get turned over to the regions.

MR. CONTE: That's correct, sir.

MR. EISENHUT: Yes. As far as the first part of the question, maybe Bob LaGrange can summarize where we are.

COMMISSIONER ASSELSTINE: I'm sensitive to this subject because I just read another UCS letter on Calvert Cliffs that's kind of interesting.

MR. LAGRANGE: Bob LaGrange, Equipment Qualification Branch.

We have performed more review of TMI-1 in the EQ area than at any other plant in the country. We have performed actually three separate reviews. The first was in response to the ECS-2206 on the EFW system.

The second was the CLI-8411 radiation certification for the small break LOCA.

We have also completed our 50.49 compliance review. The SER is in preparation for being issued to the licensee -- I don't think it has been issued yet. But we have completed that review. We have looked at more documentation with the possible exception of the Diablo Canyon plants where there was a hundred-percent inspection of that documentation audit

some years ago.

This plant has had more documentation reviewed by section members of the EQ Branch or its contractors than any other plant out there. And as far as EQ goes, they are in excellent shape at this time. We know more about their program than any other plant, we reviewed more documentation than at any other plant.

Some of the hardware issues that were hanging out as a result of those reviews had to do with replacing or modifying specific equipment of the plant, and those were items that were left for verification, as Rich just mentioned here. They will be looking at them.

COMMISSIONER ASSELSTINE: Thank you.

MR. MURLEY: If there are no further questions on the plant hardware, I'd like to take a moment and discuss the augmented inspection that we plan if there is indeed a restart.

After a long outage, as I said, it is typical that we in the region, and other regions, for that matter, will have augmented inspection coverage. We did it at Pilgrim and Oyster Creek, we had round-the-clock coverage after they came back from an outage.

Indian Point we did when they had a strike a couple years ago, and you recall, Region V, Diablo Canyon had round-the-clock coverage for a few weeks when they started up.

So, we intend to do the same thing at Three Mile

Island. It will be the highest priority plant in the region for us. So, I'll just make the resources available for this kind of coverage.

We expect to have inspection help from Regions II and III because they have experienced resident inspectors from B&W plants. I have made arrangements to do that.

CHAIRMAN PALLADINO: Can you explain what inspections you are talking about?

MR. MURLEY: Yes. We normally have two resident inspectors at Unit 1 now. We will have approximately six inspectors there, so that we can have during times of evolutions like going critical, like raising power to 48 percent and then 75 percent, and so forth, we will have round-the-clock coverage during those periods.

Then, they intend -- the plant intends -- to hold for a period of training steam generator -- and so forth, maybe a few weeks. If it is in a stable period, we will cut back to maybe 16-hour coverage. That's what I mean by augmented coverage.

We intend to have four hold points for NRC approval. First, prior to taking it critical. Second is after natural circulation testing but prior to going above five percent power. We intend to have a hold point prior to going above 48 percent power level, and then there is another period at 75 percent where they would plan to hold it for a period and

before they went above 75 percent, we expect to have NRC approval.

The intention of these inspections -- and we don't expect, as you might know, a perfect error-free start-up. Our experience tells us that there are equipment problems and probably some procedural mistakes after a long outage like this.

CHAIRMAN PALLADINO: That is not any different in the other plants.

MR. MURLEY: That's right. We will be looking, in light of that experience that we have had, we will be looking at the way they handle these proglems as they come up; how the management gets involved and how they correct them.

We will be looking at their adherence to procedures and, of course, we will be checking ourselves the performance of the equipment and the plant systems.

So this, we believe, will allow us to spot trends earlier than we might otherwise with our normal inspection coverage. And if the inspectors find problems, they will notify the licensee management as well as our own NRC management.

So, in summary, that is what we plan to do -- it will probably be a three to four-month period of augmented coverage and if there are problems developed and it extends, then I'll just extend the coverage until it is in some kind of a stable operation.

So, that summarizes our views from the region here.

COMMISSIONER ASSELSTINE: Tom, in borrowing people from Region II and Region III, are you borrowing residents or regional inspection people, or a combination of the two?

MR. MURLEY: I have asked the Regional Administrators in Regions II and III if they can spare resident inspectors who have experience on B&W plants.

COMMISSIONER ASSELSTINE: Yes.

MR. MURLEY: They said, yes, they can for about -- I think I have gotten four to six man-weeks commitment from each one. I don't know the exact residents, but my impression is that it's from a plant that is in the construction phase. It may be Bellefonte or --

COMMISSIONER ASSELSTINE: Great, okay. I don't mind so much if you borrow people from Oconee, but I would be more troubled if you borrowed ones from Davis-Besse.

