UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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In the matter of:

METROPOLITAN EDISON COMPANY : Docket No. 50-289 (Restart)

(Three Mile Island Unit 1)

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25 North Court Street,
Harrisburg, Pennsylvania

Wednesday, April 1, 1981

Evidentiary hearing in the above-entitled matter was resumed, pursuant to adjournment, at 9:00 a.m.

BEFORE:

IVAN W. SMITH, Esq., Chairman,
Atomic Safety and Licensing Board

DR. WALTER H. JORDAN, Member

DR. LINDA W. LITTLE, Member

Also present on behalf of the Board:

MS. DORIS MORAN,
Clerk to the Board

8104080314

APPEARANCES:

On behalf of the Licensee, Metropolitan Edison Company:

GEORGE F. TROWBRIDGE, Esq.
THOMAS A. BAXTER, Esq.
MS. NANCY KNOWLES
Shaw, Pittman, Potts and Trowbridge,
1800 M Street, N.W.,
Washington, D. C.

On behalf of the Commonwealth of Pennsylvania:

WILLIAM DORNSIFE,
Nuclear Engineer

On behalf of Union of Concerned Scientists:

ELLYN WEISS, Esq.,
ROBERT D. POLLARD
Harmon & Weiss,
1725 I Street, N.W.
Washington, D. C.

On behalf of the Regulatory Staff:

JAMES TOURTELLOTTE, Esq.
JAMES M. CUTCHIN, Esq.
Office of Executive Legal Director,
United States Nuclear Regulatory Commission,
Washington, D. C.

C O N T E N T S

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E X H I B I T S

NUMBER	IDENTIFIED	IN EVIDENCE
UCS 32	16,879	16,885

P R O C E E D I N G S

(9:02 a.m.)

CHAIRMAN SMITH: Is there any preliminary business?

MR. TOURTELLOTTE: Mr. Chairman, a couple of matters. One, the environmental impact appraisal of the staff was mailed out on Monday, the 30th, and should be in everybody's hands shortly.

The second matter concerns the schedule of submitting proposed findings, and as the Board will recall, we had pretty much agreed among the parties we would submit proposed findings on the design issues on the first of May. At that time it was assumed that we would be through the design issues by April the 1st, and of course that has not been what has occurred.

The parties on the design issue have agreed that those findings would be submitted instead of May 1 on June 1, and their reply findings would be due a month later, July 1.

Regarding other outstanding matters, the Staff provided a copy of its version of the history or background findings, and the Licensee intends to have its additions and supplementation to that and hopefully have the whole thing finalized so that we can submit that to the Board by May 1.

On management we hope to be able to provide the findings by May 15, again with reply findings due one month

later, June 15. And in the emergency planning area we have not been able to arrive at a conclusion about when those findings might be submitted, primarily because of the present uncertainty of the schedule.

In management I might also add that we have not been able to get in touch with Louise Bradford to ask her if that is satisfactory with her, but assuming that it is, why, that would be the date.

(Board conferring.)

CHAIRMAN SMITH: Mr. Trowbridge.

MR. TROWBRIDGE: I would confirm Licensee's agreement with the three dates that Mr. Tourtellotte mentioned, namely May 1 for the procedural findings, May 15 for management, and June 1 for design findings. We slipped the last with great reluctance. Ms. Weiss had indicated to us that they would have difficulty meeting the May 1 date, the Staff had indicated the same, and we concluded we simply cannot file findings of the quality expected by the Board largely because the testimony in this area has gone on longer and prevented in particular Tom Baxter and his assistants from working on the findings as we had expected.

CHAIRMAN SMITH: Ms. Weiss.

MS. WEISS: I would just confirm that I believe it is necessary to have this additional time in order to do the findings in any degree of detail or quality.

CHAIRMAN SMITH: All right. We will discuss at a separate session the problem presented by the continuing open nature of the emergency planning problems. I think we might have to consider going up to the Commission on emergency planning and telling them --

MR. TOURTELLOTTE: I would also want to add that this picking of the date for the design issue findings also makes some assumptions about the ability to close out those design items in the SER to the satisfaction of the Board. And I do not want the Board to take this representation as the date that we are seeking to close out and to submit findings as some kind of an indication on the Staff's part at this time that we in fact are going to be able to do that.

I am still working with the technical staff and have a meeting proposed tomorrow between myself and Mr. Denton and some other members of the technical staff to work out these problems. I will advise the Board as soon as I can as to the outcome.

CHAIRMAN SMITH: Is there anything that we could be doing to assist? You suggested that early determination of the Board, what we required to be satisfied would be important; but is there anything else?

MR. TOURTELLOTTE: Actually, what I was referring to there is the first thing that has to be done is the Staff has to address the items in the SER, and then it will be

presented to the Board, and I have no way of knowing whether -- what the Staff is going to do, whether we will meet your requirements or not. I would hope that they would, but there is a possibility that they would not.

CHAIRMAN SMITH: I do not have anything particular in mind, but you will recall, for example, we sensed that certain management issues were fading away, and we brought that up and addressed it, and indeed they did to a large extent -- they had faded away, and we addressed it in a rather abbreviated way and adequately, too, I think.

If there is anything else of that nature that we can be helpful on, why, we should be alerted to it and bring it to our attention.

Anything further?

MS. WEISS: I had a couple of matters, Mr. Chairman.

First, the transcripts are getting to the public document often as late -- document room in Washington as late as three weeks after the date of the hearing, and I just would appeal to the Board to see if there is any way to speed that up.

CHAIRMAN SMITH: Yes, there is, and I am glad you raised it. The last time I checked it was within about seven days which was pretty good time, and I will inquire into it. We do have the responsibility for the transcripts -- that has been transferred from the Office of the

Secretary to the Board panel, and so we do have some control over it; and I will inquire today.

MS. WEISS: Thank you.

(Board conferring.)

CHAIRMAN SMITH: We keep a library of the transcripts in the hearing room.

MS. WEISS: Thank you.

The second thing I wanted to bring up are the tech specs. I am not quite sure exactly how to do this, so I thought I would bring it up before we leave. There have been many references throughout the hearing to requirements that will be incorporated into the tech specs for the plant prior to restart, changes that will be made in the tech specs.

And as we are beginning to get the findings together, it has occurred to us that we really ought to have those some place on the public record before the hearing is over. And I do not know what the schedule is for producing those, or if there is any mechanism for making those public.

CHAIRMAN SMITH: Mr. Trowbridge.

MR. TROWBRIDGE: We had not anticipated, Mr. Chairman, that the tech specs any more than some of the final procedures would necessarily be completed during the course of this hearing. They would be in the category for the most part of implementation by the staff of requirements

approved or established by this Board.

DR. JORDAN: Aren't tech specs part of the restart report?

MR. BAXTER: Our proposed tech specs are in Chapter 11.

MR. CUTCHIN: Certain technical specifications, Mr. Chairman, are also the subject of Board order items, particularly items related to I&E Bulletin 79-05. There was a direction there that certain tech specs would be submitted to the Staff. At the time of the writing of NUREG-0680 the Staff had not received both tech specs and the safety evaluation supporting those tech specs which is required of Licensee.

That matter will be updated in the supplement to NUREG-0680, but I have no reason to believe now that that item will be finally written off on as the Licensee indicates. That is something that is normally finalized much closer to the time that the plant would be estimated to be ready for restart.

(Board conferring.)

DR. JORDAN: Before Mr. Pollard continues his cross examination I just want to suggest one procedural item. Finish with your questions on Wermiel's testimony but before Mr. Curry starts I would like to suggest that he take us through one of these -- at least one of the fault tree

diagrams showing how he puts the numbers in and so on. At least I do not understand it thoroughly, and I think it might save time. So -- but go ahead with your --

(Board conferring.)

DR. JORDAN: I'm sorry. It looks like I was ahead of time, but I won't need to make this speech later.

(Laughter.)

MR. POLLARD: I think that would be very helpful. I just wanted to continue on this discussion of the technical specifications.

In UCS' view part of the proposed findings which we would intend to submit would depend upon an assessment of the actual technical specifications. From my own experience I know that when technical specifications -- an attempt is made to write them, it frequently has been found in the past that the plant design or the availability of instrumentation precludes the adoption of some particular technical specification.

Also, in the testimony we have been going through in the last few days the reliability of particular systems can be affected by the allowable outage time for any particular train or system, and I am somewhat at a loss to understand how I can prepare proposed findings without seeing what the actual technical specifications are going to be.

Now, I did not fully follow the discussion that we have just had. It seems to me that the Staff counsel was saying that typically these are not available and that somehow just because that is the normal way of doing things we should not expect to receive technical specifications before we have to do our proposed findings.

And I just want to express the view I do not agree with that. I think they are a vital part for much of the testimony that has gone on through this hearing.

MR. TROWBRIDGE: Mr. Chairman, as I think Mr. Pollard well knows, there have been many, many operating license hearings before the NRC and the AEC before it. Technical specifications have always been a matter in some cases of discussion, but always the final preparation has been one of the items that came along after the hearing and as part of the signoff process by Staff.

In this case, the case of this proceeding, it seems to me you have very explicit directions from the Commission that you take the requirements so far as far as you feel you need to take them and specify them, but the detailed information is left to the director unless the Board concludes otherwise.

CHAIRMAN SMITH: I am trying to recall, Mr. Pollard, if I have ever seen an initial decision by a Licensing Board which goes beyond rather general license

conditions, even down to the point of tech specs, and I cannot. Maybe you can help me on it, but I just --

(Board conferring.)

CHAIRMAN SMITH: Mr. Brenner and Dr. Little pointed out that they have seen initial decisions by Licensing Boards refer to tech specs and make requirements for tech specs, making the general statement that tech specs shall include certain conditions, but never to the point where we actually get into the approval of specific tech specs, nor do we, of course, ever write tech specs in an initial decision.

It seems to me -- and this is not a ruling or anything. I'm just trying to open it up for discussion. It seems to me that the appropriate place to challenge adequacy of tech specs is when they do not -- when they are issued after the hearing if they do not comport with conditions set out by the Board and approved by the Commission. Then you have a show cause opportunity, but it just does not seem to me to be an appropriate part of the initial decision itself, but I do not know.

We will hear argument on it. I call upon my experience and the experience of others. I just do not recall that being a judicial NRC procedure, if I understand correctly what you are asking for.

MR. TROWBRIDGE: Mr. Chairman, I would like to

point out that this suggestion comes extraordinarily late in the game. If this had been important to UCS we should have heard about it many months ago.

The Board has been allowed to estimate a hearing schedule to the Commission. The Board invited comments from all of the parties on what the hearing schedule might be. Had anyone mentioned technical specifications had to be prepared and signed off, April 30 would have been a ridiculous date. So would May 30.

CHAIRMAN SMITH: Well, that is generally the Board's view of it. And if you want to move us from that view, I guess the ball is over there for you to do it.

DR. JORDAN: Could I ask a question of the Licensee? There will be -- you do have proposed tech specs now. Are those not subject to challenge. If they do not meet the requirements of the Commission's orders, then they would be subject to challenge at this time.

MR. TROWBRIDGE: They could have been. There was ample opportunity to do that.

MR. BAXTER: The requirements are going to be set by this Board in its initial decision to a certain extent and then by the Commission.

DR. JORDAN: Yes.

CHAIRMAN SMITH: That is another reason for what the tradition has been is sometimes the requirements of tech

specs are not known until the initial decision issues, except that there are many tech specs which are not at issue in the case. Maybe you are referring to those.

MR. POLLARD: Yes, I understand now. I think this discussion has been helpful. Thank you.

DR. JORDAN: I might ask the Staff is there a similar situation with respect to other B&W plants, that although the modifications have been made, the tech specs still remain to be finalized?

MR. CUTCHIN: Dr. Jordan, I am not aware that that is the case. I believe that any time there was a design modification with approval for continued operation, the tech spec reflecting the existence of the modification had to be in being at the time of operation with that modification in place. However, I might suggest that for a look at types of technical specifications that were the subject of the I&E bulletin, those appear at pages C-2-14 and 15 of the NUREG Report 0680, and they are very specific.

In many instances they say that the change, for example, will be added reducing existing high pressure reactor trip set point from 2390 to 2300, and if someone wants to argue whether 90 psi is the appropriate change, that has been in the record now since June of 1980. Many others are equally specific. So it is difficult to see what a problem could be with those types of specifics.

We are not rewriting the total tech specs for the plant. They are going to address specific design modifications that came out of compliance with the Commission's orders or whatever the Board might decide to impose.

DR. LITTLE: Mr. Dornsife, there is one item that we would like to have taken care of prior to the emergency planning testimony by several people with the Commonwealth. In reviewing the professional qualifications statements, particularly of Mr. Lothrop and Mr. Lamazin, and to some extent General Smith, we found that there was not sufficient detail to make an opinion on their qualifications to do the jobs that they are doing. For example, it says -- some of them would say "I was a professional military man" with no indication of what type of rank and what branch of service and what job functions were involved and that sort of thing.

We would like a more specific resume for those three people. The ones from Ms. Riley and Mrs. Cox and several others appeared to be okay.

CHAIRMAN SMITH: You may proceed, Mr. Pollard.

Whereupon,

JAMES CURRY

AND

JARED WERMIEL

the witnesses on the stand at the time of recess, resumed

the stand and were further examined and testified as follows:

CROSS EXAMINATON - Resumed

BY MR. POLLARD:

Q If we could return briefly, Mr. Wermiel, to our discussion yesterday of the use of emergency feedwater flow indications to the steam generators and its role in controlling the level in steam generators. This was addressed on page 3 of your testimony.

If I recall correctly, yesterday you testified to the effect that the emergency feedwater flow instrumentation was not needed to manually control the steam generator level, is that correct?

A (WITNESS WERMIEL) I do not believe that is what I said entirely. I believe what I said was to control level in the steam generator the operator would prefer to use his level indication as opposed to flow indication from the pump, because if he used the flow indication he must infer what his level would be instead of getting a direct indication.

Q Okay. Have you reviewed or had occasion to examine the basic design of automatic steam generator level control systems?

A (WITNESS WERMIEL) No, I have not.

Q If you were told that one of the input signals to an automatic level control system was feedwater flow

indication or feedwater flow measurement, do you think that might change your opinion as to the usefulness of flow indication for the operator in controlling level?

A (WITNESS WERMIEL) No, I do not think so because an automatic indication can be done quite quickly by a comparator or some device like that. The operator, I think, would require some time to assimilate that kind of information and then make the appropriate adjustment.

Q You would agree with me that emergency feedwater is not heated as the normal feedwater is, is that correct?

A (WITNESS WERMIEL) Emergency feedwater is not heated?

Q That is right.

A (WITNESS WERMIEL) No, it is not heated, that is correct.

Q And that if you added cold, relatively cold water to the water which is boiling in the steam generator, would that not initially cause a decrease in the level by collapsing the steam voids?

A (WITNESS WERMIEL) Yes, it would.

Q So that if he was relying upon his level indication and increased feedwater flow, he might see a decrease in level.

A (WITNESS WERMIEL) He might, yes.

DR. JORDAN: Mr. Wermiel, I guess I am a little

confused. You said that the operator would probably watch his level indication primarily, but would he not want the flow indication in helping him arrive at the proper level? Isn't that an important adjunct to the operator?

WITNESS WERMIEL: Yes, it is. I did not mean to imply it was not important or he would not use it, not at all. I just -- what I meant to say was if he is controlling level in the steam generator, I believe he will be more interested in his level instrument directly.

DR. JORDAN: All right. Okay.

(Pause.)

BY MR. POLLARD: (Resuming)

Q Will there be safety grade emergency feedwater flow indication at the time of restart?

A (WITNESS WERMIEL) Yes, there will be.

Q Okay. When we terminated yesterday we were discussing the level indication for the condensate storage tanks which is discussed beginning on page 6 of your testimony under item III, which refers us to item II.A.2.i which is on page 21 of your testimony. And under the comment section there you say that "The fully redundant condensate storage tank level arrangement is scheduled for implementation by January 1, 1982 in accordance with NUREG-0737 longterm requirements."

Can you tell me, please, where specifically in

NUREG-0737 it establishes a January 1, '82 date for redundant condensate storage tank level?

A (WITNESS WERMIEL) In NUREG-0737 under item II.E.1.1, the longterm implementation date for operating reactors is identified as January 1, 1982.

Q Yes, sir. My question is where is -- I mean, in item II.E.1.1 can you point to me to show where that item addresses condensate storage tank level?

A (WITNESS WERMIEL) It does not. All the longterm items under II.E.1.1 are lumped together. The specific items are not identified in 0737 individually.

Q Can you tell me then where is the documentation which says this particular requirement is a longterm requirement rather than a shortterm requirement?

A (WITNESS WERMIEL) I do not know of documentation. This is the Staff's practice for this particular item.

Q What makes it a longterm item?

A (WITNESS WERMIEL) We have found that equipment delivery is a severe impact. Instrumentation delivery has been a very severe problem in a number of cases, and in the cases where plants have safety grade primary source of water, the instrumentation they want to provide they want to meet the qualification of the primary source. In other words, they want to provide safety grade indication, and the safety grade instrumentation required has equipment delivery

impact problems. This is what we have found.

In cases where the primary water source has not been a safety grade source, an off-the-shelf instrument can be provided, and this is a simpler thing to get.

DR. JORDAN: Was this identified as a shortterm item in NUREG-0578?

WITNESS WERMIEL: It is not identified in NUREG-0578 at all. It is not a Lessons Learned item. This comes out of the NUREG-0611 and NUREG-0635 reviews and is identified, I believe, as additional shortterm item number one in the table.

BY MR. POLLARD: (Resuming)

Q You have led, of course, to the next question. Under the comments section on page 21 of your testimony you call this a longterm requirement, but over on the left you call it a shortterm requirement. And if I understand your testimony just now, am I correct that the principal basis that the NRC is using to decide whether a requirement should be accomplished in the shortterm or the longterm is one of practicality rather than based upon any assessment of the safety significance?

A (WITNESS WERMIEL) No, sir. We assess the safety significance of all shortterm and longterm items. The shortterm items were meant for immediate or very shortterm implementation. In the case of redundant level indication

we recognized that there is presently level indication on both condensate storage tanks, that its impact on overall system reliability was not great, and therefore, we recognized that since there are these problems with equipment delivery and such that we could grant a stay or a time period, interim time period where the item did not have to be implemented if there were problems in doing that.