MR. MURLEY: Yes. I don't know exactly where they are coming from.

MR. STAROSTECKI: I would just want to make a point. We've got three sources of people to help us, Regions II and III where they have in fact spent time as senior resident inspectors, some of them in fact may be region-based people today but were in fact resident inspectors.

The other source are two national laboratories where we are getting examiners who have been giving examinations and

are certified on B&W plants. So, we are going to use those kinds of individuals who can very quickly in a few weeks of time give us an appreciation of the operational skills that these operators would be demonstrating.

COMMISSIONER ASSELSTINE: Okay.

MR. STAROSTECKI: So, we are going for that kind of expertise.

COMMISSIONER ASSELSTINE: Good.

MR. THOMPSON: In view of the time, I would just like to touch lightly on two remaining issues. One is the status of the certification status items. As you know, we had 155 items derived from the hearing record, Commission orders that staff is required to certify to the Commission before the restart of the plant.

We gave you a status report in SECY-85-64 in February that there were three items that remained open. Of those three, certification item 144, emergency preparedness which dealt with communication deficiencies in the FEMA drills in Lancaster and Dolphin Counties had been completed. We have completed our certification on that in early April.

The subcooling monitoring -- margin monitoring instrumentation error is one that we are currently still evaluating the instrument error as well as the system configuration to ensure that it comes within the 20 degrees required by the ALAB 729. And we expect to complete our

evaluation of that sometime later this month.

With respect to the environmental qualification --

COMMISSIONER ASSELSTINE: On that one, on the subcooling monitor, you say that the instrument error is less than 20 degrees Fahrenheit. How much less?

MR. THOMPSON: As I remember, it kind of depends on precisely where it is. If you want to know precisely, I'll have to ask someone else.

COMMISSIONER ASSELSTINE: The concern is, is the point raised in the UCS letter that if they are going to go to a buscooling margin of 25 degrees and it's fairly close to 20, that doesn't leave you much of an error band there.

MR. THOMPSON: As I understand, the error band is fairly small, it's more along 17 degrees.

But let me see, John, do you have specifics on that?

MR. STOLZ: The subcooling margin monitor, of course, operates whenever the reactor coolant pumps are on.

COMMISSIONER ASSELSTINE: Right.

MR. STOLZ: And it's normally well below 20, that's the error. In addition to that, there is a so-called physical configuration factor which accounts for the difference between where you send the temperatures and the pressures from the top of the candy cane. That allows -- that differs, and that's about 1.3 degrees. So, when you add the two together, you are well below 25.

So, we conclude that the subcooling margin monitor is within the ALAB requirements. The other element that we were considering -- and this what took the time -- was the situation that happens when you are not using subcooling margin on it, that is, whenever the ractor coolant pumps are off. And under those circumstances, you are relying on in-core thermocouples, that's the highest five, the average of the highest five thermocouples that is read out from the control room area.

Under those circumstances, one does a manual calculation to determine subcooling margin. And we wanted to verify what the margin was using the in-core thermocouple. Today, we received a response from the staff that says, well, the error in that is about twenty -- the physical configuration factor is still 1.3. So, the total is still below 25. I think that is where we are going to be coming to you on.

We will be accounting for that slight difference above 20 degrees and in fact, the Appeals Board said approximately 20 degrees. They weren't pulling hair. So, we think we can support the error analysis within a 25-degree subcooling margin.

COMMISSIONER ASSELSTINE: Yes.

COMMISSIONER BERNTHAL: How do these numbers compare to other plants?

MR. STOLZ: Other plants use 50 degrees subcooling,

and two other B&W plants in the higher ranges have less than 50 degrees, I think something like 35. ATA uses 25, and those are the generic guidelines.

So that if other plants just submit an error analysis, account specifically for the errors in their instrumentation, we would accomodate them like we are doing with TMI, we would evaluate the error.

The principal thing we are concerned with is that we operate the plant without boiling, that we remain in subcooling limits.

COMMISSIONER BERNTHAL: But how does the margin compare with other plants? And we are talking about a margin here roughly between 20 --

MR. STOLZ: The margin for other plants, in most of the B&W plants, still uses 50 degrees.

COMMISSIONER ASSELSTINE: So, the margin is much bigger for other plants.

MR. STOLZ: Because they presumably have not evaluated the error in their instrumentation.

COMMISSIONER BERNTHAL: You mean the difference between the subcooling factor and the normal error margin is what I am talking about. And in this case we are talking roughly 25 in the first and roughly 20 in the case of the second. Now, what are we talking about --

MR. STOLZ: If you recall, in the 50 degree sub-

cooling margin there was an assumed error of 45 degrees in the instrumentation --

COMMISSIONER BERNTHAL: I see.

MR. STOLZ: -- with a five degree subcooling, physical configuration factor. So that that's a gross assumption that is made without going into the details of a specific instrument analysis.

When you get down to the details of what the error really is, then you can justify a lower margin.

COMMISSIONER ASSELSTINE: Do all of these subcooling margin monitors not work when the reactor coolant pumps are off, for all the plants?

MR. STOLZ: I believe that's true.

COMMISSIONER ASSELSTINE: I hadn't really picked up on that before, but that's sort of interesting. I mean, in terms of thinking about how much improved things are since TMI --

(Simultaneous conversation)

COMMISSIONER ASSELSTINE: -- that, you know, the pumps are off, they don't work. So, in all the plants they don't work if the pumps aren't running.

MR. STOLZ: I am advised that they work, but the accuracy is in question.

COMMISSIONER ASSELSTINE: Okay, but they are not reliable. So, you are back to the thermocouples and doing the

hand calculations.

CHAIRMAN PALLADINO: What do you rely on? I'm sorry, I missed it.

MR. STOLZ: I said, the subcooling margin monitor still works, but when the flow isn't going through, that is, when the pumps are off, the accuracy is called into question. So, actually, we rely on the use of the in-core thermocouples and the manual calculations.

CHAIRMAN PALLADINO: And why -- I don't have a picture of what this gadget is like, so my question may be stupid. But why don't they work when the flow isn't there?

MR. STOLZ: Because they are not measuring -- you know, the reactor coolant pump flow, it's not measuring the temperature and flow conditions as it exits the core. We are interested in the subcooling margin at the core level.

COMMISSIONER ASSELSTINE: Yes. Is that where the measurement is taken, as it exits the core?

MR. STOLZ: John Thome can probably explain this, or Walter Jensen.

MR. JENSEN: My name is Walt Jensen, Reactor Assistance Branch.

The instrumentation for the subcooling meter is located about ten degrees below the U-bend up at the top of the candy cane, and that's about 30 feet above the core. If the coolant pumps were not running, there would be some time

delay at least between the data the subcooling meter read and the temperature of the core.

So, for that reason to obtain a greater accuracy, the operator would use the core exit thermocouples that are located directly on top of the core.

COMMISSIONER ASSELSTINE: Okay, so you could have boiling in the core before it was reflected up in the U-bend.

MR. JENSEN: Yes, possibly you could.

CHAIRMAN PALLADINO: Why did they design things like that? If you want to know subcooling in the core, why not measure the subcooling in the core?

MR. JENSEN: Well, that's true. On the other hand --

CHAIRMAN PALLADINO: It may be too late to ask that question.

MR. JENSEN: They measure the subcooling in the loops very well, and it's also important to keep subcooling in the loops because that ensures you have natural circulation capability.

CHAIRMAN PALLADINO: Yes, on the candy cane it's important to have it at both places. Okay, thank you. You helped me understand it better.

MR. THOMPSON: The third certification item deals with the electrical qualification for radiation of containment and auxiliary electrical components. The licensee has replaced

certain of those components, those that were in question, with qualified components and completed the evaluation. We have completed our review of those and have issued a safety evaluation report, and we are preparing our certification paper to you now.

Next slide, please.

COMMISSIONER ASSELSTINE: Let me go back to that sub-cooling monitor for just a minute.

(Laughter)

COMMISSIONER ASSELSTINE: What percentage of accidents where you would want that and need that information are you going to be running the pumps, and what percentage aren't you going to be running them, the pumps?

The pumps got shut off at TMI. I mean, I'm wondering if we required a piece of equipment and the way it got designed, it isn't going to be terribly useful in a large number of accident situations.

CHAIRMAN PALLADINO: It might be useful, but it will be only useful in part without that particular component.

COMMISSIONER ASSELSTINE: Yes.

MR. JENSEN: I suspect in a tube rupture accident where a single tube would rupture, as in the design basis, that the reactor coolant pumps would stay in operation because the subcooling margin will be maintained.

COMMISSIONER ASSELSTINE: Yes, yes.

MR. JENSEN: But for a small break LOCA --

COMMISSIONER ASSELSTINE: Station black-out.

MR. JENSEN: Well, in a small break LOCA the sub-cooling margin will probably be lost fairly quickly.

COMMISSIONER ASSELSTINE: Yes.