(Counsel for UCS conferring.)

Q Were there any items among the requirements for emergency feedwater systems that the Staff has considered so vital that they would require them to be implemented prior to restart even if there were equipment availability problems?

A (WITNESS WERMIEL) I do not --

CHAIRMAN SMITH: What are the bounds of your question?

MR. POLLARD: Of all the requirements applicable to emergency feedwater systems.

WITNESS WERMIEL: I do not recall any offhand. I do not -- I cannot think of any at this time.

BY MR. POLLARD: (Resuming)

Q What compensating features or compensating actions have been taken to justify allowing restart without the redundant safety grade level indication for the primary water source at TMI-1?

A (WITNESS WERMIEL) A compensating feature? The fact that there is indication on the primary source now, the fact that there are actually two tanks, that there are backup water supplies, backup procedures, and procedures for utilizing the backup water supplies we felt for the shortterm were sufficient.

Q So it is again a question of the level of risks posed by the present design as to how long you are going to allow that level of risk to persist.

A (WITNESS WERMIEL) And the fact that when we view it in the overall system point reliability its impact is not severe.

Q But it is severe enough that you are unwilling to let the plant operate for the rest of its design lifetime in this configuration.

A (WITNESS WERMIEL) Yes. We feel this is a feature that should be incorporated in the design because it has merit.

(Counsel for UCS conferring.)

Q In the Staff's determination that eventually they should have to have safety grade redundant level indication for the primary source of water for emergency feedwater at TMI-1 did the Staff make the finding that the provision of that instrumentation would provide substantial additional protection which is required for the public health and

safety?

I am reading from the regulations of 50.109 which is entitled "Backfitting," which says under what conditions the Commission may require backfitting of a facility.

A (WITNESS WERMIEL) No, I do not believe reference to that part of 10 CFR 50 was in the thinking process.

Q Well, I am not asking whether you specifically considered this regulation. My question is will the provision of this instrumentation provide substantial additional protection for the public health and safety?

A (WITNESS WERMIEL) I do not know how to define the word "substantial." I believe I just said its impact in the overall reliability of the system is not that great. So again, I cannot put bounds on the word "substantial," and I do not know how to answer that question.

Q Let me ask it a different way. Suppose -- make the assumption that after restart occurs Metropolitan Edison comes back to the Staff and says we are not going to put in the redundant level instrumentation on the condensate storage tank.

Do you consider that instrumentation -- that requirement to be so solid a requirement that you would then order the plant shut down?

A (WITNESS WERMIEL) I think we would have to take that particular point under advisement and consider it on a

case by case basis for this particular plant. We would want justification for why they do not propose to do it when we have asked for it, and then we would make our -- use our engineering judgment to determine if that justification warranted their case.

Q But I am correct as far as the information you now have available to you and the decisions the staff has made, you have decided that this is a requirement that must be implemented in the longterm.

A (WITNESS WERMIEL) Yes, sir. And we --

Q But you are not willing to say that the basis for providing it must be implemented is it would provide substantial additional protection for the public?

A (WITNESS WERMIEL) I just do not know that that was what was involved when this particular item was created. I did not develop the criteria, and I do not know what the people that did were thinking.

I know that we have decided that it does provide a measure of additional capability to the operator which we feel is -- it has merit.

Q Do you know of any other legal authority or regulations which give the NRC the authority to impose additional requirements without making the finding that it would provide substantial additional protection for the health and safety of the public?

MR. CUTCHIN: I object, Mr. Chairman. If he is asking for a legal interpretation, I think the question should be directed to one who could give a legal interpretation.

CHAIRMAN SMITH: If in the performance of his duties he has to make a determination as to -- or act under advice as to what is legally within the Commission's purview to enforce, then he can answer. If he does not know, then he can say that.

WITNESS WERMIEL: I really do not know what is in the purview of the Commission's enforcement policy for backfits. I know we at times in our licensing we recommend backfits, and we review them, as I have said, with our engineering judgment on a case by case basis, and we right safety evaluations which are reviewed by other staff peopl and eventually go to the Commission for concurrence.

That is basically wha. I do, and that is my understanding of the process.

(Counsel for UCS conferring.)

BY MR. POLLARD: (Resuming)

Q When you make a recommendation for a change in design or a backfit, do you make that recommendation on the basis that it would provide substantial additional protection for the public, or do you make that recommendation just on anything that has merit that would

result in an improvement?

A (WITNESS WERMIEL) No. We make the recommendation that the public health and safety would be improved. The word "substantial" I find so subjective and such a measure of degree that it is argumentative, you know, and we make -- we make judgments, and of course we would review it then, if that is the way the regulation reads, as a substantial improvement.

In other words, we are not making recommendations lightly. We would do it because health and safety would be improved, we feel

BY MS. WEISS:

Q Do you have any idea how many backfit orders go out to operating plants in a year?

A (WITNESS WERMIEL) Absolutely no idea.

Q It's a very rare thing, isn't it?

A (WITNESS WERMIEL) Not lately it has not been, not at all.

Q It is not something --

DR. JORDAN: I missed the question.

BY MS. WEISS: (Resuming)

Q I am trying to get a fix for whether it is normal operating procedure at the NRC to issue backfit orders any time you think that safety at the plant might be improved.

A (WITNESS WERMIEL) We are constantly reviewing

plants at different stages for backfits, and we make backfit recommendations. Lately, of course, we have made quite a few.

Q Would you say there was a fairly high standard of improvement, that you do not issue a backfit order to an operating plant any time you think the safety can be improved somewhat?

MR. BAXTER: Mr. Chairman, I object to the materiality of this line of questioning. We have no indication that the Licensee is not going to implement this requirement, and it is clearly stated by the witness that it is a requirement that the Staff has imposed, and why they have imposed it and what degree of improvement he thinks is going to come from it. Why the exploration of a legal authority is beyond me.

CHAIRMAN SMITH: I think your objection may be sustainable now. However, if the concept is not explored by Ms. Weiss, it is going to be explored by the Board when we try to determine what the basis is for deferring the safety grade automatic initiation. So the same questions will be relevant then. As a matter of fact, I have been waiting for a hiatus in their examination to ask some questions of the Board on this area. I think your objection is correct; that is the state of the record.

On this one particular item if it is not at issue,

well, all right, then we will sustain the objection; but the general line of questioning will come up again, I am sure.

MS. WEISS: I am just as happy to let the Board bring it up.

WITNESS WERMIEL: I would like to make an overall statement. You know, we are concentrating on one item, and we have been looking, the Staff has looked at emergency feedwater system reliability. This is a part of the overall upgrade of reliability and is a part of a number of backfits; therefore, we consider the improvement in reliability a substantial improvement or benefit to public health and safety, this being a part of that. In and of itself I do not know that I would characterize it as such.

BY MS. WEISS: (Resuming)

Q Well, the questions I was just asking you were general questions, and they did not go --

A (WITNESS WERMIEL) Okay.

Q Precisely to this amendment, but the question that is on my mind and I think is on the Board's mind at the moment is after you impose backfit order, and I think we would all agree that that is a significant action which is not taken lightly --

A (WITNESS WERMIEL) Yes.

Q And it includes deadlines, as it did in this case, and deadlines prior to restart. The plant is down until

certain things are accomplished.

I would like to have some feel that you have criteria for waiving those, that they are not infinitely flexible based upon what Mr. Pollard referred to as practicalities. Please feel free to comment on that if you would like to.

A (WITNESS WERMIEL) As I said, you know, we felt that the protection provided by the existing design, this particular item was such that on an interim basis the implementation of this was not immediately required in the short term, and that was the judgment that we used.

Q Well, we are also against this backdrop. We are also considering the emergency feedwater automatic initiation.

A (WITNESS WERMIEL) Yes, we are.

Q And many other items. So can you give me an idea if you have some general criteria by which you judge, for example, if Licensee comes to you three weeks ago -- I think there was a meeting in Mr. Ross' office which you may have attended, Mr. Denwood Ross.

CHAIRMAN SMITH: Ms. Weiss, we -- Mr. Ross was present and discussing in general NUREG-0737 items, and in particular water level indication in the reactor vessel where the same debate has come up, and I might commend that for your reading. And I urge you to continue your inquiry,

because there are confusing items open there as far as the Board is concerned.

BY MS. WEISS: (Resuming)

Q Well, the question simply was that it has happened in the past in this case, and I think it is reasonable to anticipate that it will happen in the future that the Licensee will come to you and say we have problems with meeting this deadline; can you give us six months or until the next refueling or whatever.

Are there some criteria by which you are going to judge those requests?

A (WITNESS WERMIEL) I think generally we would, as I say, study these particular items on a case basis for this particular plant. We would look at what is provided as a backup, say, to the implementation of the particular concern. We would look to see based on our engineering judgment whether that backup provides sufficient assurance of maintaining the public health and safety on an interim basis.

We may even ask for a numerical probabilistic approach to our decision to make that -- to decide that from a probability standpoint the particular item can be delayed, that sufficient defense in depth is available in the current plant arrangement to allow the delay.

CHAIRMAN SMITH: How about cost effectiveness? In

the first instance do you take that into account?

WITNESS WERMIEL: We have not, at least in my knowledge, ever assessed cost in our licensing practice that I am aware of in my work.

CHAIRMAN SMITH: You would --

WITNESS WERMIEL: Indirectly I suppose cost is a concern, because if an item requires the plant to be shut down, then cost is certainly a concern because every time -- every day the plant is shut down is a substantial burden on the utility. So I believe it is only indirectly that this particular type of cost is assimilated in the licensing practice.

DR. JORDAN: This topic, of course, will be pursued more generally by the Board when we get to discussions of the improvement of all the items from the restart design and its estimated probability Mr. Pollard referred to yesterday, and whether the probability estimates with restart are really high enough, and so it is -- as I say, we will discuss the totality, but the Board will not be involved with the individual things. However, that does not prevent Mr. Pollard from looking at the individual items.

WITNESS WERMIEL: I understand.

CHAIRMAN SMITH: Ms. Weiss, I interrupted you to point out that we had Dr. Ross, and I forgot to ever get to my point on it, so if you thought it was a pointless

interruption, it was.

I do commend the reading of the transcript on that, and recognizing who Dr. Ross is and what his responsibilities are, you have to take into account that this witness may not be at the level where those judgments are made. However, I still urge you to determine to the extent that you can what he does know about it.

MS. WEISS: A gratuitous comment is on the way, but I have noticed that sometimes there is a disjunction between the person who makes the decision and the person who knows the information upon which the decision is based. And I generally would rather have the latter, and I think I probably do.

BY MS. WEISS: (Resuming)

Q You mentioned as one criterion you look at what exists to back up the system, and I think Mr. Pollard will pursue that with respect to backups to the condensate storage tank level indication. But I wanted to pursue just a bit on backup to automatic initiation of emergency feedwater.

Would it be generally accurate to characterize your testimony yesterday as having stated the opinion that bleed and feed provides the requisite backup, at least in the interim, which compensates for emergency feedwater automatic initiation?

A (WITNESS WERMIEL) That is part of it. In the event the existing automatic initiation system did fail, feed and bleed is part of the backup. Further backup is provided by the operator's capability to manually compensate for the failure that might compromise his ability to deliver emergency feedwater flow, and the time period in which he can take action which we deem to be sufficient.

Q Within five minutes?

A (WITNESS WERMIEL) No. He has 20 minutes by analysis as a minimum now.

Q So you have defined success differently for purposes of that analysis than you have for Mr. Curry's analysis of success, emergency feedwater initiation.

A (WITNESS WERMIEL) Mr. Curry has already testified that he looked at a specific case, a five minute case. He did not look at recovery capability over a 20-minute period, and I believe that is on the record.

Q Have you analyzed the capability of an operator to recover within 20 minutes any of these scenarios that Mr. Curry presents -- the loss of offsite power, loss of DC power, loss of AC power, loss of main feedwater?

A (WITNESS CURRY) I have not, no.

Q Do you know?

A (WITNESS CURRY) I believe in the B&W reliability study, that is, BAW 1584, the 15-minute and 30-minute cases

are discussed and described, and there is some credit for recovery included in there.

(Counsel for UCS conferring.)

Q And is it still accurate that the Staff has not received or reviewed a detailed description from the Licensee of the bleed and feed mode of cooling, that the equipment used and the measures required and the procedures required to manipulate?

A (WITNESS WERMIEL) I am not familiar to the extent that we have reviewed feed and bleed. I believe I said on the record that we have not seen an analysis of the decay heat removal capability over an extended period of time for the feed and bleed mode.

Q Maybe the best way to ask it is whether there has been any change since the time Mr. Jensen testified with respect to what the Staff has reviewed?

A (WITNESS WERMIEL) Not that I am aware of.

Q The Board has already expressed the opinion that they are interested in the general things. I have an easier time understanding it when I focus on some specifics. I would just like to pursue for one moment or so the level indication on the condensate storage tank where we are now concerned about the primary water supply for the emergency feedwater pumps.

And if I heard you correctly, you said part of the

consideration of the backups available to compensate for not having fully redundant safety grade level indication at the time of restart was the availability of other water supplies.

A (WITNESS WERMIEL) Yes.

Q That is correct. Now, in your review of the emergency procedures for transferring the source of water, is it not correct that one of the principal indications that the operator will use to decide whether to transfer to the alternate water supply is specifically the condensate level instrumentation?

A (WITNESS WERMIEL) Yes, it is.

Q Well, if it is the instrumentation itself which is not fully complying with your longterm requirements at the time of restart and it is that instrumentation which the operator will use to determine whether to transfer to the alternate water sources, I have difficulty understanding how the alternate water sources can be a compensating feature for not having the level instrumentation.

A (WITNESS WERMIEL) If the level instrument should fail, he will know that he must get an alternate source. It will indicate that he has no level in the condensate storage tank and therefore must recover from that.

Q Well, but you have -- what particular type of failure mode did you assume when you just made that statement?

A (WITNESS WERMIEL) Perhaps the power supply to the instruments have failed.

Q All right. So can you discuss a failure of the level instrument which indicates adequate water in the condensate storage tank when in fact there is a decreasing level or inadequate water to provide a positive suction head for the pumps?

A (WITNESS WERMIEL) He does have two indicators, one on each tank, so I would assume if he got divergent readings from them, he would question the one or the other in an attempt to find out which one is correctly indicating the level.

Q Are the levels for the two condensate storage tanks always the same?

A (WITNESS WERMIEL) I believe they are supposed to be, yes. There is a reserve volume in each tank that is the same, 150,000 gallons in each tank.

Q Yes, but when we are taking water out of the tanks, do the level of the two tanks decrease in step, that they both are going down always at the same level?

A (WITNESS WERMIEL) The tanks do float on the system, and they are not supposed to be isolated one from the other normally.

Q I see. Is this the existing instrumentation safety grade with the exception of being not redundant on each tank?

A (WITNESS WERMIEL) I do not recall offhand if it is fully safety grade. I could not say.

Q Will the operability of that instrumentation be a limiting condition for operation in the tech specs?

A (WITNESS WERMIEL) I believe there are limiting conditions concerning the volume of water in the tank.

Q That was not my question. Is the operability of the level instruments going to be a limiting condition for operation?

A (WITNESS WERMIEL) I do not recall.

Q Do you think it should be?

A (WITNESS WERMIEL) I would say that once the redundancy is provided that certainly some operability requirement or action statement should be implemented.

Q I am not -- let me see if I can -- I am sorry. Let me phrase the question more specifically. It is my fault. At the time of restart when we will not have redundant level instrumentation on the condensate storage tank do you believe the operability of the instrumentation which will be provided at restart should be the subject of a limiting condition for operation?

A (WITNESS WERMIEL) I believe so, yes, because then he could not verify that he is meeting his tech spec requirement for providing the required level.

Q Nor could he decide when he needed to switch to an

alternate water supply.

A (WITNESS WERMIEL) That is true.

Q Thank you.

If we can move on now to -- I'm sorry.

DR. JORDAN: A little clarification.

WITNESS WERMIEL: Yes, sir.

DR. JORDAN: The two tanks, A and B, I see on your diagram are connected all right, but are the valves open so that the two levels do remain the same?

WITNESS WERMIEL: They are supposed to be, yes, sir, and they are supposed to be locked open.

DR. JORDAN: I see. Okay. That I had not understood. And then you say there is a level indication for each tank.

WITNESS WERMIEL: Yes, sir. Yes, sir, there is.

DR. JORDAN: All right. Eventually that will be redundant information on each tank.

WITNESS WERMIEL: Yes, sir.

DR. JORDAN: Is it continuous information on level that is redundant, and is there then a low level alarm? Is that the way it works?

WITNESS WERMIEL: Yes, sir, there is. That is correct.

DR. JORDAN: All right. That is fine.

BY MR. POLLARD: (Resuming)

Q Now, all of the backups that we have just discussed for this condensate level in terms of the alternate water supplies, in terms of bleed and feed, all of those alternatives will still be available after the redundant instrumentation is installed, isn't that correct?

A (WITNESS WERMIEL) Oh, yes.

Q You do not intend to relax the requirements.

A (WITNESS WERMIEL) No, sir.

Q So then I am correct that these alternatives are not something that have been added to compensate for the lack of redundant information. It is just that you considered their existence in deciding to allow restart without the redundant level instrumentation.

A (WITNESS WERMIEL) That is correct.

Q Okay. I am referring now to item 4 on the top of page 7 of your testimony. About the middle of the paragraph you refer to recent Licensee event reports indicating the need to improve the quality of system testing and maintenance.

How recent are those LERs?

A (WITNESS WERMIEL) That again is a statement that comes out of NUREG-0611, and I believe the LERs in question there are for a time period just prior to publishing of that document. I am not familiar with the exact dates for that time period.

Q Can you help me and tell me about when 0611 was published?

A (WITNESS WERMIEL) Let me think a minute. I believe it was published in approximately the fall of '79 sometime, late '79.

Q And this was after the other B&W plants had been permitted to resume operation, is that correct?

A (WITNESS WERMIEL) Yes, I believe so.

Q Did these Licensee event reports indicate deficiencies in the changes that had been required in the short term which were the basis for allowing the B&W plants to restart?

MR. BAXTER: I am sorry. I am confused. I understood 0611 was a report on Westinghouse plants.

WITNESS WERMIEL: It is.

WITNESS CURRY: That is correct.

MR. POLLARD: Okay. I am sorry.

BY MR. POLLARD: (Resuming)

Q Let me slow down. Again, what my concern is that on page 3 of your testimony you are describing the changes that have been made, or actually it begins on page 2, about the bulletins imposed the following specific requirements related to emergency feedwater systems, and then you discuss the administrative measures about making sure that valves -- periodic checks of proper valve positions, revising

procedures to assure that emergency feedwater system valves are returned to their proper operation -- position following testing, revising the tech specs, informing plant personnel, and operating and maintenance personnel of the seriousness and consequences of simultaneously blocking, and then you say these administrative measures improve the availability of the emergency feedwater system to function on demand.

Then when we get to page 7 you refer to these recent LERs which indicate the need to improve the quality of system testing and maintenance. And basically my question is did those Licensee event reports occur after the changes on page 3 of your testimony had been implemented?

A (WITNESS WERMIEL) I do not think so. The B&W plants were shut down at the time NUREG-0611 was being compiled.

Q But what about the Westinghouse plants that the report is written on? Have they been required to modify their surveillance and testing procedures?

A (WITNESS WERMIEL) Yes, they have.

Q But nevertheless, these Licensee event reports indicated the need to improve the quality of system testing and maintenance.

A (WITNESS WERMIEL) Yes, they did.

Q You then continue saying, "Specifically, periodic testing and maintenance procedures inadvertently result in,

one, more than one emergency feedwater system flow train being unavailable during test."

Let me stop there and jump down. And then you say, "The Office of Inspection and Enforcement has taken action to correct item 1." What specific action did the Office of Inspection and Enforcement take?

A (WITNESS WERMIEL) My understanding of what they did was to review plant test procedures, periodic test procedures to verify that all testing of emergency feedwater system flow trains was done on a staggered basis, and that if that was not the case, measures were taken to correct that.

Q Okay, then, returning back now to the item 2 about the testing and maintenance procedures inadvertently result in the emergency feedwater system flow train under test not being properly restored to its operational condition following the test or maintenance, later you say concerning item 2 Licensees were required to confirm flow path availability of an emergency feedwater system flow train that has been out of service to perform periodic testing or maintenance.

When you say Licensees were required, were they required to do that before or after the recent Licensee event reports that you refer to earlier?

A (WITNESS WERMIEL) This is a requirement that came

after those LERs, and I believe it is based on those LERs.

Q And where is that requirement set forth?

A (WITNESS WERMIEL) This is all discussion from NUREG-0611 which is part of item II.E.1.1 of NUREG-0737.

DR. JORDAN: Was this included in the bulletins and orders?

WITNESS WERMIEL: It was part of the bulletins and orders task force review, yes, sir. I believe the heading for this whole section of my testimony is B&O task force review. Yes, it is.

BY MR. POLLARD: (Resuming)

Q Now, the corrective action that has been taken, as I understand your testimony, is to implement procedures which require an operator to determine that emergency feedwater system valves are properly aligned, and a second operator to independently verify that the valves are properly aligned.

My question is why rather than simply checking valve positions you have not required an actual flow test of the system?

A (WITNESS WERMIEL) We have. That is the next item.

Q Well, but that is not done except after an extended outage. What I am concerned about is the periodic tests of emergency feedwater which require manipulation of valves. Simply going back and looking at a handwheel to see whether

the valve is open or not in my view is not as reliable as actually performing a flow test. Would you agree with that?

A (WITNESS WERMIEL) I would agree, but I do not agree that a flow test is necessarily a practical thing to do while the plant is operating.

Q Can you explain to me why not?

A (WITNESS WERMIEL) Well, injecting the cold emergency feedwater into the steam generator at 100 percent power might result in some excursion to the system that would be unacceptable or unsafe even.

Q Has the Staff examined that to determine whether it might or might not be the case?

A (WITNESS WERMIEL) I am not aware that we have looked into it in detail, no. I am also aware -- I mean, in some cases it might not even be possible to do that. I am trying to think of system configurations, and I may be wrong, but I --

Q When you say it might not be possible are you talking about Three Mile Island Unit 1?

A (WITNESS WERMIEL) No, no, I am not talking about Three Mile Island Unit 1.

Q So that if I understand, Three Mile Unit 1, you think inadvertent actuation of emergency feedwater might pose a safety hazard.

A (WITNESS WERMIEL) Inadvertent actuation of

emergency feedwater? I do not know that it might result in a safety hazard. I do know that it might result in an excursion that would have to be compensated for, and I do not know what the ramifications of that are.

Q So then am I correct in concluding that you have not done an analysis to weigh the benefits and the risk of requiring the performance of a flow test?

A (WITNESS WERMIEL) No, I have not.

Q Has anyone on the staff done that to your knowledge?

A (WITNESS WERMIEL) Not that I am aware of.

Q Are you familiar with past failures where although the valve operator indicated the valve was open, the mechanical failure of the valve had in fact occurred, and the flow path was blocked?

(Panel of witnesses conferring.)

A (WITNESS WERMIEL) Yes, I could see where that could be a possibility, yes.

Q If we could move now to the top of page 9 of your testimony where you are talking about the independence of the turbine-driven pump train from AC power. Is this AC independent air supply safety grade?

A (WITNESS WERMIEL) Yes, I believe it is.

Q Will it be the subject of a limiting condition operation in the technical specifications?

A (WITNESS WERMIEL) I do not recall if it is or not.

Q Do you think it should be?

A (WITNESS WERMIEL) It is a passive component, so I am not sure how its operability will be verified, but I would say yes, if there was something that would fall within the realm of tech specs, then it should be included, yes.

Q Now, moving on to page 9, the bottom, where we now begin your testimony on the Lessons Learned review, and in the middle of that paragraph you are talking about the need for automatically initiating emergency feedwater system, and you are discussing this in the context of satisfying or consistent with satisfying the requirements of General Design Criterion 20.

Is it the Staff's position that the emergency feedwater system must comply with General Design Criterion 20? .

A (WITNESS WERMIEL) It is currently our practice that it must, yes.

Q But that it need not require -- it need not comply with General Design Criterion 20 prior to restart.

A (WITNESS WERMIEL) I am not familiar with the details of compliance with GDC 20, and I have not done the reviews against that General Design Criterion.

Q Well, this -- I mean, your testimony states that the analysis of feedwater transients and the results of reliability studies of installed emergency feedwater systems

pointed out the need for automatically initiating the emergency feedwater system consistent with satisfying the requirements of General Design Criterion 20. And I thought I understood your earlier testimony that the automatic initiation of the emergency feedwater systems for Three Mile Island Unit 1 will not be accomplished prior to restart.

A (WITNESS WERMIEL) The safety grade automatic initiation would not, that is right.

Q That is correct. So am I correct that at the time of restart Three Mile Island Unit 1 will not meet General Design Criterion 20?

A (WITNESS WERMIEL) What I am saying is I do not know that GDC 20 says that automatic initiation systems must be safety grade. I am just not familiar with the details. If that is what is meant by this paragraph from the Lessons Learned NUREG, then what you are saying is correct.

Q I do not know if you have it available for reference, General Design Criterion 20, but you have quoted in your testimony the exact words. General Design Criterion 20 is entitled "Protection System Functions."

"The protection system shall be designed: one, to initiate automatically the operation of appropriate systems, including the reactivity control systems, to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences; and two, to

sense accident conditions and to initiate the operation of systems and components important to safety."

A (WITNESS WERMIEL) I would infer from that discussion that the TMI-1 system at the time of restart was needed because they will have an automatic initiation of emergency feedwater function.

Q But that it will not be safety grade automatic initiation.

A (WITNESS WERMIEL) That is correct, and as I was saying, I do not see in that discussion that you've just quoted me where that safety grade is mentioned.

(Pause.)

CHAIRMAN SMITH: Do you read General Design Criterion 20 to require that the protection system be safety grade or that the system initiated by the protection system be safety -- but that it had the capacity to sense the accident conditions and to initiate the operation of systems and components important to safety?

MR. POLLARD: Well, Mr. Chairman, with this particular witness I am trying to avoid going over the discussion that we have had earlier as to whether or not the instrumentation which turns on a particular system is part of that system or part of the protection system.

I also do not intend to pursue with this witness whether or not meeting General Design Criterion 20 requires

a safety grade system.

There is no question in my mind that the instrumentation which turns on emergency feedwater is part of the protection system, and I think the testimony that is on the record already when we talked about safety grade, safety-related, important to safety is adequate in that regard, which is why I did not pursue it here. It is no different from the instrumentation which automatically initiates high pressure injection.

CHAIRMAN SMITH: I was just having trouble with the language of Criterion 20 as it fits into your exchange. Criterion 20, if we accept your view that the words "important to safety" are equal to safety grade, Criterion 20 says the protection system. It does not say that the protection system would be safety grade, but the protection system shall be designed to sense accident conditions and to initiate the operation of systems, safety grade systems.

But I understand, but it just did not seem to fit into this exchange that you are having. The answer and the questions did not seem to match the criteria.

MR. POLLARD: I think that is because of the answer I received. This witness thinks GDC 20 can be satisfied by the existing design. I simply decided it is not worth pursuing with this witness.

BY MR. POLLARD: (Resuming)

Q With respect to the implementation date for the safety grade automatic initiation for the Three Mile Island Unit 1 emergency feedwater systems am I correct that in the series of events that occurred originally, NUREG-0578 required this to be accomplished by January 1 of 1981, and then NUREG-0737 required this to be accomplished by July 1 of 1981, and in the restart SER which is Staff Exhibit 1, NUREG-0680, on page C-8-37 the Licensee has proposed a schedule for installation of the fully safety grade longterm design during the first refueling outage after restart. However, the Staff did not accept that and stated that we will require that the fully safety grade modification described above be installed within 60 days after receipt of the required equipment.

And if I understood your testimony that we are now discussing, that this could be delayed until the next refueling after restart.

A (WITNESS WERMIEL) That is conceivable. A decision has not been made yet.

Q But has the staff abandoned their earlier position that it must be installed sixty days after receipt of the equipment?

A (WITNESS WERMIEL) I do not know that we have or not. That may still be. That may end up being our position. I am not sure.

Q Do you know why the staff rejected the original Licensee proposal of not installing this until the first refueling outage after restart and instead imposed upon them the demand to be installed within sixty days after the receipt of the required equipment?

A (WITNESS WERMIEL) I think we felt at the time this was written that it was perhaps important enough where it should be put it as soon as it should be. Unfortunately, I do not know that that particular requirement holds much weight in that if the equipment delivery was delayed until the plant was down for their refueling outage, it never would have been met; that statement never would have been met anyway.

Q I understand that, which is the reason I am pursuing another area where I am trying to decide what criteria the staff has that are not, in Ms. Weiss' phrase, infinitely flexible as to when a safety improvement is actually going to be accomplished at TMI-1.

A (WITNESS WERMIEL) Again, I think we would weigh

all the factors involved in implementing the requirement: whether or not the plant would be shut down, for how long, what the time factor is between the date of equipment delivery and the proposed shutdown for refueling, what is available as backup. All these factors must weigh upon a decision when you are involved with an operating reactor.

Q Can you identify for me any new information that the staff has obtained that would result in changing the conclusion that was stated in the restart SER that this was important enough require that the equipment be installed within sixty days after receipt of the equipment?

A (WITNESS WERMIEL) I am not aware of any new information, and I am also not aware that the statement will even be changed.

(Counsel for UCS conferring.)

Q Can you tell me why the staff thought that this requirement was so important that it should be implemented within sixty days after receipt of the equipment, which at that time was estimated to be -- "at that time" meaning the time this SER was written -- that receipt of the equipment was scheduled for March of '81?

A (WITNESS WERMIEL) As I indicated before, I believe, and has been shown by Mr. Curry's numbers, this does provide a significant improvement in the immediate reliability of the system. By immediate I mean the

automatic availability of the system. And for that reason we felt it should be put in as soon as practical.

MR. POLLARD: We have some requests off the record here for a break, Mr. Chairman. This is a convenient breaking point for me.

CHAIRMAN SMITH: Fine. Thank you.

Let's take a 15-minute morning break.

(Recess.)

CHAIRMAN SMITH: Are we ready to proceed?

Maybe it is helpful for the parties to know about the schedule for limited appearance statements. We do have one scheduled for 1 o'clock and two at 5 o'clock.

MR. BAXTER: Mr. Chairman, I was not here during February and March when this routine started evidencing itself. Are there any time limits the Board has set for limited appearance statements in terms of the duration?

CHAIRMAN SMITH: No. We recommend that they be held from 5 to 10 minutes, but we have not set an absolute time limit. We will approach that on a case-by-case basis.

BY MR. POLLARD:

Q Mr. Wermiel, on page 11 of your testimony towards the end of the first paragraph, in fact the last sentence, you talk about resolution of the equipment, environmental and seismic qualification concerns. Is it staff's position that these concerns are required to be resolved before

restart?

A (WITNESS WERMIEL) I am not aware of the details of the staff's position on equipment -- the environmental qualification of equipment, and I am also not aware of the implementation for the seismic qualification or the concern over potential problems with the seismic qualification. I have not seen the schedule on either of those.

(Counsel for UCS conferring.)

Q In the staff's safety evaluation report on environmental qualification of safety-related equipment, which was transmitted on March 24 by a letter dated March 24, 1981 to Mr. Hukill of Metropolitan Edison, it does include a listing of equipment used in the emergency feedwater system.

If that equipment was found to be not environmentally qualified, would that change your decision as to whether or not Three Mile Island should be allowed to restart?

A (WITNESS WERMIEL) In my view it would not because equipment environmental qualification, again, is not a significant contributor to overall system reliability. The particular environment we are talking about has to do with the steam line break environment, and the steam line break is a relatively low probability event.

Q Is it low enough a probability event that it would

be acceptable if the entire emergency feedwater system failed as a result of the environmental consequences?

A (WITNESS WERMIEL) No, it is not. Eventually the environmental qualification would have to be assured. But again, on an interim basis that is a low probability occurrence and does not impact my feelings on the overall reliability of the system.

Q Mr. Wermiel, could you just give me any example of some defect in the emergency feedwater system that would affect your assessment of its reliability?

A (WITNESS WERMIEL) Yes. I would say that if we found that something within the system that was looked at did not meet the single failure criterion, then I believe the reliability would be impacted and would be affected to the point where we would have to look at that particular failure and see what its consequences are and what its effects on reliability are.

Q Well, when you made the changes to your testimony yesterday on page 25, you said that the single-failure criterion would not be met prior to restart.

A (WITNESS WERMIEL) That has to do with the automatic initiation system again not meeting the single-failure criterion.

Q But that did not affect your assessment of whether or not the system was safe enough to restart.

A (WITNESS WERMIEL) We looked at the effect of that single failure, and as I said before, we decided for an interim time period that the defense-in-depth provisions of feed and bleed and operator recovery from the single failure were sufficient to assure a reliable enough system on an interim period for restart.

(Counsel for UCS conferring.)

Q Is that the only way in which the single-failure criterion will not be met at the time of restart?

A (WITNESS WERMIEL) I believe there is another that I mentioned when I was here before that had to do with the steam line break. In the event of a steam line break in one steam generator and a single failure in the flow control valve to the intact steam generator, you may not automatically deliver emergency feedwater. And again, that does not impact on my relative assessment of the reliability of a system because the steam line break is a low probability occurrence.

This single failure point will also be corrected by this proposed long-term upgrade that we have already mentioned. The automatic initiation upgrade includes redundant valves.

(Pause.)

Q In making your judgment as to whether or not the emergency feedwater system for Three Mile Island Unit 1 is

sufficiently reliable, do I understand you to say that you will compensate for the lack of compliance with some requirements by considering the probability of demand for the system? Is that what you are saying when you say you are not concerned about the steam line break or high energy line break?

A (WITNESS WERMIEL) You are talking about the probability of the initiating event?

Q Yes, sir.

A (WITNESS WERMIEL) That is part of it. And I believe I have espoused or stated the rest of our consideration.

Q Assume that if there were a high energy line break and this resulted in a guaranteed failure of the total emergency feedwater system, would you recommend restart? In other words, assuming that a high energy line break occurred and because of lack of environmental qualification of the equipment in the emergency feedwater system, we knew that the entire emergency feedwater system would fail, would you recommend restart under those conditions?

A (WITNESS WERMIEL) I believe I would so long as I assured myself that the probability of that occurrence was as low as we expect it to be. In other words, there is not some flaw in the steam line that has gone undetected or --

Q What probability do you assign to a high energy

line break?

A (WITNESS WERMIEL) I believe Mr. Curry knows that better than I. I have heard numbers like 10^{-6}, I believe.

Q That is not my question. My question is to you: what probability would you consider acceptable for allowing restart, the probability of a steam line break occurring that you would consider acceptable as a basis for restart, knowing that such a high energy line break would disable the entire emergency feedwater system?

A (WITNESS WERMIEL) I believe it would have to be on the order of 10^{-6} or something like that.

Q 10^{-6} per reactor year?

A (WITNESS WERMIEL) Yes.

CHAIRMAN SMITH: That is given as a certainty that the break would --

MR. POLLARD: Would disable emergency feedwater.

WITNESS WERMIEL: I might also say that we do not use the number per se as justification. We would have to, again, assure ourselves that the feed and bleed backup is available in this kind of event for decay heat removal.

BY MR. POLLARD: (Resuming)

Q As I understand your testimony, neither you nor anyone on the staff has done so.

A (WITNESS WERMIEL) Pardon me? Has done --

Q Neither you nor anyone else on the staff has

determined that the feed and bleed mode is an adequate means of removing decay heat.

A (WITNESS WERMIEL) I believe we have said that it is an adequate means for removing decay heat for a certain time period.

Q You have done some analysis of that?

A (WITNESS WERMIEL) No, we have no analysis of that; but we do know its availability is there and that it can do that, and I believe that is on the record.

Q And you have looked at that specifically for high energy line break and steam line break, that you know that feed and bleed will not be affected by lack of environmental qualification of the equipment.

A (WITNESS WERMIEL) I do not know about the environmental qualification of a high pressure injection system.

(Counsel for UCS conferring.)

Q Do you know about the environmental qualification of the other equipment used for bleed and feed other than high pressure injection?

A (WITNESS WERMIEL) No, I do not.

(Pause.)