MR. JENSEN: And then the pumps would be chipped and the core exit thermocouples would have to be dependent upon --

COMMISSIONER ASSELSTINE: Okay, yes because I always thought those were kind of neat things so you didn't have to rely on steam tables and doing the hand calculations, and reading the thermocouples, and all the things that caused problems at TMI.

MR. JENSEN: They would still be there and be able to be used for a determination of things like how to get core cooling. But as you got super-heat up there, you will know that things were badly wrong.

COMMISSIONER ASSELSTINE: Yes, that's true. Yes, okay.

MR. CONTE: Excuse me, Commissioner, I think there is another key point here. In the ATOC procedures it is a key parameter that the operators monitor. But there is another Licensing Board condition that also directs the operators to rely on the most conservative instrumentation indicating sub-cooling.

There are other means of indicating that. One is the steam tables, plant computer, the subcooling monitors. The operators are directed to use the most conservative. So, it is somewhat of a key parameter in the ATOC procedures for the operators to protect the core to understand that the -- to make sure that there is subcooling in the plant.

But there is other instrumentation to back up that monitor.

COMMISSIONER ASSELSTINE: Okay.

CHAIRMAN PALLADINO: Proceed.

MR. THOMPSON: To kind of summarize where we are with respect to the schedule, the steam generators were returned to operable status on April 10 when they completed the plugging.

The plant currently or it will be ready for heat-up for criticality as part of their extended start-up program in early May. We still will want to evaluate these licensee submittals of the effects of the plugging on greater than 1,500 steam generator tubes which will be completed early in May. We will still need to have the regional readiness report on the unit, those certification items that they anticipate being able to complete in early May.

We will have completed our certificatio of the 155 items derived from the orders in the hearing record in early May, and we then will need to be prepared to issue the license

amendment which is directed from the Commission's decisions, orders, and the Board's.

MR. CONTE: Excuse me, Hugh. The chart that is up there, so there is no confusion, that says ready for hot functional testing April 17.

MR. THOMPSON: I believe they completed that hot functional testing. We were talking about now is the heat-up for the criticality activity.

MR. CONTE: And that's May, we estimate.

MR. EISENHUT: And I guess, Tom, they have been going through the leak tightness test on testing the leak tightness of the steam generator tubes at this point in time.

MR. THOMPSON: That was done this week.

MR. EISENHUT: And I understood the off-gas monitors were -- remember, they run this very sensitive test where, I think it's Krypton --

MR. MURLEY: They inject Krypton.

MR. EISENHUT: The off-gas monitors didn't really indicate a leak. Then they go in and they take grab samples to check down to the extremely -- very, very low levels, of any leakage. I don't think we have heard the results of those, at least yesterday we didn't. They may well have the results of the detailed check by tomorrow.

MR. CONTE: Preliminary indications indicate it's less than a gallon an hour, maybe a gallon an hour. The

licensee is going to evaluate the data after all analyses results come in.

MR. THOMPSON: That completes my presentation today. Unless there are any specific questions, in view of the time -- I think we ran slightly over our allotted hour and-a-half.

CHAIRMAN PALLADINO: Are there questions? Commissioner Roberts.

COMMISSIONER ROBERTS: If there was a restart and this schedule on your last slide is followed -- and I appreciate you can't predict, but based on your past experience of other plants, what would be the period of time -- leading back to your increased inspection opportunity, three months, where would they likely be after three months?

MR. THOMPSON: Dr. Murley might want to address that, I think he has a kind of a --

MR. MURLEY: Yes. Assuming things went well, that is to say, after a restart order that they would go into some preliminary tests and then a final heat-up of about four days. Then they would be ready for criticality, at least according to our schedule. And then there would be a period --

CHAIRMAN PALLADINO: When would they be, based on your schedule, when would they be at criticality?

MR. MURLEY: I'm just talking about the plant readiness now, and not any other conditions that are put on it. The schedule I have shows some feedwater inspections probably

need to be done, and then a final heat-up of the plant for a few days. And then some natural circulation testing. And then they would be ready for criticality.

There would be a period of probably some low power physics tests and then, after a few days, they would be ready to increase power to 48 percent. The chart that I have that the staff prepared shows about -- it looks like about a week to go from low power up to 48 percent power, at which time they would stay for about 25 days, about three weeks, at that mode.

That allows for operator training and familiarization with the plant, and so forth. Then, there would be a period of about eight days where they would increase from 48 percent to 75 percent power. They would hold there for another three weeks or so for plant training, operator training. The plant exhibits different stability characteristics at these power levels, that's why it is important to hold for a few days.