Q On the top of page 12 of your testimony you state that the table, meaning the table attached to your testimony, identifies each current emergency feedwater

system requirement when compliance with the requirement was or will be implemented by the Licensee and the source of the requirement and where a discussion of the evaluation against the requirement can be found.

I would like you to refer to page 25 of your testimony and tell me whether you believe that sentence I just read is correct.

(Witness reviewing document.)

A (WITNESS WERMIEL) I am not sure I follow the question.

Q Well, look, for example, at item -- pick an item: item 10, 9, 8, 7.

A (WITNESS WERMIEL) Yes?

Q Can you tell me where the source of those requirements are from on that table?

A (WITNESS WERMIEL) Yes. The source of these is the standard review plan.

Q And can you tell me from that table where a discussion the evaluation against that requirement can be found for TMI Unit 1?

A (WITNESS WERMIEL) I guess I cannot. I have not identified it here. The reason for that is because I believe I put in "not applicable" in the Prior to Restart column because the system designed had already met that requirement or that item of criteria.

Q Well, of course, what I am interested in is on what basis you entered "yes" in the Prior to the TMI-2 Accident column.

A (WITNESS WERMIEL) On the basis of an evaluation of the system design.

Q And your evaluation is not written down in some place where I could examine the discussion of how the requirement is met; is that correct?

A (WITNESS WERMIEL) We do not necessarily in our evaluation describe item for item, line for line, a discussion of its evaluation -- its compliance against evaluations. We review it and we review it as we feel -- to impart enough information to other parties that they understand what it is we have done.

(Consel for UCS conferring.)

Q Perhaps you can help me find the item in the table dealing with environmental qualification of emergency feedwater.

A (WITNESS WERMIEL) On page 24, item 2.

Q Thank you. In that entry on that page you had a "yes" under the Prior to the TMI-2 Accident, that the equipment was protected against the effects of high and moderate energy piple breaks.

A (WITNESS WERMIEL) Yes.

Q But if I understand your comments over to the

right and the staff's recent safety evaluation report on environmental qualification, apparently there is some doubt as to whether or not the system had been protected against those effects when the plant was originally licensed or even prior to the TMI-2 accident.

A (WITNESS WERMIEL) Yes, that is true.

Q Can you tell me, then, why I should have a great deal of confidence for the yesses you have entered for items 7, 8, 9 and 10, for example, on page 25?

(Pause.)

A (WITNESS WERMIEL) Only in that I rereviewed the information available and found no deviation from it for those items. If something new had been discovered somewhere along the line, then there might not be indicated compliance with that item such as is indicated for environmental qualification.

(Counsel for UCS conferring.)

Q At the time the Three Mile Island Unit 1 was licensed, it was not reviewed against the requirements in the Standard Review Plan, is that correct?

A (WITNESS WERMIEL) The requirements in the Standard Review Plan were not identified, as I say, item for item, line for line. The review was, in my understanding, essentially in the same fashion that we now use the SRP. I do not know the specifics of the original review and I do

not know precisely what is documented for that original review.

But the SRP is not something -- when it was written it was not something that was entirely new. It was meant to identify how the staff does its review and what we look for and what we have looked for.

Q Okay. Referring to item 4 on page 25 of your testimony where you say failure of non-essential components does not affect the emergency feedwater system, reference Regulatory Guide 1.29, you say that this was met prior to the TMI-2 accident.

Has the staff done a systems interaction study for Three Mile Island Unit 1?

A (WITNESS WERMIEL) I am not aware of one.

Q Well, what review did you do in order to enter this "yes" under Prior to the TMI-2 Accident?

A (WITNESS WERMIEL) I examined to the best of my capability the location of the system with respect to nonseismic structures and nonseismic piping systems and how they may impact the operability of the system.

Q Are you familiar with the recommendations the ACRS made on this subject for Three Mile Island Unit 1 in December of 1980?

A (WITNESS WERMIEL) No, I am not.

(Counsel for UCS conferring.)

(Counsel distributing document to Board and parties.)

(Witness reviewing document.)

MS. WEISS: I wonder if I might inquire through the Board if it is necessary to mark this as an exhibit or whether the staff intends to put this ACRS letter in along with the SER supplement on closing the open items.

MR. CUTCHIN: Mr. Chairman, I have to say I honestly do not know, but it was my understanding that the staff intended somehow to address ACRS concerns; but I cannot guarantee that those concerns will be addressed in Supplement 1.

DR. JORDAN: There has been a promise from the staff to address these items, but there is also, I believe -- was this not entered into the record by Ms. Bradford? She brought it up, I know.

MR. CUTCHIN: I do not know, sir.

(Board conferring.)

MS. WEISS: Well, if it has not already been admitted, then we would want to mark it for identification at this point as a UCS exhibit, but I just do not know.

(Board conferring.)

CHAIRMAN SMITH: The suggestion was made that this was produced into the record by Ms. Bradford for the additional comments of Moeller and Okrent, and it was not.

It was given to us as a basis for a contention, underlying basis, but it never made its way into the evidentiary record.

MS. WEISS: In that case, we would like to mark it as a UCS exhibit for identification, and I have no idea what number we are up to.

CHAIRMAN SMITH: 32.

MS. WEISS: Thank you.

(The document referred to was marked UCS Exhibit No. 32 for identification.)

MR. BAXTER: Mr. Chairman, I do think that the copy that is provided to the reporter for the official record should not be the one that is marked up as has been the one that we have been distributed.

CHAIRMAN SMITH: I do not see any bias in the marking.

MR. BAXTER: I can.

MS. WEISS: I can mark the other two paragraphs that are not, and then they will all be marked.

CHAIRMAN SMITH: I agree. If we have two copies before us, one marked and one not marked, we would take the unmarked one, but do you see any prejudice in the marking?

MR. BAXTER: I would be glad to provide you with an unmarked one. Yes, I do.

CHAIRMAN SMITH: Okay.

BY MR. POLLARD: (Resuming)

Q You are, of course, free to read the whole letter. I am particularly interested in directing your attention to item 1 on page 2 of UCS Exhibit 32 where the ACRS recommends again that the Licensee should conduct reliability assessments of the plant as modified and that the ACRS, as you can see, is concerned when they state that we believe the Licensee should examine the plant from the standpoint of systems interaction that may degrade safety.

Now, the ACRS also went on to say that in their view, completion of these systems interactions should not be a condition for restart. After seeing this letter -- is this the first time you have heard of these requirements?

A (WITNESS WERMIEL) Yes, it is.

Q If there were systems interactions at TMI Unit 1 that could degrade the reliability of that system, would that affect your evaluation or your recommendations concerning restart?

A (WITNESS WERMIEL) I think it might, depending on what the interaction is and what it would do to the emergency feedwater system should that particular failure occur.

Q Without doing a systems interaction study and then not in a position to know whether there are such interactions and a chance to evaluate their probability, on

what basis do you believe that restart should be permitted without performing such a study?

A (WITNESS WERMIEL) We do a type of systems interaction in our reviews, and I did in my review. I did examine certain potential interactions and satisfied myself that there were none and that none could compromise the operability of the system.

Q How did you go about doing that evaluation? Did you --

A (WITNESS WERMIEL) I examined the documentation available in the restart report, and then I walked the system down to examine its physical location and its supporting systems and other items in the area of the system.

Q Did you examine for the types of interactions such as could occur by rupture of a non-safety system in some other part of the plant and, for example, backing up through a drain system?

A (WITNESS WERMIEL) Yes, I did. I examined the drains in the room and where they went, what other fluid systems were in the vicinity that might impact the emergency feedwater system, and I could find no problems from my review.

Q Did you review the instrumentation circuits for not only emergency feedwater but as well as all the auxiliary supporting systems for emergency feedwater?

A (WITNESS WERMIEL) No, I did not.

Q Do you think that that could be a possible source of systems interactions?

A (WITNESS WERMIEL) I believe we have reviewed these circuit -- not I, but others have -- and have identified where there may be interactions, and we are pursuing corrective action in these areas.

Q You mean you found some systems interactions that have to be corrected?

A (WITNESS WERMIEL) Well, we have identified the single failure in ICS problem and are pursuing that one, for instance.

Q Do you think what the staff has done already has satisfied the recommendation that the ACRS has made here?

A (WITNESS WERMIEL) If I read this literally, I honestly could not say. I do not know --

Q Have you --

A (WITNESS WERMIEL) Certainly the Licensee, as far as I know, has not conducted reliability assessments of the plant as modified. For instance, I do not know what the Licensee has done from the standpoint of identifying systems interactions.

Q I know you told me you had not seen this letter before. Have you been following any of the reports of the ACRS dealing with the methods that must be used to perform

systems interactions studies in their view?

A (WITNESS WERMIEL) No, I have not.

(Counsel for UCS conferring.)

MS. WEISS: Mr. Chairman, I would like to move UCS No. 32 for identification into evidence.

MR. CUTCHIN: Objection.

CHAIRMAN SMITH: Mr. Cutchin.

MR. CUTCHIN: Until I get a clarification, Mr. Chairman, I have no objection to its being introduced for the purpose of indicating its existence, for whatever use that is.

CHAIRMAN SMITH: The letter exists. Do you believe that the letter accurately represents the view of the ACRS?

MR. CUTCHIN: I have no way of knowing one way or the other, Mr. Chairman.

CHAIRMAN SMITH: Well --

MR. CUTCHIN: Normally these letters are admitted into evidence merely for the purpose of demonstrating compliance with the statutory requirement that the ACRS had indeed performed a review. In this instance there is no such statutory requirement.

CHAIRMAN SMITH: Ms. Weiss.

MS. WEISS: I frankly do not know the answer to the question of whethere there is a statutory requirement in

this case or whether the Commission is requiring the ACRS to perform this review. I suspect that they are, but I would like it into evidence to show that this is a letter which the ACRS has written, and I do not think there is the slightest challenge, reasonable challenge, certainly, from Mr. Cutchin's side of the table that this is a genuine copy of a letter from the ACRS.

MR. CUTCHIN: Oh, no.

CHAIRMAN SMITH: He concedes that. He only objects on the basis -- well, he would allow it in -- well, I think there are three levels in which we could receive this exhibit. One is that the letter has been written and for no other purpose, and you do not object to that, or you do object to that.

MR. CUTCHIN: I do not object to its being admitted for the purpose of indicating that such a letter exists.

CHAIRMAN SMITH: The next level would be that the letter accurately reflects the views of the author, and of course the highest level would be that the views of the author have some evidentiary weight in this proceeding, and you are not even arguing that last one.

MS. WEISS: No, but I think it is clearly an official document of the Commission and I think that it is subject to official notice. I would think that the burden

would fall, under those circumstances, on the staff if they had any question about this reflecting the true opinion of the ACRS as stated in there.

MR. CUTCHIN: I will even stipulate, Mr. Chairman, that the letter purports to represent the collegial views of the committee.

MS. WEISS: That is fine, then.

CHAIRMAN SMITH: Then you have no difference of opinion. All right.

Mr. Baxter.

MR. BAXTER: I have no objection.

CHAIRMAN SMITH: Then UCS Exhibit 32 is received, and Mr. Baxter, you will provide a clean copy. Thank you.

(The document referred to, previously marked for identification as UCS Exhibit No. 32, was received in evidence.)

DR. JORDAN: I think perhaps UCS does know, but just for the record, Mr. Rowsome will be here in response to Board questions and this will be a topic which we will be inquiring into. We have asked him what the IREP study is, where it stands, how it will be applied to TMI-1, and he will be coming shortly, I believe.

MR. CUTCHIN: Mr. Rowsome is sitting to my left, Dr. Jordan.

DR. JORDAN: All right.

BY MR. POLLARD: (Resuming)

Q On page 12, Mr. Wermiel, of your testimony --

A (WITNESS WERMIEL) Pardon me?

Q Page 12, second paragraph, first sentence. Is that a sentence you wrote or is that lifted from some other document?

(Witness reviewing document.)

A (WITNESS WERMIEL) That is a sentence that I wrote.

Q Can you please give me your definition for the words "availability" and "reliability"?

A (WITNESS WERMIEL) Availability is, I believe, the -- at a point in time the emergency feedwater system would be available to perform its design function. Reliability is a reflection if the potential availability of the system over a period of time. In other words, it is time dependent.

(Counsel for UCS conferring.)

Q What units or terminology would you use to express a numerical availability as compared to a numerical reliability?

A (WITNESS WERMIEL) I am not entirely sure. I do not do reliability studies in my work and I am not heavily involved in this type of thing. I know Jim Curry could answer that question much better than I.

Q That is why I am asking you, because it is your

testimony. When you wrote this, is there some distinction in your mind between availability and reliability other than the time frame?

A (WITNESS WERMIEL) Yes, I believe there is a distinction.

Q Can you tell me what that is, please?

A (WITNESS WERMIEL) There are certain ways in which a system might be available at a particular point in time, but because it is constantly being maintained or under -- is down for various reasons, its reliability over a period of time may not be what you would want it to be because it is not available.

(Counsel for UCS conferring.)

Q Let's assume that --

CHAIRMAN SMITH: Well, it may have been that Mr. Pollard did not want Mr. Wermiel to have any help, so you want to be careful about that.

WITNESS WERMIEL: I am sorry.

CHAIRMAN SMITH: In the sense of the way he put the question, he wanted your answer and not Mr. Curry's answer.

WITNESS WERMIEL: I might say --

CHAIRMAN SMITH: However --

WITNESS WERMIEL: I did not mean to quantify it in this statement here. I just meant to tie the two together

in that they both reflect on the capability of the system to perform its function. That was all I meant from a qualitative standpoint.

BY MR. POLLARD: (Resuming)

Q An example may help me to understand the distinction you intended when you wrote your testimony. Suppose a system, one train of the emergency feedwater system has been taken out of service for the purpose of performing a periodic test, and that to do so renders it incapable of operating if there were an actual demand.

Would that affect its availability or reliability or both?

A (WITNESS WERMIEL) I guess it would affect both because now you have the potential for a failure more likely causing the system to not perform its function, and therefore it is perhaps not as readily available to do its function because one train is down.

Q Can you give me an example of a problem in the emergency feedwater system that would affect its availability but not its reliability, and then conversely, something wrong with the system that would affect its reliability but not its availability?

A (WITNESS WERMIEL) I do not think I can. I think they are both a relation or both are related to the overall system's performance capability. I do not think there is any

distinction or I am not sure I meant any distinction when I used the two words. Only in that they are not synonymous, necessarily.

(Pause.)

Q I am sorry I am taking so long. You already answered some of my questions when you summarized your testimony.

Perhaps the easiest way to proceed is I am, frankly, somewhat confused by your table entries, "yes" versus "yes" with an asterisk, particularly when you have entered a "yes" in the Prior to TMI-2 Accident column. Perhaps if I gave you an example you can help explain my confusion.

You indicated, as I recall, when we discussed the condensate level storage tank instrumentation that this requirement had been met prior to the accident but that some upgrading was necessary. Am I correct that when you enter a "yes" it may be that the subject matter of the requirement was met but clearly at the time of the accident they did not have redundant level instrumentation on each tank? They had some --

A (WITNESS WERMIEL) It was redundant to a point. It was not fully redundant. There was one on each tank. So a failure of the instrument on one tank still leaves you the other one. The problem with redundancy is in the power

supplies.

Q So as a general rule, if I saw a redundancy such as occurs on page 20 for item II.E where we are talking about the flow test for these two hours independent of all AC power, when you say "yes" in the Prior to the Accident at TMI-2 column, does that mean yes, they had done a flow test for two hours independent of all AC power prior to the accident?

A (WITNESS WERMIEL) No. What it means is that we in our review had determined that the EFW system at TMI-1 prior to the accident could supply -- we are talking about item E, right?

Q Yes, E.

A (WITNESS WERMIEL) Yes, could supply emergency feedwater to the steam generator independent of all AC for a two-hour time period.

Q And your subsequent review found out that the earlier determination was incorrect.

A (WITNESS WERMIEL) Not really incorrect. There was a defect in a portion of the design that needed to be corrected to assure this capability in a more reliable fashion. And that had to do with the safety valve setpoint, I believe, on the steam supply line to the turbine and the capabaility to operate the steam pressure control valve on the steam inlet.

Q Isn't this the area where we had to add the backup air supply for the valves?

A (WITNESS WERMIEL) Yes, it is.

Q Because the original air supply was not independent of AC.

A (WITNESS WERMIEL) That is correct, and the valve failed open as it should, but there was some concern that in this fashion, should there be some fluctuation or degradation of the steam supply, that the turbine might trip on overspeed.

Q So that when you say a requirement in general was, yes, it was met prior to the accident, but then in the subsequent columns of prior to restart or post-restart where we have a "yes" with an asterisk, it means the requirement was perhaps partially met prior to the accident and that some improvement or change in the plant is necessary to fully meet the requirement.

A (WITNESS WERMIEL) Well, at the time the review was done, it was felt that it fully met it, but subsequently we got additional information from some source that might hve indicated that our original evaluation missed something.

Q With that explanation, can we turn to page 21 and look at item I? Now, here you made a change to the written testimony by deleting the asterisk from the "yes" in the column Prior to Restart, so now the table reads, with

respect to the additional short-term recommendation concerning the primary emergency feedwater, water source level indication, you say yes, this was met prior to the accident, yes it will be met prior to restart, but yes with an asterisk with respect to post-restart.

Am I incorrect if I interpret that table as saying what eventually the staff is going to require was not met prior to the accident and will not be met prior to restart and will only be met in the long-term post restart?

A (WITNESS WERMIEL) That is correct. The staff's present requirements for this item will not be met until the long-term post-restart.

Q Okay. On page 23, item II.B.

A (WITNESS WERMIEL) Pardon me, I missed the item number.

Q I am sorry, II.B, design basis for emergency feedwater system flow capacity.

A (WITNESS WERMIEL) Yes, sir.

Q In your comments you refer me to the restart SER. On page C.1-3 of the SER, it says the plant will have to be shut down in 48 hours, but your testimony on page 3 says it has to be shut down in 72 hours. Is that an inconsistency or am I misinterpreting those two sections?

A (WITNESS WERMIEL) No, that is a misinterpretation. Our actual concern or our actual

criteria and requirement is for a 72-hour action statement before shutdown. The Licensee has agreed to a more conservative position of 48 hours, and that is documented in their proposed tech specs.

(Counsel for UCS conferring.)

A I hope I have made myself clear. The 72 hours is a requirement that we impose on all plants and is a little more conservative for this plant only by Licensee's own documentation.