Then there would be about another ten-day period where they would move on up to 100 percent power.

So, starting, let's say, with the restart decision up to a hundred percent power -- was that your question, Commissioner?

COMMISSIONER ROBERTS: Yes.

MR. MURLEY: -- it would be about 90 days, in my estimate; about three months.

COMMISSIONER ROBERTS: So, the three months increased inspection would be just about to get you to full power.

MR. MURLEY: Yes.

COMMISSIONER ROBERTS: I'm not criticizing --

MR. MURLEY: No, that's why I set the three months, that's our estimate of the time. We would keep augmented inspection for whatever we judge is necessary.

COMMISSIONER ASSELSTINE: And that's about the time, then, that they would have to do the eddy current tests, 120 days.

MR. MURLEY: Yes, I don't know the license condition.

(Simultaneous conversation)

MR. THOMPSON: A hundred-and-twenty days.

CHAIRMAN PALLADINO: Other questions?

COMMISSIONER ASSELSTINE: No.

CHAIRMAN PALLADINO: Well, we thank you very much for bringing us up to date on those items. I would remind everyone that we do have another meeting tomorrow in which other interested participants would discuss the steam generator problems as they see them.

Well, thank you, and we'll stand adjourned.

(Whereupon, at 4:12 p.m., the meeting of the Commission was adjourned.)

# CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the UNITED STATES NUCLEAR REGULATORY COMMISSION in the matter of:

NAME OF PROCEEDING: Briefing on TMI-1 Steam Generator and Other Plant Matters Public Meeting

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were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission.

(sigt) M. E. Hansen

(TYPED) M. E. Hansen

Official Reporter

Reporter's Affiliation

Ace-Federal

# COMMISSION BRIEFING

APRIL 17, 1985

TMI-1 STATUS

## OUTLINE - MATTERS AFFECTING TMI-1 RESTART

- OVERVIEW OF TMI-1 LICENSING ACTIONS
- STEAM GENERATOR OPERABILITY (TUBE PLUGGING)
- REGIONAL INSPECTION STATUS
- CERTIFICATION ITEMS (3) REMAINING PER SECY-85-64 (2/25/85)

  CI #144 - EMERGENCY PREPAREDNESS

  CI #154 - SUBCOOLING MARGIN MONITOR INSTRUMENT ERROR

  CI #155 - ENVIRONMENTAL QUALIFICATION FOR SBLOCA/RADIATION PER CLI-84-11

- RESTART SCHEDULE SUMMARY
- 2.206 PETITION -- EFW SYSTEM

# OVERVIEW - TMI-1 LICENSING ACTIONS

SINCE 1979:

- 84 MULTIPLANT ACTIONS APPLICABLE TO TMI-1 COMPLETED
  19 REMAIN OPEN

- 93 NUREG-0737 ACTION ITEMS APPLICABLE TO TMI-1 COMPLETED
  8 REMAIN OPEN

- 55 LICENSE AMENDMENTS ISSUED
  4 LICENSE AMENDMENT REQUESTS REMAIN OPEN

- NO OPEN LICENSING ACTIONS PRECLUDE RESTART

# TMI-1 STEAM GENERATOR CHRONOLOGY

## KINETIC EXPANSION REPAIR

| | |
|---|---|
| 11/81 | DISCOVERED MAJOR CORROSION PROBLEM |
| 2/83 | COMPLETED KINETIC EXPANSION REPAIR AND PLUGGED TUBES |
| 10/84 | ASLB INITIAL DECISION |
| 12/84 | ISSUED KINETIC EXPANSION REPAIR AMENDMENT |
| 12/84 | TMIA FILED APPEAL AND MOTION TO REOPEN RECORD |

## LOOSE AND MISSING PLUGS

| | |
|---|---|
| 7/84 | LOOSE AND MISSING PLUGS IDENTIFIED (1 UTS; 6LTS) |
| 10/84 | LOOSE PLUG REPAIRS COMPLETED |
| 3/85 | SER ISSUED ON REPAIRS AND OPERATION WITH 6 MISSING PLUGS |

## RECENT INDICATIONS AND REPAIRS

| | |
|---|---|
| 11/84 | SCHEDULED ECT IDENTIFIED 336 DEFECTIVE TUBES PER CURRENT CRITERIA |
| 4/15/85 | ALL DEFECTIVE TUBES PLUGGED - SGs LEAK TESTED (1.5 GPH) AND OPERABLE. TOTAL 1542 TUBES PLUGGED |