Q Okay. While we are there on page C.1-3 of the SER, it says, in the middle of the first paragraph, under item 4, if a flow path is unavailable to both steam generators or if capacity drops below 100 percent to both steam generators, the reactor will be shut down within one hour and placed in a cooling mode, which does not rely on the steam generators, within an additional 12 hours.

Can you explain to me, please, how at Three Mile Island Unit 1 the plant can be placed in a condition which does not rely upon steam generators within 12 hours if both flow paths to the steam generators are unavailable?

A (WITNESS WERMIEL) TMI-1 utilizes the main feedwater for normal startups and shutdowns. Main feedwater would be available.

Q All right. Let's assume that in taking the plant off the line we lose offsite power as was required to be

considered in connection with General Design Criteria 17. Can you meet the technical specification without offsite power?

A Yes, you may for decay heat removal. You can rely on the high pressure injection system in the feed and bleed mode if all feedwater was not available.

Q And it is your testimony that relying upon bleed and feed would place the plant in a condition that it would not rely upon the steam generators.

A (WITNESS WERMIEL) That is right. The feed and bleed mode does not utilize the steam generators for decay heat removal.

Q What is the significance of the 12 hours, then?

A (WITNESS WERMIEL) This is written for a shutdown utilizing the normal main feed system, and after 12 hours, presumably, you would go to your decay heat removal system. You would be at the cut-in temperature for decay heat removal.

Q We cannot get the decay heat removal in 12 hours using bleed and feed, can we?

A (WITNESS WERMIEL) I do not know whether you can or not.

Q On page 24 of your testimony, item II.3, which deals with seismic classification of emergency feedwater system, the only entries you have in the table is yes, this

requirement was met prior to the accident, not applicable prior to restart; but your comments is the Licensee has performed the staff that some emergency feedwater system valves may not be fully seismically qualified; this is being reviewed by the staff.

Is it the staff's requirement that this matter be resolved prior to restart or not?

A (WITNESS WERMIEL) I am not aware of the staff's requirement in this area. It is not part of any of the restart items that I am aware of.

Q Do you know whether or not the staff requirement, whether it would ever be resolved even in the post restart?

A (WITNESS WERMIEL) It is my understanding that it will be resolved at some time, yes. It is a staff requirement that it at some time be resolved.

Q So then why on your table don't you have a "yes" with an asterisk in the Post-Restart column?

A (WITNESS WERMIEL) Because it may be resolved prior to restart. I just do not -- what I am trying to show here is my evaluation, and I am not involved in this particular reevaluation, and I just do not know what is involved in it and I am not aware that it impacts the restart requirements.

Q As far as your testimony goes, you do not know whether or not the emergency feedwater system has to be

seismically qualified prior to restart.

A (WITNESS WERMIEL) I do not know that, that is true.

Q Okay. On page 26, Item II.1.1, this deals with adequate instrumentation and controls as it relates to General Design Criteria 19, is that correct?

A (WITNESS WERMIEL) Yes.

Q And when you say that this requirement will be met prior to restart, does that entry include your evaluation of whether or not the requirement will be met if there is loss of access to the main control room?

A (WITNESS WERMIEL) I am not aware of what is being done to improve this area, considering a loss of access in the control room.

(Counsel for UCS conferring.)

Q Are you aware of the provisions of General Design Criterion 19 that address loss of access to the main control room?

A (WITNESS WERMIEL) Not in detail, no.

Q Then what was your basis for the entry of the "yes" if you do not know what the requirements of General Design Criterion 19 are?

A (WITNESS WERMIEL) General Design Criterion 19, I understand, goes well beyond merely its impact on emergency feedwater and there are other reviews involved in that that

I am just not involved in.

Q I am only asking you about emergency feedwater. Let me read to you the portion of General Design Criterion 19: Equipment at appropriate locations outside the control room shall be provided, one, with a design capability for prompt hot shutdown of the reactor, including necessary instrumentation and controls to maintain the unit in a safe condition during hot standby, and two, with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures.

MR. CUTCHIN: Clarification, Mr. Chairman. I believe Mr. Pollard inserted the words "hot standby," when I read from my copy of the regulations, "hot shutdown." Was there any intent for a different meaning?

CHAIRMAN SMITH: We were reading from the same copy, I observe.

MR. POLLARD: I stand corrected. The actual words are "hot shutdown."

BY MR. POLLARD: (Resuming)

Q Would you think that this requirement applies to the emergency feedwater system?

A (WITNESS WERMIEL) Yes, it does, and I am aware that they have control capability outside of the main control room for emergency feedwater. Again, I am only trying to identify the upgrade that was in my review area

that has been committed to.

Q So there might be some portion of General Design Criterion 19 that is outside your review area that is not met.

A (WITNESS WERMIEL) I do not know.

(Counsel for UCS conferring.)

A (WITNESS WERMIEL) I might add that I do not know if the plant's compliance with GDC 19 is a restart requirement.

Q Well, I am trying to interpret your testimony, Mr. Wermiel. It is your testimony on page 26 where you are referencing a requirement from the Action Plan that deals with General Design Criterion 19. We have had previous testimony in this proceeding about the nature of the communications necessary between the control room and the feedwater regulating valve area and between the control room and some other area, which I have to admit escapes my memory at the moment.

What I am trying to determine is whether in your testimony when you entered the "yes," that you specifically examined whether or not there is adequate instrumentation, communication and controls to operate the emergency feedwater system under the conditions of loss of access to the main control room.

A (WITNESS WERMIEL) No, I did not.

CHAIRMAN SMITH: Let's break for lunch now. Is that a logical breaking place?

MR. POLLARD: As you can see, it is. That was the last question.

(Laughter.)

CHAIRMAN SMITH: All right. We will be back at 1 o'clock, at which time we will take a limited appearance statement.

(Whereupon, at 11:55 a.m. the hearing was recessed, to reconvene at 1:00 p.m. the same day.)

AFTERNOON SESSION

(1:03 p.m.)

CHAIRMAN SMITH: Is Mr. Manik present? Mr. Manik, would you take one of the microphones, sir, and make sure it 's on.

MR. MANIK: Is this one all right?

CHAIRMAN SMITH: Yes, that one works. Make sure it is on.

Mr. Manik, do you have a copy of your remarks, an extra copy?

MR. MANIK: Not at the moment. I changed my format from your other meeting, and when I got a call this morning, I did not have anybody to type it over.

CHAIRMAN SMITH: Okay. Make sure that the microphone is close to your mouth. Bring it as far forward as you can.

LIMITED APPEARANCE STATEMENT OF ALBERT MANIK

MIDDLETOWN, PENNSYLVANIA

MR. MANIK: My name is Albert Manik. I live in Middletown.

Members of this panel, I ask you to view General Public Utilities' 1978 Annual Report. Can you see it (indicating)? Can you see this report all right or do you want me to move.

CHAIRMAN SMITH: Yes, sir, I can see it.

MR. MANIK: On the cover is a downriver shot. It shows the hydroelectric plant and a view of Three Mile Island. Now, you wonder what this has to do with the restart of No. 1, so I will explain.

Certainly the caption on the bottom of this page states that this hydroelectric plant has performed for a period of 75 years of power, York Haven to Three Mile Island, now 78 years old. Simply this is where the power is coming from at present. It is the type of plant that Canada has built and are performing at the present time.

We have rocks in our head to invite more and more trouble with nuclear plants. We have a large abundance of coal. We have excellent coal-fired plants located on this river doing a great job with a minimum of problems to health and safety of the people who live in the area. I know because I lived in the area before I came to Middletown. We simply cannot allow you to restart this glorified unit.

I spoke to this panel in Hershey when you heard hearings. I asked you about the metallic taste people had encountered. I told you that we did not know of our problem. You promised to give me an answer. You took my name and address, but I didn't get no answer. I am still waiting. I never received an answer from anything I asked of the NRC.

I feel that perhaps this government does not care

of its citizens, does not have to respond to their wants and needs. Your group is a wonderful example of this type of government. No more nuclear plants. We are going back to what we have an abundance of. That is coal. Nuclear power is expensive, dangerous, and that is why you are in town, and not at all absolutely necessary.

What I would like to tell this panel to do is go home and please read a copy of their fire insurance. If your fire insurance policy states that you are insured for nuclear accident, please tell me your fire insurance company so I can get insured by the same company, though I doubt your policy reads any different than ours.

I thank you.

CHAIRMAN SMITH: Thank you, Mr. Manik.

Mr. Manik, I recall your appearance at Hershey. I remember your comment about the metallic taste, and I also recall asking you to explain it a little bit. However, I do not recall nor do I believe it is the case that I promised you that I would report to you. But for your information, other than that night at Hershey, Pennsylvania, I have never again heard anything through all these witnesses about a metallic taste.

MR. MANIK: You have not been reading the same reports or newspapers I have, sir.

CHAIRMAN SMITH: Okay. Than you know more about

it than I do, sir. Thank you very much, sir.

MR. MANIK: If you are in doubt, and I cannot see how you can hold hearings without GPU's stock reports, I am certainly going to tell you to get copies of the 1978-1979 stock reports.

CHAIRMAN SMITH: Thank you, sir.

MR. MANIK: And I do not know how educated people can hold such important hearings as you people are supposed to do and not have copies of something. I am sure you have something up there, or you should have.

CHAIRMAN SMITH: Yes, sir.

All right. What was worked out concerning Mr. Rowsome's appearance.

MR. CUTCHIN: Mr. Chairman, I understand that UCS has a great need to finish up with the witnesses on feedwater in order that they also, UCS, may get back home tonight. But to put it in perspective, Mr. Rowsome has perhaps a five to ten-minute statement max to give the Board, a briefing on the present status of the IREP work, and then he does not have much more in the way of voluntary information to give.

It would then depend on what questions the Board may have. So I would presume we could get him on and off in perhaps half an hour at the most. But I do not have a feel for how many more questions UCS has and whether that would

jeopardize being able to complete with these two witnesses or whether we might complete with them even if Mr. Rowsome did not go on now.

CHAIRMAN SMITH: You have no questions of Mr. Rowsome?

MS. WEISS: Quite frankly, Mr. Chairman, we thought his testimony was given last week when we were not here.

CHAIRMAN SMITH: That was one of the testimonies that we understood from you that you would prefer if possible to have put off until you could be here.

MS. WEISS: I did, but I did not realize that you had agreed to that. I thought he had gone on last week. But in any case, I have read the testimony and I would not have any questions on the testimony as it stands, although, depending on what he says, how he responds to questions of the Board, questions may develop. But we would not have anything, I think, in particular on this.

CHAIRMAN SMITH: I think it is worthwhile to try to accommodate Mr. Rowsome.

MS. WEISS: I do, too.

CHAIRMAN SMITH: I understand his problem and I think we should do it.

(Board conferring.)

CHAIRMAN SMITH: All right. Then if you don't

mind, let's take Mr. Rowsome.

MS. WEISS: I just wanted to say that we did not disagree. What we had suggested was that we go to the first afternoon break and then see where we were, but if it is a matter of half an hour, I have no objection.

CHAIRMAN SMITH: We have discussed it and we do not think it will be as long as that, if it is that long, I mean as far as the Board's questions are concerned, and that is probably the controlling consideration.

MR. CUTCHIN: We appreciate the Board's and the parties' indulgence.

Mr. Chairman, I would ask, does the Board wish to have the testimony that was viewed as not very helpful included in the record, or would we just start with asking him one direct question on having him update the status? I really do not care; whichever the Board prefers.

CHAIRMAN SMITH: I think we should put the professional qualifications in.

MR. CUTCHIN: Fine.

CHAIRMAN SMITH: Let's see.

MR. CUTCHIN: We can do the whole thing.

CHAIRMAN SMITH: I think it is probably easier just to put the testimony in as you presented it.

MR. CUTCHIN: Fine.

Whereupon,

FRANK H. ROWSOME,

called as a witness by counsel for the Nuclear Regulatory Commission, having first been duly sworn by the Chairman, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CUTCHIN:

Q Mr. Rowsome, did you prepare a document with the caption of this proceeding entitled NRC Staff Testimony of Frank H. Rowsome Relative to the Interim Reliability Evaluation Plan (Board Question 3), consisting of three pages?

A That is right.

Q Did you also prepare a statement of your professional qualifications which is attached thereto?

A Yes, I did.

Q Are there any corrections to the testimony as filed which you wish to make?

A No, no corrections, thank you.

Q Then the testimony is true and correct, to the best of your knowledge and belief?

A Yes, that is right.

Q Do you adopt it as your written testimony of this proceeding?

A Yes, I do.

MR. CUTCHIN: Mr. Chairman, I ask that the

documents just identified be received into evidence and bound into the transcript as if read. I will provide a copy to the reporter later.

CHAIRMAN SMITH: All right. If there are no objections, the testimony will be received.

(The document referred to, NRC Staff Testimony of Frank H. Rowsome Relative to the Interim Reliability Evaluation Plan (Board Question 3), follows:)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY, et. al.	)	Docket No. 50-289
	)	
	)	
(Three Mile Island Nuclear Station, Unit 1)	)	

NRC STAFF TESTIMONY OF FRANK H. ROWSOME
RELATIVE TO THE INTERIM RELIABILITY EVALUATION PLAN
(BOARD QUESTION #3)

Q.1 Please state your name and your position with NRC.

A. My name is Frank H. Rowsome. I am an employee of the Nuclear Regulatory Commission assigned to the Division of Systems and Reliability Research. I have been a member of this Division or its anticedent Probabilistic Analysis Staff since July 2, 1979.

Q.2 Have you prepared a statement of professional qualifications?

A. Yes. A copy of this statement is attached to this testimony.

Q.3 Please state the nature of the responsibilities that you have had with respect to Three Mile Island, Units 1 and 2.

A. None.

Q.4 What is the purpose of your testimony?

A. The purpose of my testimony is to provide a response to additional Board Question #3 which states:

(Tr. 2392) The results of the Interim Reliability Evaluation Plan (IREP), as applied to Crystal River Unit No. 3 (CR-3) was scheduled for completion in July 1980. (The Board wants to receive a copy of this report.)

a. When will the IREP be applied to TMI-1?

b. Does the IREP address the adequacy of the proposed actions for B&W plants?

Response: A draft report on the IREP study of CR-3 was submitted to the Office of Nuclear Regulatory Research (RES) in May 1980. Three reviews were made of the draft: one by RES project management, one by a Research Review Group composed of personnel from RES, NRR, and consultants, and one by the licensee/owner, Florida Power Corporation. These reviews identified a number of deficiencies in the draft report, some of which are significant. RES project management is currently negotiating with the contractors, Sandia and Science Applications, Inc., to define a workscope and schedule for the revision of the draft and its publication

as a NUREG-CR report. The authors of the draft are currently assigned to IREP studies of other plants. Completion is not expected until early calendar year 1981.

Question 3.a: "When will IREP be applied to TMI-1?"

Response: The Office of Nuclear Regulatory Research, which is conducting the current IREP studies, does not plan to include TMI-1 in IREP. The current IREP studies (the analysis of four other plants commenced September 15, 1980) are intended to serve as a proving ground for procedural guidelines that can be followed by licensees. The procedural guidelines should be ready for use by the end of calendar year 1981. In accord with NUREG-0660, it is expected that NRR will require such studies to be performed by owners and submitted to the NRC for review. We anticipate that many, if not all, operating plants will be asked to submit IREP-type studies. TMI-1 may be among these.

Question 3.b: "Does IREP address the adequacy of the proposed actions for Babcock and Wilcox (B&W) plants?"

Response: No.

PROFESSIONAL QUALIFICATIONS

Frank H. Rowsome

Position:	Deputy Director, Division of Systems & Reliability Research, Office of Nuclear Regulatory Research
Education:	BA, Physics, Harvard College, 1962 Doctoral studies (no degree), theoretical physics, Cornell University
Relevant Professional Experience:	Nuclear engineering and system reliability engineering, Bechtel Power Corporation, 6 years Deputy Director, Division of Systems & Reliability Research and its anticedent organization, the Probabilistic Analysis Staff, July 2, 1979 to present

BY MR. CUTCHIN: (Resuming)

Q Mr. Rowsome, would you provide a brief statement updating the status of the IREP work between the time you filed your testimony and the present?

A Yes, I will be happy to do that. The study of the Crystal River Plant, which we refer to as the Phase 1 of the IREP program, remains in limbo. No work has been done on it since the draft report was submitted in May and a peer review or rather three peer reviews of that draft were performed early last summer.

We did milk that draft for some safty recommendations which were transmitted to NRR on the occasion of the resumption of power generation of the Crystal River Unit in July, and which can be made available to you all if you wish.

We also milked the draft report for the lessons we could learn from it for how to do and how not to do IREP studies and folded that into a document called the Procedure and Schedule Guide for Subsequent IREP studies, and four additional IREP studies were started last September, one of which entails a B&W plant, Arkansas Nuclear 1, Unit 1.

Those studies are now about halfway done, halfway through. Two of the four interim reports from the contractor teams that are performing these studies have been submitted but they have not gotten to the point of producing

actual answers in terms of a safety profile of the reactor.

Therefore, we have nothing further in writing we can show you in the way of results other than perhaps to send you a copy of the memorandum we transmitted to NRR last July in the safety findings from the draft Crystal River Report.

BOARD EXAMINATION

BY DR. JORDAN:

Q Why did you abandon the Crystal River study?

A In fact, we do intend to fix it up and publish it, and we have negotiated with the contractor who performed the study a scope of work and we are awaiting his assemblage of the personnel necessary to do the work before we give him the green light to go ahead with the rewrite and publication of that report.

Q Is it the same contractor that di. --

A Yes.

Q Who is that?

A SAI, Science Applications, Inc.

Q I know it. They have so many locations.

A The Bethesda office.

Q Bethesda office.

Do you feel that the report is inadequate as performed up to the present, incomplete and therefore needs a lot more work?

A Well, the principal deficiency is that it is highly inscrutable. It is difficult to tell what was done and what was not done, what was covered and what was not covered in their probabilistic safety analysis.

Q This was SAI?

A That is correct. That is the draft report to which you referred.

Q Is SAI the contractor for Oconee? Did you say Oconee? That would be one of the other reports?

A SAI is one of several contractors at National Laboratories that is participating in the Phase 2 study for plants under IREP. There is another risk assessment which we have recently published which has nothing to do with IREP but is a follow-on to the reactor safety study, called the Reactor Safety Study Methodology Applications Program, which also entailed a risk assessment of four reactors. But this is quite distinct from IREP. The Oconee study is one of these.

Q I see. Will SAI do the Oconee study, or do you know?

A The Oconee study has been published and it was done by Sandia National Laboratories. They may have had an individual contractor who may have worked for SAI or may have not. I don't really remember off-hand. But the principal work was done by Sandia National Laboratories and

Battelle Columbus Laboratories on the reactor safety study methodology applications risk assessments.

Q Let's go back, then, to the SAI Crystal River study. You said it was deficient. Would you explain a little more why it was deficient and what will be done in the Phase 2 study to correct the deficiencies?

A Well, there were deficiencies of reportage and scrutability and there were also some technical deficiencies. The most severe technical deficiency was the failure to pull out those mechanisms, those accident mechanisms which could both precipitate the initiating event and at the same time degrade the reliability of a safety system called upon to respond to that event.

The Crystal River study, as are most risk assessments published today, has taken initiating events as given and described by the historical actuarial data base for the most part.

Q From past experience, LERs and so on?

A That is right, at least for transients. LOCAs, of course, the frequency of LOCAs are inferred and not just obtained from historical data. But the frequency of transients was taken from historical data and they were assumed to occur in a non-mechanistic fashion, and to pose challenges to standby systems such as the emergency feedwater system.

Q Do you remember how frequent they chose for loss of main feedwater?

A That is a sensitive subject. The number we use in the reactor safety study, and that has recently been confirmed by LER studies, is three feedwater transients a year, and that is a good industry average. On the other hand, a feedwater transient is not necessarily a complete interruption of main feedwater delivery, and complete interruptions of main feedwater delivery are not necessarily extended interruptions of the kind that would really hazard the cooling of the core.

There is good evidence that there are a good average of three feedwater transients a year in most light water reactors. On the other hand, less than one in three of these entails a total interruption of main feedwater flow.

Q Does that mean less than one in three entail a challenge to the emergency feedwater system?

A Most of them entail a challenge to the emergency feedwater system in the sense that they will kick in the autostart, but very few of them entail a critical challenge, if you will, of the emergency feedwater system in the sense that main feedwater could not participate in saving the core from melt.

Q So it is a little bit like challenges to the reactor protection system.

A That is right. That is right.

Q Well now, you say that they failed to include --

A Let me say this.

Q -- transients which would --

A Let me cite a specific example. For example, the accidents at Rancho Seco and the one that occurred at Crystal River itself while the study was going on entailed the failure of a non-nuclear instrument power supply. The so-called NNI bus fault, which precipitated a loss of feedwater and also compromised the autostart of the emergency feedwater system, at least at Rancho Seco.

That kind of accident mechanism was outside the scope of the Crystal River IREP study because they did not attempt to develop a causal mechanism for why feedwater trips might occur that could tease out the commonality between the bus fault as an initiating event and the bus fault as a way of compromising the reliability of the emergency feedwater system.

We clearly do not want future risk assessments to have that kind of a blind spot, and we have altered the procedures to make sure that it does not.

Q Does it make an attempt to include common mode failures?

A Yes.

Q Has there been any progress since -- what is it,

Chapter 4 of WASH-1400 that addresses common mode failures?

A Yes.

Q New and better techniques.

A There are several different ways of improving upon the WASH-1400 approach to common cause failures. Some of them have to do with developing better causal models for how faults propagate from the root cause into system failures.

For example, progress has been made in modeling seismically-induced failures in power plant equipment. Progress has been made in modeling fires and floods by such mechanisms. Developments for more general mathematical models to deal with statistically correlated failures in similar equipment due to common design, common manufacture, common maintenance and so forth have been developed by our methodology people.

In addition, of course, we also have a much larger statistical data base of experience than we had when the reactor safety study was done.

Q Yes. Of course, one of the problems with common mode failures is if you could anticipate them, you could protect against them.

Well, in your opinion, will this be a good technique for investigating interactions between, say, safety and nonsafety systems?

A Yes.

Q Will it be a good answer, therefore, to the ACRS, their section -- I guess it was Section 1 -- that we read this morning?

A Yes. The ACRS has been urging for the last year or two in a number of different forums that NRR begin to ask licensees or applicants to do probabilistic safety analyses along the lines of the Reactor Safety Study as a tool to investigate just this kind of problem. It is certainly our feeling in the Office of Research, and I believe it is shared by Harold Denton and the majority in NRR, that this would in fact be a good thing to do.

What is holding the process up is the development of a standard methodology, a consensus that here is a sensible way of doing a reasonable amount of work with reasonable assumptions. And the IREP project has as one of its principal goals the development and debugging and trial use of standard procedures for these techniques to use probabilities to deal with multiple failure accident scenarios.

Q You said there was one other study going on. Was it the Oconee study that you mentioned or was it Arkansas 1?

A We are in the process of publishing now some completed or very nearly completed risk assessments under the reactor safety study methodology applications program. Oconee is one of these and has been published. Sequoyah is

another and is due to be published any day now. Two others are in the pipeline and I expect them out within six months.

Within the Round Two, if you will, of the IREP program there are four other plants that are being subjected to the new kinds of risk assessment techniques which entail some of the improvements on common mode failures, and Arkansas Nuclear 1 is one of these.

Q What was that?

A Arkansas Nuclear 1 is one of that set of four, the only B&W plant among that population. These I do not expect to be published until late summer, early fall.

Q I guess I do not want to take a lot of time to go into it, but can you tell me briefly what the difference is between the reactor safety type studies and the IREP studies, and which do you feel are the most powerful and are most likely to uncover possible transient sequences that might result in core damage?

A The principal difference between IREP and the reactor safety study is that IREP is scaled down and abbreviated in an attempt to make a manageable scope of work. It does not include consequence analysis, it does not include detailed computer-assisted analysis of the challenge posed to containment systems by core melts. It is principally a look at the avenues to core melt and the likelihood of those.

Q That is IREP?

A That is IREP.

Q I see. I see.

A It does contain a couple of wrinkles that make that look a little bit more incisive or insightful than the reactor safety study procedures, in particular the inclusion of a mechanistic analysis of initiating events.

Q Do both of them use the techniques of the WASH-1400, namely, event tree/fault tree?

A That is right, they do.

Q Do you feel that a study performed by a licensee can be made -- will produce possible new information that will be valuable as contrasted to the studies that -- well, the WASH-1400 study, for example, that was done by the staff or the IREP studies that are being done by contractors under the staff.

A The answer is yes. We discovered a lot of evidence, I should say, accumulated in and after the accident at Unit 2 at Three Mile Island tending to suggest that the susceptibility of plants to core melt accident sequences may vary significantly from plant to plant and that a single risk assessment using one or two reference reactors or even half a dozen of them may misrepresent other reactors not so analyzed.

We believe having one done for each individual

plant is desirable. It will not be perfect in the sense that we will not achieve completeness, we will not quantify with great accuracy the risks from each of these plants, but we will have a tool that will enable operator training, for example, to be a little better focused on the real threats than they might otherwise be.

Emergency planning may be a little bit more accurately tuned on real scenarios than otherwise. It will provide a frame of reference with which to assess the severity of operating occurrences.

Q To what?

A Operating occurrences.

Q To suppress?

A Assess significance.

Q Assess.

A You can say in what accident sequence, if any, would a particular fault that has actually occured belong. Does that fault suggest the presence of failure mechanisms that were not in the model, in which case you can use that experience to improve the model, or if it is in the model, it gives you a frame of reference with which to evaluate its severity.

It should be a very valuable contribution to operational safety to have such a model in hand.

Q We have had during the day while you were here, of

course, testimony which we will explore later this afternoon about probability analysis that was done in the case of TMI-1. Now, in that case there was a licensee analysis, and we are also going to hear from Mr. Curry this afternoon about the staff study.

Is that analysis that was done by Met Ed for the limited case of the emergency feedwater system typical of the IREP studies that would be done by a licensee for the complete plant, or will the IREP study be more intensive, have greater depth, or will it just be broader?

A It would be principally broader. It would be more intensive or of greater depth in the sense that it wou include, because of its breadth, the fault tree analysis of all of the support systems of the emergency feedwater system; and an IREP study would be capable de novo of identifying common cause vulnerabilities that might link the initiating event with the emergency feedwater failure through these support systems, which a one-system realiability analysis could not do.

However, the studies of each of the individual systems comprising an IREP study would not be appreciably more intensive than a study of the emergency feedwater system was in this instance.

Q There have been recommendations made in this case that the integrated control system can indeed be a source of

common mode failures and that what is needed, and I think the ACRS has pointed this out, is a system interaction study. Did the Crystal River study produce or give any further insight into the possible interactions between the integrated control system and the overall system that has not been out by the failure modes and effects analysis of the ICS?

A. Well, the study itself did not, in fact. That is one of the deficiencies in the study, that it did not track down that kind of failure mechanism. On the other hand, the experience of that reactor and at Rancho Seco has made is in Research intensely aware of the potential role of the control system buses, the NNI buses, as being a weak spot.

Q All right, then. I guess that is essentially what I am leading to last. Now, as a result of the studies that you have so far, are there any lessons that we should be aware of? Has anything new turned up that would indicate further either modifications in the hardware or the training that has not been identified, say, in the Lessons Learned Task Force or some of the other task forces or, well --

A Some of our results did get fed into the NUREG-0667, the NUREG report on the transient stability of B&W plants. Now, we do not have any new recommendations, new discoveries of vulnerability beyond those which I believe are part of the record in one place or another. I

can summarize them very quickly.

We found three potential common mode linkages that could constrain the reliability with which a plant can deal with a loss of feedwater. One of them is the station blackout scenario in which AC power is the system that fails, and the recommended --

Q That is offsite AC?

A Offsite and onsite. This is the subject of ALAB 603.

Q Yes.

A And our position is essentially that of the 603 board, to-wit: that the plant should have one train of the emergency feedwater system capable of starting and running without AC power, and that the operator should be trained for it.

MR. BAXTER: What plant are you speaking of, Mr. Rowsome?

THE WITNESS: ALAB 603 referred to St. Lucie 2.

The second has already been mentioned. It is the NNI buses. One would like to see a design in which the autostart of the emergency feedwater system cannot be defeated by the loss of an NNI bus.

And third, another potential common mode lies in the automatic system intended to deal with steamline break accidents in B&W plants. Its function is to isolate main

and emergency feedwater to a depressurized steam generator, presumably one depressurized by the main steamline or feedline break.

In Crystal River during their incident, both steam generators were isolated by this system. Even though they did not have a steamline break, they simply had an overcooling transient which allowed the pressure to decay in the two steam generators to the point that both steam generators satisfied the logic for steamline break and thus the heat sink was shut off. As it happened, it did not matter in that case because they were cooling with ECCS.

But we would prefer to see a design in which there is an interlock so that both steam generators cannot be isolated by an indication of low pressure in the steam generators.

Q Do you know whether that has been adequately taken care of in TMI-1?

A TMI-1 is in compliance with respect to the loss of offsite power design, and I believe there are plans afoot to address both the other concerns by the first refueling outage after restart.

Q I see. I am quite familiar -- we had a fair amount of testimony this morning on the automatic start and control of the emergency feedwater system, but I think we have not addressed very thoroughly yet today anyhow -- and my memory

is a little unclear as to where we stand with respect to the steamline break.

But I take it you believe that that is one of the long-term items.

A That is my understanding, but I am not an authority on this plant.

Q All right. We will ask Mr. Wermiel about that one when he gets back.

Then is it the staff's plan to eventually require an IREP by each licensee, and if so, how long will it be before there will be one required for TMI-1?

A That decision will be made by NRR. My understanding is that NRR has already committed in principle to the idea that this should be done on most, if not all, plants. They are awaiting our development -- by "our," I mean the Office of Research -- our development of the standard set of procedures and prescription of what constitutes an adequate job for such studies.

We will be able to deliver that to them probably by the end of 1982. They will then elect to schedule and pick the plants that are to be asked to do such studies.

Q But so far as you know, the experience thus far with the IREP has not turned up a failure mode that has not really been thought about or has not been addressed in the redesign of TMI-1?

A Not that would be applicable to TMI.

DR. JORDAN: All right. I guess that is all I have.

CHAIRMAN SMITH: Ms. Weiss.

CROSS ON BOARD EXAMINATION

BY MS. WEISS:

Q Mr. Rowsome, if you were asked to do an analysis of the reliability of the emergency feedwater system at TMI-1 would you use the component and human error reliability data you used in the reactor safety study?

A With a very few exceptions, yes.

Q What kind of exceptions?

A We know today, for example, that failure rates for code safety valves instead of being the 10^{-5} per challenge used in the reactor safety study is closer to 10^{-3}.

DR. JORDAN: Is that failure to open, by the way?

THE WITNESS: Yes, I believe so.

DR. JORDAN: All right.

THE WITNESS: I really do not have all the exceptions in my head, but there are a minority that have changed appreciably. For example, another one is

turbine-driven pumps. Failure rate on demand for turbine-driven pumps is around 10 percent instead of the 10^{-3} that I believe was used in the reactor safety study.

BY MS. WEISS: (Resuming)

Q Ten percent instead of 10^{-3} ?

A Yes.

Q That is a fairly substantial change.

DR. JORDAN: We will have a chance to ask Mr. Curry what number he used.

BY MS. WEISS: (Resuming)

Q Just one last question. I am curious about what sort of overall uncertainty level you would assign to figures -- well, to the figures which Mr. Curry has developed concerning the probability of failure of emergency feedwater on demand for TMI-1.

A Well, there are uncertainties and then there are uncertainties. One can calculate an uncertainty based entirely on the statistical uncertainties in the raw data that goes into the mathematical model, and that certainly is a contributor to the uncertainty of the answer.

There are biases or errors in the model itself or completeness issues having to do with the structure of the model which introduce uncertainties that cannot be quantified.

Studies such as that done by Mr. Curry tend to

have a conservative bias in both modeling assumptions and in the data used. On the other hand, there is no assurance that they found everything. There is a completeness problem. You can never prove to everybody's satisfaction that there might be something that nobody has noticed yet.

So whether those two things balance out or not is not obvious, but within what we know, to the best of our ability the models are made to have if any bias, a conservative bias, but that nagging concern about completeness remains.

Q Well, can you put a number or your best number on the uncertainty limits to these absolute probability figures for emergency feedwater failure, your best professional judgment?

A Well, this is judgment, and it falls in modeling as well as statistics. If I were to discover tomorrow that they were non-conservative by as much as a factor of 10 or conservative by more than a factor of 100, I would be mildly surprised but not very surprised. If you were to enlarge that band by another factor of 10, I would be quite surprised.

So in terms of my own sense of confidence in these things I would not be astounded if they underestimated the failure rate by 10, but I would be very surprised if they underestimated it by 100. And I think there is a

conservative bias that I would be -- would not be at all surprised to discover they were conservative by a factor of 10.

Q I am sure you must be familiar with some of the comments that Dr. Okrent has been making lately in the ACRS.

A Yes, indeed.

Q Both formally and informally about the extent to which one can show with any degree of certitude that the probability of core melt is less than 1 in 10,000. Do you have any comments on -- well, I guess basically I am asking you do you have an opinion on his opinion? Would you agree or disagree with him?

A I am not sure what remarks of his you are referring to. I would need to be a little more specific before I pass judgment on his --

Q That is fair. Are you familiar with the paper that Dr. Okrent delivered in Stockholm last fall at the IAEA conference?

A I may have seen it, but I do not remember it well enough to comment on it.

(Counsel for UCS conferring.)

MS. WEISS: Thank you. That is all.

CHAIRMAN SMITH: Mr. Dornsife.

BY MR. DORNSIFE:

Q I just have one question. Could you verify

something? Are you testifying today that indeed probabilistic type of risk studies have been used to determine whether the Lessons Learned from the TMI accident items are indeed either necessary or sufficient?

A No. That has not been done. We did a brief review of the risk relevance of the recommendations of the Tedesco Task Force. This is not Lessons Learned, but the Tedesco Task Force that was constituted after the incident at Crystal River. And they have been run through a filter for risk effectiveness or risk relevance, although a rather judgmental, quick pass under considerable pressure of time. This has not been done for the TMI Lessons Learned.

Q Do you think a study such as that would be useful to determine whether the changes are either necessary or sufficient?

A I think it would be useful to gain perspective on that, yes.

Q But just to that extent, not to see if you have obviously missed something that is a glaring error or something that really is not -- something you could have added that would reduce the risk by a much larger factor than some you did indeed require.

A That might be the outcome of such a study.

Q Is there any intent on the staff to do that kind of a study?

A Not specifically in the context of Lessons Learned. It is being done in the context of the rulemaking initiatives going forward. That kind of an analysis will be part of the research foundations for the standard engineered safety features rule and for the degraded core rule.

MR. DORNSIFE: Thank you.

CHAIRMAN SMITH: Mr. Baxter.

BY MR. BAXTER:

Q Mr. Rowsome, you testified that three per year was an industrywide average for feedwater transients, and I think I understood you to say that that would not necessarily involve a loss of all main feedwater, but that in many cases there was actuation of at least some part of the emergency feedwater system, is that correct?

A That is right.

Q It is my understanding from the testimony in this record that a TMI-1 emergency feedwater system is actuated by a loss of both of the two main feedwater pumps or of the reactor coolant pumps, whereas at CE and Westinghouse plants emergency feedwater can also be initiated by low steam generator level.

Is that your understanding?

A I know that it is common practice in Westinghouse plants to initiate on low steam generator level. I am not an authority on TMI.

Q So do you know if your comment that for many of the feedwater transients industrywide that you referred to, possibly involving at least actuation of part of the emergency feedwater system, whether that applies to TMI-1?

A I cannot -- I should not speak to TMI-1, not having studied that plant.

Q Okay.

A In many B&W plants that I have studied that would be a correct statement, but I am not an authority on TMI-1.

(Counsel for the Licensee conferring.)

Q Unless the other B&W plants have emergency feedwater systems which initiate on low level, how could there be a partial actuation of the system?

A Most of them do actuate on low level.

MR. BAXTER: I see. I have no further questions.

CHAIRMAN SMITH: Mr. Cutchin.

MR. CUTCHIN: No redirect, Mr. Chairman.

(Board conferring.)

CHAIRMAN SMITH: All right. Thank you, Mr. Rowsome. You are excused.