## REMAINING ACTIONS

LICENSEE - SUBMIT ANALYSIS ON EFFECTS OF PLUGGING MORE THAN 1500 TUBES ON TRANSIENT AND ACCIDENT RESPONSE

STAFF - ISSUE EVALUATION ON CAUSE OF RECENT INDICATIONS

- ISSUE EVALUATION ON EFFECTS OF PLUGGING MORE THAN 1500 TUBES

## REGIONAL INSPECTION STATUS

- OPERATOR READINESS ASSESSMENT
- SALP RESULTS
- STATUS OF HARDWARE
- AUGMENTED INSPECTION PROGRAM

## OPERATOR READINESS ASSESSMENT

- o DETAILED ASSESSMENT DONE
  - PLANT WALK-THROUGH
  - ORAL EXAMINATION
- o FINDINGS
  - KNOWLEDGEABLE
  - WELL TRAINED
  - EFFECTIVE REQUAL PROGRAM
  - SOME OPERATIONAL SKILLS DECLINED
- o FOLLOW-UP PERFORMED BY GPUN AND REGION I
  - WEAK AREAS CORRECTED
- o CONTROL ROOM ENVIRONMENT
  - DISCIPLINE ENFORCED
  - ACCESS CONTROL EXERCISED

## SALP RESULTS

- ASSESSMENT PERIOD: FEBRUARY 84 - JANUARY 85
- SALP BOARD - MARCH 13, 1985
- SALP MEETING WITH LICENSEE - APRIL 11, 1985
- 7 OF 9 AREAS CATEGORY 1; 2 AREAS CATEGORY 2
- EXTENDED SHUTDOWN PERIOD - NOT NECESSARILY REFLECTIVE OF OPERATIONS - MANAGEMENT AND ATTITUDES FOSTER SELF-ASSESSMENT AND CONSTRUCTIVE FEEDBACK

# PLANT HARDWARE STATUS

- o MAINTENANCE AND SURVEILLANCE PERFORMED
- o INSPECTIONS INDICATE PLANT IS READY (SOME REGIONAL INSPECTION ITEMS)
  - CERTIFICATION ITEMS
- o COMPARISON WITH OTHER PLANTS AFTER EXTENDED OUTAGE
  - SIGNIFICANTLY FEWER OPEN INSPECTION ITEMS

## AUGMENTED INSPECTION PROGRAM

- o TMI-1 RESTART - HIGHEST PRIORITY IN REGION 1
- o EXTENSIVE INCREASE IN ON-SITE INSPECTORS
  - SUPPORT FROM OTHER REGIONS
  - FAMILIARITY WITH B&W OPERATIONS
- o MANAGEMENT INVOLVEMENT
- o 3 MONTH EFFORT

# CERTIFICATION ITEMS STATUS

## CI # 144 -EMERGENCY PREPAREDNESS

- o FEMA REPORTS FAVORABLE FINDING ON LANCASTER AND DAUPHIN COUNTY DRILLS

- o NRC COMPLETED CERTIFICATION APRIL 2, 1985 (BN-85-032)

## CI # 154 - SUBCOOLING MARGIN MONITOR (SMM) INSTRUMENT ERROR

- o BACKGROUND
  - IN ALAB-729, ALAB REQUIRED SMM INSTRUMENT ERROR TO BE LESS THAN 20°F (PLUS 5°F SYSTEM CONFIGURATION FACTOR)
  - PREVIOUS EVALUATION IN SECY 84-237 (6/14/84) FOR SMM ERROR ± 22.1°F.
  - LICENSEE SUBMITS REVISED ANALYSIS, 8/31/84 (BN-84-164; 9/26/84)
- o THE LICENSEE HAS NOW DEMONSTRATED THAT SMM INSTRUMENT ERROR IS LESS THAN 20°F; SYSTEM CONFIGURATION FACTOR 1.3°F
- o SMM MEETS ALAB-729 REQUIREMENTS - MANUAL SM CALCULATION UNDER REVIEW
- o SER ISSUANCE APRIL 1985

## CI # 155 - ENVIRONMENTAL QUALIFICATION FOR RADIATION PER CLI-84-11 (7/26/84)

- o THE LICENSEE HAS REPLACED CERTAIN COMPONENTS WITH QUALIFIED COMPONENTS (15).
- o CERTIFICATION SECY PAPER TO BE ISSUED APRIL , 1985 (NO JIO'S)

## RESTART SCHEDULE SUMMARY

| | | |
|---|---|---|
| o | RETURN OF SG'S TO OPERABLE STATUS (COMPLETE PLUGGING) | APRIL 10, 1985 |
| o | PLANT READY FOR HEATUP FOR CRITICALITY | MAY 1985 |
| o | STAFFS EVALUATION OF SUBMITTAL ON EFFECTS OF PLUGGING GREATER THAN 1500 SG TUBES. | MAY 1985 |
| o | REGIONAL REPORT ON PLANT READINESS | MAY 1985 |
| o | STAFF COMPLETES CERTIFICATION OF 155 ITEMS DERIVED FROM COMMISSION ORDERS AND HEARING RECORD | MAY 1985 |
| o | ISSUE LICENSE AMENDMENT WITH LICENSEE CONDITIONS APPROVED/ORDERED BY COMMISSION AND BOARDS | MAY 1985 |

## UCS 2.206 PETITION - EFW SYSTEM

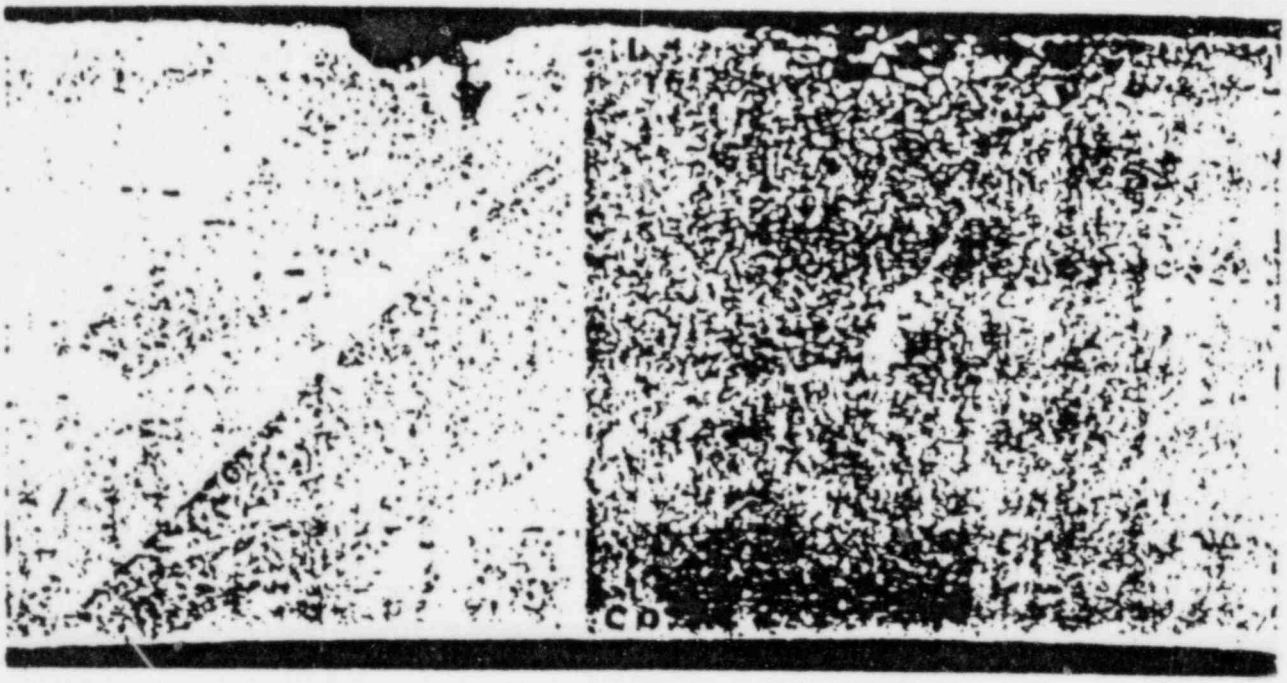
REMAINING ACTIONS ON THE SUPPLEMENTAL PETITION

- OI INVESTIGATE WHETHER LICENSEE MADE MATERIAL FALSE STATEMENTS REGARDING ENVIRONMENTAL QUALIFICATION. (PETITION REQUESTED COMPLETION PRIOR TO COMMISSION VOTE ON RESTART).