(The witness was excused.)

MR. CUTCHIN: Again, I appreciate the Boards' and the parties' indulgence.

CHAIRMAN SMITH: I think we could probably use a study of error bands and confidence levels in predicting the

length of testimony. We are simply never right.

MS. WEISS: I said five hours. I think we're going to come pretty close to that when you subtract out Mr. Rowsome.

(Laughter.)

Whereupon,

JAMES CURRY

AND

JARED WERMIEL

resumed the stand and were further examined and testified as follows:

CHAIRMAN SMITH: Are you ready to proceed?

MR. ADLER: It depends on what the Board has in mind for order. We are done for now of questioning Mr. Wermiel. Do you want the other parties to question him before we proceed to Mr. Curry, or --

CHAIRMAN SMITH: Take this into account. If you proceed with Mr. Curry, then you can have greater assurance that you complete your cross examination tonight, but then you will take the risk of having questions by other parties tomorrow.

MR. BAXTER: Mr. Chairman, my cross examination does not divide cleanly between the two witnesses. I would prefer we do the panel.

(Board conferring.)

CHAIRMAN SMITH: I think just go ahead. Then you will have your option at least.

MR. POLLARD: Before we proceed with Mr. Curry, I would like Dr. Jordan, he had mentioned he wanted something done first by Mr. Curry before we began.

DR. JORDAN: Yes, I did. I thought it would actually save time.

MR. POLLARD: I agree with you. I think it will. In fact, doing so will probably answer some of the questions I was intending to ask. It would be a more orderly way to do it.

DR. JORDAN: Very well.

You heard me I think this morning, Mr. Curry. I would like for you to take us through a typical -- take us through one of these diagrams, analyses. Explain how -- what do you do and particularly how you get figures in on say errors, human errors, the standard figures for frequency of turbine failures, for example, and how you come out with the final numbers that you do now.

I do not have any advice for you, just exactly how to do it, but I do have a blown up copy that was supplied and has been very helpful, because I was having a very hard time reading the smaller copies.

WITNESS CURRY: Why don't I just start from the top, and if you have any questions just chime in.

DR. JORDAN: If you would do that.

WITNESS CURRY: Okay. All right. The methodology used to analyze the reliability of the EFWS at TMI-1 was a fault tree which is presented as Attachment 1 to my testimony. The fault tree is basically a deductive type of logic network where one postulates a top event and then tries -- or a top failure and then tries to deduce from that some events which would lead to the failure of concern. In general, the level of detail of the fault tree which can be drawn to many levels of detail is limited by the analyst's information.

In this fault tree when my information was limited I made a conservative assumption. All right. The top event to this fault tree is inadequate flow to the steam generator, which I defined as less than 460 GPM. That number was picked as a limiting number based on testimony by Jensen before as to what would we need to mitigate any transient.

DR. JORDAN: Yes. We had a lot of testimony on that number.

WITNESS CURRY: Okay. All right. Perhaps I should go through the symbols a little bit first so you understand what we are talking about.

The rectangles are indicative of events. The first bullet type symbol you see near the top of the tree is

what is known as an and gate, and is indicative in the fault tree logic of a multiplicity of events that must occur in order to achieve the event the and gate is connected to.

The other bullet type symbol, the one with the point at the top, is an or gate, and is a logic representation which indicates that if any of the events beneath the or gate occur, the event to which the or gate is connected will occur.

The ovals that you see connected, possibly to either an and gate or an or gate, are just key points or just places in which the analyst can note key points or assumptions that he made in his analysis.

The circles indicate basic events for which component failure reliability data is available. The diamonds indicate the limit of resolution for which data is available for a given event. The difference between a circle and a diamond might be or is that the diamond could be further developed.

DR. JORDAN: Could be what?

WITNESS CURRY: Further developed if necessary. However, a number may be available for the diamond, so it is not necessary to go into further details to determine the probability of occurrence of a diamond.

DR. JORDAN: And the little triangles?

WITNESS CURRY: The little triangles are transfer

points within the three. If a triangle is upright, such as triangles 2, 7, and 9 on the right side of your tree, it indicates a transfer from another point in the tree in which the exact same events occur. If the triangle is upside down, it indicates a parallellism in that while the same event, exact same event is occurring, a parallel event would be occurring. For instance, the failure of EFV-30A may be developed, and rather than develop the failure rate of EFV-30B, EFV-30B has parallel redundant components. It is the exact same thing, but they are redundant components.

DR. JORDAN: For example, the number 8 you say no flow to steam generator B. You mean there is a parallel. It would be steam generator A?

WITNESS CURRY: That is right.

DR. JORDAN: I see.

WITNESS CURRY: That is right. Okay.

DR. JORDAN: Yes.

WITNESS CURRY: So the top event, as I said, was inadequate flow to the steam generator, less than 460 GPM. Well, that event will occur if there is no flow from the turbine-driven pump train, and there is no flow from either electric pump train.

DR. JORDAN: Okay.

WITNESS CURRY: Okay. Now we will proceed now down the turbine-driven pump train path. Stay on the same

page for a while. We will go down the turbine-driven pump train path, and then we will come back and go down the electric pump train path.

DR. JORDAN: I think you do not need to go in great detail through each path.

WITNESS CURRY: All right.

DR. JORDAN: Before too long we will need to know how you get the numbers in.

WITNESS CURRY: Let me just summarize on the first page. I think if the Board has a perspective on the first page, the farther you go it gets much more detailed, so the Board understands the first page.

DR. JORDAN: Yes, I think so.

WITNESS CURRY: Fault trees can be drawn many ways. I chose to draw it this way so that I personally could see what areas of the system contributed most to the unavailability of the system. So if we were looking at the event where we had no flow from the turbine-driven pump train, that event would occur if we had failure of the turbine pump itself, if we had failures related to the suction, the water suction to the turbine pump, or if we had failures on the discharge side of the turbine pump.

There is also a possibility that that train may be out for test and maintenance which is added separately on the left. Similarly, on the right side of the tree where we

had no flow from either electric pump train, it has been stated earlier that either electric pump is capable of supplying the required flow; so we have an and event, that is, both electric pump train A must fail and electric pump train B must fail in order to get no flow from either electric pump train.

Similarly, they are broken down to pump failures themselves, discharge failures, suction failures, and test and maintenance failures.

In doing the fault tree if one were to proceed into greater depth, one would note that support systems for pumps, for instance, must be taken into account as a failure mode and as well as human interactions with the system.

DR. JORDAN: Now, where does the failure of the electric supply show?

WITNESS CURRY: Okay. This particular event, and I did draw it on the tree to indicate that, this particular -- well, let me say there were there initiating sequences analyzed: the simple loss of main feedwater where all power --

DR. JORDAN: Yes, I understand that. I had forgotten that. Go ahead.

WITNESS CURRY: Okay. I guess that is a brief overview. The tree would proceed down to the point where if you were to look on a later page, if I could suggest, oh,

perhaps page 5, picked at random, it seems to be a fairly simple example. And if one were to look at the triangle labeled 5 --

DR. JORDAN: That takes you back to page 1, does it?

WITNESS CURRY: That would feed back into table 1 or page 1. If you looked on page 1 there was a block or an event entitled "No flow from the condensate storage tanks."

DR. JORDAN: Ah, yes. Now I am catching up.

WITNESS CURRY: Then on page 5 under event 5 we develop that possibility, and that possibility would arise if we had no flow from the condensate storage tank A and no flow from the condensate storage tank B. And then the logic proceeds to the point where we are examining methods or ways in which we would get no flow from, for instance, condensate storage tank A. And we see at the very base of the tree failures which indicate the limit of resolution of our data.

The circles indicate a basic failure rate. The triangles indicate failure rates again or failure events -- I am sorry -- again that could be further developed but which either are not necessary to further develop or are impossible to develop.

DR. JORDAN: I see, but the data now goes in at the circles, is that what you were telling me?

WITNESS CURRY: That is essentially correct.

Either the circles or the diamonds.

DR. JORDAN: Or the diamonds.

WITNESS CURRY: Right, right.

DR. JORDAN: Oh, yes. I see.

WITNESS CURRY: And from there is propagated back up through the tree going through the logic of the ands and the or gates until a top event -- that is, inadequate flow to the steam generator -- is calculated or is estimated.

Now, it should be pointed out that such a method uses Boolian algebra, and one cannot rigorously or one cannot blindly plow through the logic gates and expect to get the correct answer at the top, because consideration must be taken into account for the common mode failures that we have talked about before.

DR. JORDAN: Yes. That is what I wanted to explore at your leisure. Go ahead.

WITNESS CURRY: Go ahead. Do you want to talk about the treatment of common mode failures now?

DR. JORDAN: Wherever it comes up. You go ahead.

WITNESS CURRY: Okay. Okay. Well, the key points, additional key points that I want to mention about this tree --

DR. JORDAN: This being the whole?

WITNESS CURRY: This is one tree, the tree that estimates the probability of failure on demand.

DR. JORDAN: I see. That is six pages.

WITNESS CURRY: Yes, sir.

DR. JORDAN: All right.

WITNESS CURRY: Yes, sir. Is to keep in mind the purpose of this tree, and that was to estimate the probability of the EFWS system to fail to deliver flow within a five-minute period.

DR. JORDAN: Per challenge?

WITNESS CURRY: Per demand. That is correct. That is correct. So consequently when the tree is being drawn little credit is given in the tree for such operator recovery actions.

DR. JORDAN: Yes.

WITNESS CURRY: Which would certainly improve the reliability as a general rule. The number that comes out then is essentially a function of basic equipment failure rates and the probability of the system being in the correct configuration upon demand.

Now, common mode failures, the treatment of common mode events is taken into account by finding the point in the tree at which the commonality becomes apparent. So in other words, if there were a common mode failure of the two electric pumps, I would look on page 1 and find the block that said no flow from either electric pump train and apply the common mode at that point, because it adds in -- adding

in at that level of the tree has a greater effect on the overall reliability number than individually adding those failures in farther down on the tree.

Mathematically what it boils down to is if you multiply two small numbers together even once you are liable to wind up with a very small number later on. So common mode -- if a common mode failure of redundant components has been identified, it is a matter of simply adding that probability to the overall failure rate of the system.

DR. JORDAN: Well, now, that particular one, of course, sounds like maybe -- maybe I am wrong -- a fairly easy case because you do have experience about how often you have an electric power failure -- I guess that is the obvious common mode failure in this case, is that right?

WITNESS CURRY: Clearly, if one were to postulate the initiating event being loss of all AC, I need not draw a fault tree to determine the probability of failure of the electric pump train.

DR. JORDAN: All right. But suppose now we had a loss of main feedwater. Isn't that in itself possibly going to trigger an opening of the circuits on loss of load and thereby possibly take down the whole grid, and do you take that into account?

WITNESS CURRY: No. The transient events that were analyzed here were a simple loss of main feedwater, a

loss of main feedwater with concurrent loss of all offsite power, which sounds close to the transient that you are talking about. I do not really care whether main feedwater caused the loss of offsite power or not. I analyzed the reliability given that I have no offsite power available, and that the third transient was the loss of main feedwater with the loss of all AC power.

DR. JORDAN: No. I guess I have seen your numbers. Oh, yes, they were separated out for the three different possibilities.

WITNESS CURRY: That is correct.

DR. JORDAN: And so therefore I would say is not main feedwater -- well, and you have not actually then put into the calculations the probability of loss of main feedwater or the probability of loss of offsite power.

WITNESS CURRY: That is correct. The probability that these initiating events have no bearing on the probability of the system responding to them.

DR. JORDAN: All right.

WITNESS CURRY: The Staff decided they were worthwhile events to analyze; therefore, we do so.

DR. JORDAN: All right. How do you take into account possible common mode failure of both electric pump trains without a loss of offsite power?

WITNESS CURRY: Well, I have to identify a common

mode failure of the electric pump trains.

DR. JORDAN: Failure of a breaker, say. There must be -- aren't there a lot of ways of getting a common mode failure?

WITNESS CURRY: There should not be a lot of ways to get a common mode failure. It is design philosophy to make the trains as separate as possible. That is not to say that there are not any ways.

DR. JORDAN: All right. Did you include common mode failure then for the two pump trains? Did you put in a number for it, and if so, how did you get it?

WITNESS CURRY: I do not believe I found a common mode failure for the two pump trains.

DR. JORDAN: All right.

WITNESS CURRY: I found a common mode failure of the system but not explicitly the two electric trains themselves.

DR. JORDAN: Okay. Well, then, you go ahead and tell me where you found common mode failures and how you put it in.

WITNESS CURRY: All right. The common mode or a common mode failure that I found to contribute to the unavailability of the system or that I had no evidence to believe, I should say, did not contribute to the unavailability of the system would be the miscalibration of

the level sensors on the condensate storage tanks.

If indeed the level sensors were miscalibrated, and depending on the ways in which they are calibrated --

DR. JORDAN: Yes. The usual type of common mode failure.

WITNESS CURRY: That is right. They could very well have been calibrated by the same person or with the same instrument and therefore both be incorrectly calibrated. I assess that as a common mode failure of the system.

DR. JORDAN: Okay. Where did that come in? How did you put that in?

WITNESS CURRY: That is simply using the data base that I had; that is simply added on to the suction failure common mode --

DR. JORDAN: Is that part of the data base in your table? Did I miss that one?

WITNESS CURRY: Yes. Let me get my testimony out here.

DR. JORDAN: You are now going to Attachment 2?

WITNESS CURRY: Yes, Attachment 2. Okay. That number is in here, and, okay, the number that I used for that was the item that you see under Table 3-2, item number III entitled "Human Acts and Errors."

And under that Roman numeral III, item A -- A.2,

now as you can see, this table has a number of values associated with it. The heading of the table there, at least three values for each of the acts listed in this table, a point estimate value, a value of the likelihood of that occurrence if, for instance, there was indication in the control room, or a value for the likelihood of that occurrence if only local walkaround and doublecheck procedures were used, and a value of the occurrence if neither the double walkaround or control room indication was provided.

So if we read this table we would see that item A has the "title valves mispositioned during test or maintenance," for item A.1. And A.1.a and A.1.b is "inadvertently leaves correct valve in wrong position."

DR. JORDAN: Okay. Now, then, let's see the numbers that you have there and explain those.

WITNESS CURRY: Okay. And let me add one other thing. Then the item that most concerns your question in terms of common mode probabilities is item 2 under A which is entitled "more than one valve is affected (coupled error)."

Now, these human error rates were developed in consultation with a number of experts in the human error field and were provided to the Staff for its use in the studies previously referenced in NUREG-0611 and NUREG-0635

which analyze the reliablity of Westinghouse and CE associated systems.

We use the same data base here for the reason that we wanted a solid base of comparison between designs. There may be some arguments on the validity of data, but using a common data base does allow us some justification for comparing designs.

DR. JORDAN: Yes. I understood your testimony in that respect.

Now, then, about these numbers here, I do not quite see that, however. Take the 1-A figure. You have got a $1/20\ 10^{-2}$ 1 over X. Explain those to me.

WITNESS CURRY: Well, that particular thing is not applicable to this failure we are discussing.

DR. JORDAN: All right. Give me one that is.

WITNESS CURRY: The one that is applicable is the one that I chose was more than valve is affected.

DR. JORDAN: All right.

WITNESS CURRY: Or more than one item is affected.

DR. JORDAN: Okay. The point value is NI times 10^{-4}. What is the NI?

WITNESS CURRY: The N is really an approximation sign. I guess they could not find a little squiggle so they used an N when they typed up the table.

DR. JORDAN: I see. It is N. One times 10^{-4}.

WITNESS CURRY: Let me take that a little further. That would be true. However, I was under the understanding that the level instrumentation was indicated in the control room. Therefore, one can make the assumption that it is less likely than 10^{-4} that the failure would go unnoticed. So I actually referred you to the valve failure rate, but the sensor miscalibration rate is exactly the same, and that number is 1 times 10^{-3}. It is actually listed under three in that table.

(Board conferring.)

DR. JORDAN: Dr. Little asks your squiggle meaning "about or approximately." What do you mean approximately? An order of magnitude or a factor of two?

WITNESS CURRY: Well, there are error bands associated with these numbers, if you read just to the right of the number, for instance.

DR. JORDAN: I see. So it is a factor of 20, is that right?

WITNESS CURRY: In this case it would be a factor of 10 on that particular number as I read the table.

DR. JORDAN: Oh, I see. I see. The 1 times 10^{-3} is the point value with valve position in the control room. You say that is estimated a point value of 10^{-3} with an error factor of 10.

WITNESS CURRY: That is right.

DR. JORDAN: All right. Okay. Now I understand. Thank you.

WITNESS CURRY: So it was a matter of judgment when assigning the error, a human error probability associated with these numbers. The information I had on hand was that the position of the valves was indicated in the control room, so I chose that number; and had it not been indicated in the control room, I would have had a number based on whether it was doublechecked or not doublechecked. But it is indicated in the control room.

DR. JORDAN: Now, do you have the numbers on the tables that you used to get both of the figures that you gave us yesterday for the design mid-1979 and also the other two points?

WITNESS CURRY: All right. Okay. I can explain all the numbers on the little chart I gave you yesterday. Let me give you a little history.

When we were asked to present quantitative estimates to the Board, the only information we had on hand was a checking type analysis that we had done on the B&W report submitted to the staff.

It was thought more valuable if we redid an analysis to provide some information on what the system is or would be.

DR. JORDAN: Yes.

WITNESS CURRY: So in light of that, the checking type analysis is such and was performed to ascertain whether the dominant failure modes of the system had been correctly identified by B&W in their report, and to confirm the relative reliability of these systems compared to others. So it is probably a little less rigorous than that that was redone by the Staff for the updated system.

DR. JORDAN: I see. But now then, the question I had was somewhat simpler. The numbers that you have now in this Table 3, are those the numbers for the final system as it will finally be, or does Table 3 actually have all three sets of numbers in?

WITNESS CURRY: Table 3, well, which is my Attachment 2 that we are talking about --

DR. JORDAN: Yes.

WITNESS CURRY: Is the data base that was used both by B&W for its original analysis and by myself for the analysis of the proposed design.

DR. JORDAN: These are the numbers for the proposed design. I am just asking.