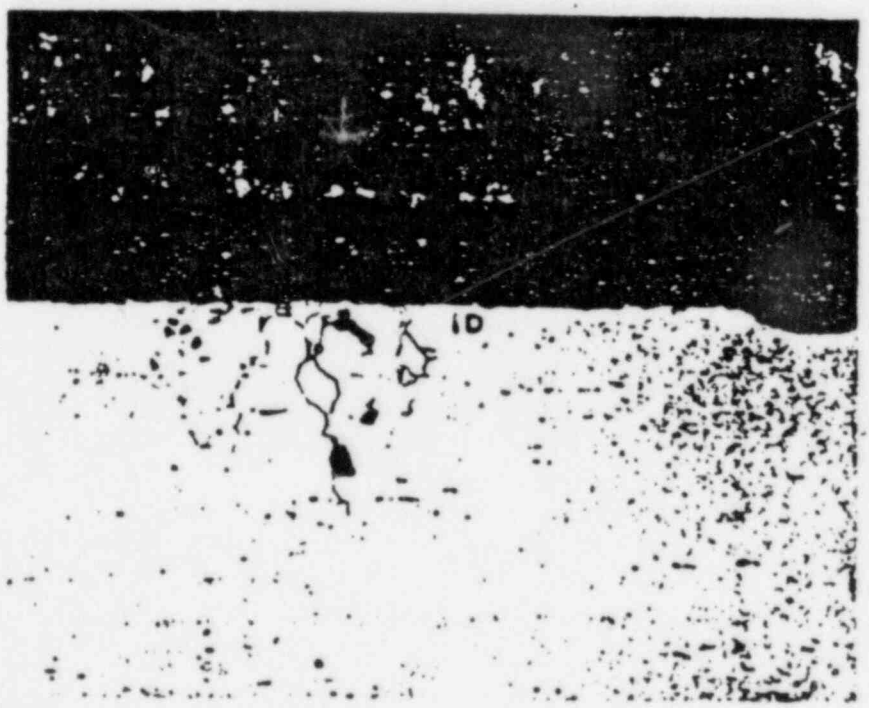
  STATUS: OI INVESTIGATION STILL IN PROGRESS

- OIA INVESTIGATE WHETHER NRC STAFF PROVIDED FALSE OR MISLEADING INFORMATION, OR HAS BEEN DERELICT IN ITS DUTY REGARDING TMI-1 ENVIRONMENTAL QUALIFICATION.

  STATUS: OIA REPORT FINDINGS TO COMMISSION (2/8/85)

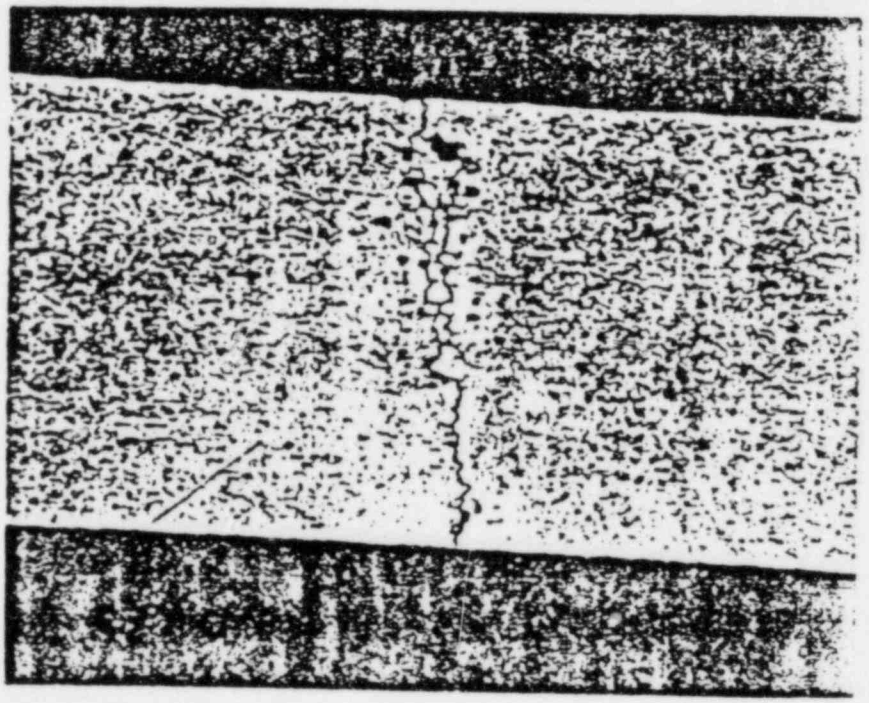



1st 100X




2nd 100X

Figure 4. First (0.000") and second (0.005") sections across the crack.



14th 50X

Figure 13. Fourteenth (0.091") section across the crack.


3rd 100X


4th 100X

Figure 5. Third (0.012") and fourth (0.018") sections across the crack.

12/82

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Meeting Title: Briefing on Unit-1 Steam Generator & Other Plant Matters

Meeting Date: 4/17/85 Open X Closed ____

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