WITNESS CURRY: Now we are talking about what I gave out yesterday. Okay. Now, what I gave out yesterday to show on the bar graph, the number that is indicated as 4, approximately 4 times 10^{-4}, is the design that will have all of the completions that we have talked about included in

there. The number that is indicated as 8 times 10^{-3} was the number based on the Staff's checking analysis of the original B&W report. And the 3 times 10^{-3} is an estimation of what the system will be at restart.

DR. JORDAN: Yes.

WITNESS CURRY: Based on my understanding of what they will have in it.

DR. JORDAN: Okay. But the numbers you use, for example, to get the 3 times 10^{-3} are not in this table.

WITNESS CURRY: The derivation of 3 times 10^{-3} came about after I had completed the analysis for the completed system.

DR. JORDAN: Good, good. That is helpful. Thank you.

Okay. I think -- did I interrupt you by the way?

WITNESS CURRY: No, sir.

DR. JORDAN: I kind of have a feeling that I understand now. It probably will turn out that I was entirely mistaken about something; but I think perhaps we are at a place where you can go ahead, Mr. Pollard.

CROSS EXAMINATION - Resumed.

BY MR. POLLARD:

Q Just one question I have to continue the general explanation. The data that are contained in Attachment 2 to your testimony are the data which were inputted to the

circles and the diamonds, is that correct?

A (WITNESS CURRY) That is correct.

Q And then the data which appear on pages 35 and 37 of your testimony are what results when you propagate the data through the fault tree.

(Pause.)

A (WITNESS CURRY) That is right.

Q Just to make it crystal clear then, the separate sheet that you handed out as Attachment 3 to your testimony, the 8×10^{-3} corresponds directly to the graph shown on page 37, specifically the lefthand table labeled "Loss of main feedwater," and there is a little triangle shown in the first box between 10^{-2} and 10^{-3}, and that corresponds to the 8×10^{-3}.

A (WITNESS CURRY) That is right.

Q And then if you were to hand out Attachment, let me postulate, 4 and 5 for the other two transients, namely loss of main feedwater coincident with loss of offsite power and loss of main feedwater coincident with loss of all AC power, you could have another graph like this for those two other transients.

A (WITNESS CURRY) Certainly.

Q Thank you.

In your discussions with Dr. Jordan on the common mode failure of the electric pumps, as I understood you you

said you did not identify any particular common mode failure that would affect just the two electri pumps, was that correct?

A (WITNESS CURRY) Yes. I did not recall any that would single those two out.

Q So you attach no probability or a zero probability to the case where there may be some design deficiency in the two electric motor-driven pumps.

A (WITNESS CURRY) When doing these analyses I do assume that the equipment is designed correctly to achieve its function.

Q And that is why, for example, you would have no input into this fault tree for a common mode failure involving a design deficiency.

A (WITNESS CURRY) I did not catch the first part of that.

Q Because you assume that the equipment is properly designed, that is why there is no input into your fault tree of a common mode failure that would stem from a design deficiency.

A (WITNESS CURRY) That is right. If I had a way in which I could assign a credible number for design deficiencies of the pump and the probability of both pumps being designed incorrectly, I could certainly add to that.

I do not have a way to do that, and my judgment is

that that is probably less of a failure probability than others that do become apparent.

A (WITNESS WERMIEL) Could I add something to that? I might point out that operating experience with the pumps since they have been installed would tend to uncover such possibilities, we would hope, and if they did occur we might then correct them. And as far as I know, no such occurrences have been discovered.

Q Mr. Wermiel, how many times have the emergency feedwater pumps at Three Mile Island Unit 1 been called upon to operate?

A (WITNESS WERMIEL) In surveillance testing they have been called upon, oh, I would estimate at least 50 times.

Q And during the surveillance testing how long do the pumps run?

A (WITNESS WERMIEL) I am not how long they are run.

Q How long would the pumps have to run during a real accident?

A (WITNESS WERMIEL) That depends on the transient we are talking about and what the circumstances are.

Q Without knowing how long the pumps run during periodic tests and without knowing how long they would have to run for some particular accident, what is your basis for saying that there are no common mode design defects in the

Three Mile Island Unit 1 emergency feedwater pumps?

A (WITNESS WERMIEL) I did not say I knew there were none. I am saying what has transpired so far has identified none, and I have some feeling of confidence in saying that.

Q Without --

A (WITNESS WERMIEL) I also am aware that there will be a 48-hour endurance test performed on these pumps which hopefully will identify any other potential common type problems with these pumps.

Q Do you feel confident of this without knowing how the periodic tests are done, without knowing how long these pumps run?

A (WITNESS WERMIEL) I do not know the length of time the pump is run in a periodic test. That test requires the pump reaches it design discharge pressure. I do not know how long that takes.

Q You think one 48-hour endurance test is sufficient to discover any potential design deficiencies in the pumps.

A (WITNESS WERMIEL) Again, I did not say that.

CHAIRMAN SMITH: Mr. Pollard, I do think that you have twice now misconstrued his answer.

MR. POLLARD: That could very well be, because I lost track of why he interrupted. I was asking Mr. Curry why.

CHAIRMAN SMITH: His interruption is consistent

with tradition, consistent with the practice that we have had throughout this hearing that if a witness believes that he can add to the record, he should. If you do not want that in your cross examination, you are free to ask for it, but there have been times when you have been pleased to have it.

BY MR. POLLARD: (Resuming)

Q Mr. Wermiel, I believe I was asking Mr. Curry why he had no input on his fault tree for a common mode failure of both electric pumps, and I believe he said he had no basis for providing some reliable estimate of what that common mode potential would be.

Now, can you clarify for me what your addition to his answer was?

A (WITNESS CURRY) What I meant to say was we have a feeling that such commonalities perhaps have been, the possibility of them has been reduced by periodic surveillance testing, and other type tests that will be performed on these pumps, and take confidence in that this testing may uncover something that we might have overlooked, and since they have not up until this point, we feel that this possibility has been reduced. That is all I was trying to say.

Q You cannot quantify how much it has been reduced, can you?

A (WITNESS WERMIEL) No, I cannot.

Q Has the periodic testing had the capability of detecting common mode failures caused by the severe environment that would result during a high energy line break?

A (WITNESS WERMIEL) No, it does not simulate that.

Q So there are other potential common mode failures that have not been thoroughly explored by the periodic testing.

A (WITNESS WERMIEL) The periodic testing would not explore that type of common mode, that is correct.

DR. JORDAN: I guess maybe I would just ask a question here. Mr. Rowsome has stated that there have been advances over the WASH-1400 study, namely Chapter 4 which was devoted to common mode failure. And he feels that there are ways now of doing a better job of estimating common mode failure.

Are you familiar with what he was talking about, and are we using it?

WITNESS CURRY: Well, I am not sure if there was a particular methodology that Mr. Rowsome is talking about. We certainly are better aware or more aware of those possibilities and make every effort to take them into account, but I am not aware of a specific methodology.

DR. JORDAN: There are, of course, a number of

types of common mode failure. I presume you do include common mode failures due to errors of maintenance, is that correct?

WITNESS CURRY: That is correct.

DR. JORDAN: So some types of common mode errors at least you do include.

WITNESS CURRY: Oh, yes. We are aware of any particular type of common mode failure. If we are aware of it, we include it.

DR. JORDAN: Of course, those common mode failures of design are the toughest of all.

WITNESS CURRY: Again, they are tough. The question -- or it should be added again that my judgment is that they probably do not contribute as much to the unreliability of the system.

DR. JORDAN: I see. The ones that you have included, they are the dominant ones.

WITNESS CURRY: Clearly.

DR. JORDAN: Right. Okay. Thank you.

Go ahead.

BY MS. WEISS:

Q I am just curious about this design deficiency question. If it is a question of design deficiency, in two pumps that are of the same design it would be -- the same probability that both would fail as the one would fail,

isn't that correct, due to design deficiencies?

A (WITNESS CURRY) Once again, that is the nature of common mode. If there were a shortcoming in the design one could postulate that under similar operation many components are just as likely to fail as one.

Q So isn't --

A (WITNESS CURRY) You know, I might add is part of what is thought of in the deterministic licensing process in that there is some review by the Staff about the design and operation of systems and components of systems.

Q I guess the difficulty -- it seems to me that the difficulty you have in finding a probability number for a common mode failure due to a design deficiency is your difficulty with assigning any number to the probability of a design deficiency. It does not matter whether it is a common mode failure or whether it is -- whether it causes two pumps to fail or one pump to fail. The difficulty is assigning a number to it, a design deficiency, isn't that correct?

A (WITNESS CURRY) Sure, sure.

Q Do you do that at all throughout the --

A (WITNESS CURRY) Let me try to put a perspective on it. We only -- the design deficiency contributed to a pumps failure probability is only one means or one contributor to a components failure probability. If we had

no idea what the probability of a pump or a valve or any component failing was, we would go down to each of its possibilities of failing and try to assess what their probabilities of occurrence are.

We do, however, have data on pump reliabilities and the way in which it fails is somewhat immaterial to the performance of reliability analysis.

Q So you do not know -- you are using actual historical data, and you do not know how much -- you cannot segregate the causes for failures of pumps or valves whether they are design deficiencies or --

A (WITNESS CURRY) Design deficiency, production deficiency, materials. We do not have data that finely defined.

BY MR. POLLARD: (Resuming)

Q Mr. Curry, before we get to the substance of your testimony I would like to inquire a little bit about your professional qualifications statements attached to your testimony. Can you tell me, please, what you were doing between 1970 and 1974?

A (WITNESS CURRY) I think there is a typo here. I actually received my B.S. in '74, so I was in school between '70 and '74.

Q Oh, so the last paragraph should say you received your B.S. in 1974.

A (WITNESS CURRY) That is right.

Q And what about the period 1976 to 1978?

A (WITNESS CURRY) I was in graduate school.

Q In the first paragraph you list the responsibilities you have had since you were assigned to the Division of Systems and Reliability Research, and you list those as having included the review and development of a computer model for radioactive isotope migration analysis of several feedwater system designs, management of the reactor safety study methodology applications program, and participation in the IREP program.

Can you break that down for me as to how much time you spent on each one of those responsibilities?

A (WITNESS CURRY) Well, I would say about a year in the radioactive isotope migration area, which was another section within our division. The rest of the time the work somewhat overlapped. There is no distinct time or discrete interval for these other activities. They were performed concurrently in other words.

(Counsel for UCS conferring.)

Q The year that you spent on the isotope migration study, was that from March of '78 until about a year later?

A (WITNESS CURRY) That is about right.

Q And you think -- even though you were doing the other three things somewhat concurrently, you cannot allocate the amount of percent of your time that you spent on each one?

A (WITNESS CURRY) Well, I am very overworked. So it was more than, you know, it would not add up to 40 hours a week. It really is a kind of concurrent type activity. So --

BY MS. WEISS: (Resuming)

Q I would worry about your calculations if it adds up to more than 100 percent.

A (WITNESS CURRY) You would worry about that?

Q I would worry about that.

A (WITNESS CURRY) Well, it might.

(Pause.)

BY MR. POLLARD: (Resuming)

Q Am I correct that the plants you were project manager of were not B&W plants and they were both for construction permit proceedings?

A (WITNESS CURRY) They were CP proceedings. Greene County was a B&W plant, by my recollection.

Q It was?

A (WITNESS CURRY) Yes.

Q Has that been cancelled or indefinitely deferred?

A (WITNESS CURRY) One of the two. I am not sure what its current status is.

Q And you clearly state the other one was Westinghouse.

Are you familiar, fully familiar with the criticisms of the reactor safety study contained in the risk assessment review group's report, sometimes referred to as the Lewis report?

A (WITNESS CURRY) Well, I am not sure of the adjective "fully." I am somewhat familiar with it.

Q You are aware of some of the criticisms of the data base used by the reactor safety study?

A (WITNESS CURRY) I am aware that there is some question about the data base on general.

Q And the data base that is in attachment 2 to your testimony, as I understood you to say, you took that from NUREG-0611?

A (WITNESS CURRY) It is the same data base that was used there. Many of the values were taken from WASH-1400, as Mr. Rowsome said, with some modification.

Q Do you know whether the modifications were in direct response to the criticisms or comments of the Lewis committee?

A (WITNESS CURRY) I think the modifications were in response to improved knowledge.

(Counsel for UCS conferring.)

Q On page 31 of your testimony you state: "The testimony provides the staff estimate of the reliability of the TMI-1 emergency feedwater system as it is depicted in part one of this testimony."

And then on page 39 of your testimony you discuss why the uncertainty bounds associated with various component failure and human error rates were not propagated to the analysis on the grounds that this was not necessary in order to do a comparative reliability assessment.

If the goal was to determine reliability rather than a comparative reliability, why do you feel it was not necessary to propagate the errors through the analyses?

A (WITNESS CURRY) Well, the goal was originally, in terms of these studies, to develop a comparative reliability estimate of these designs. The means for doing such or the basis for doing that was to develop a point estimate of the systems reliability.

(Counsel for UCS conferring.)

Q Since you did not propagate the uncertainty bounds through the analyses, is it correct then that we cannot rely upon the actual probability figure that you reported for the Three Mile Island Unit 1 emergency feedwater systems?

A (WITNESS CURRY) Well, as I said in the testimony, the reliability, point estimate of the reliability that is presented here, should be considered to have an uncertainty bound associated with it, and the actual system reliability to lie somewhere within that uncertainty bound.

The question was asked to provide the staff's estimates of the system's reliability and this is it.

BY MS. WEISS: (Resuming)

Q Let me direct you -- I suppose you are now on page 39. The large paragraph right in the middle, the sentence that starts with, "The uncertainty bounds." You say, quote:

"The uncertainty bounds associated with the various component failure and human error rates were not estimated and propagated through the analyses. Such an approach is cumbersome and unnecessary for the purpose of the analysis: the assessment of the reliability of a given auxiliary feedwater system compared to other designs and the identification of major contributors to a given auxiliary feedwater system unreliability, so that system upgrading can be most effectively undertaken is desired."

Now, in light of that, your own statement of the purpose of the analysis, to what extent can your probability, your bottom line probability figures, be used as indicators of the absolute probability of emergency

feedwater failure at TMI-1?

A (WITNESS CURRY) Well, again, I would go to the heading of that paragraph, which says "The actual system reliability must be considered to be within the range about the point estimate presented here, due to uncertainties in component failure and human error rates."

Q What is the range?

A (WITNESS CURRY) I would concur with Mr. Rowsome's judgment that it would be within an order of magnitude either way. I would also be surprised if it was any greater outside of that order of magnitude.

Q The absolute probabilities, not the comparative probabilities, would you expect that to be --

A (WITNESS CURRY) I would be surprised if the absolute probabilities lie outside the order of magnitude range about the point estimate presented here. I would also concur that it may -- the reliability estimate presented here may lean toward the conservative side.

Q I asked you these questions bearing in mind that what I consider to be the major criticism of the risk assessment review group report was the underestimates of uncertainty and the conclusion of the review group report that in their opinion the uncertainty bounds were so large that absolute probability figures cannot be derived from WASH-1400, but they are good for comparison purposes.

I thought that was the kind of clarification that you were making in your testimony. But I gather you feel more confident that you can attach a range of uncertainty to your absolute probability figures than the Lewis group felt toward WASH-1400?

A (WITNESS CURBY) Well, once again, I think -- the first point I would like to make, I think what I have said is not inconsistent with the quote that you just gave. I think it is very consistent. Keep in mind, however, though, that in discussing WASH-1400 once again we are talking about sequences, not reliabilities of individual systems.

The more -- the greater your analysis, the more sequences, systems, components and human interactions that you have to take into account, the greater the uncertainty estimates. So I would probably feel certainly more comfortable with estimating a small system's -- a small individual system's reliability than I would with the probability of occurrence of major sequences.

The reason for that is to a large extent due to the possibility of common mode failures and systems interactions that can be overlooked.

Q You mentioned when you were back on Table III-2 -- I just want to pick it up before I forget it -- item a.3, and I guess that is (b), a.3(b), "more than one sensor relay affected."

You mentioned that you had thought that there was indication in the control room, but I was not clear on whether you found out that you had used an incorrect number or there is not indication in the control room. You made some qualification I did not follow. I need you to clarify it.

A (WITNESS CURRY) Well, failure probabilities, the probability of something being in a failed state, changes with the operator's knowledge of the system. So if the item in question is indicated in the control room, where there are constantly personnel, it is less likely that, you know, such a failure will occur than if it was in an isolated portion of the plant and it is not constantly under observation.

Q Didn't you say that you had thought that there was a level instrument indicated in the control room which you have since discovered has no such indication, or did I just hear you incorrectly?

A (WITNESS CURRY) No.

Q You were just describing generally, you would give more credit?

A (WITNESS CURRY) Yes.

Q Okay, thank you.

(Counsel for UCS conferring.)

BY MR. POLLARD: (Resuming)

Q On page 34 of your testimony, the last sentence in the paragraph, it says: "For example, such assumptions were often necessary when interaction of the operator with the system had to be considered without the specific operational procedures available for review."

Am I correct in understanding that sentence of your testimony that when you prepared your fault tree or inputted data to the fault tree, you did not review the specific operational procedures for Three Mile Island Unit 1?

A (WITNESS CURRY) Well, certainly if they were not available I did not review them.

Q Were they available or weren't they available?

A (WITNESS CURRY) I did not have them available.

CHAIRMAN SMITH: I think that, as these next series of questions -- they sound familiar to me. I think you should try to give concrete answers. I mean, you did not. No would have been adequate.

WITNESS CURRY: I apologize. I thought that was as concrete as I could give.

CHAIRMAN SMITH: I beg your pardon?

WITNESS CURRY: I said I apologize. I thought I was --

CHAIRMAN SMITH: I know. We are familiar with Mr. Pollard's cross-examination. I am familiar with what his

objectives are. And if you just give -- if you listen to the question and give him concrete answers, it will be quite helpful.

(Pause.)

CHAIRMAN SMITH: There was nothing wrong with your answer. I am not criticizing you for your answer at all. But we have been through this many times and I know -- I know what we are going to be going through now.

(Pause.)

BY MR. POLLARD: (Resuming)

Q I had skipped a more complex question. Let me back up just a moment. If I could direct you first to the bottom of page 32 of your testimony. Well -- well, this is a rather lengthy question. So I will try to go slow and frame it.

On page 32 you are discussing the three types of transients that you have analyzed. And you wind up concluding that the reliability of the emergency feedwater system during these transients -- I think you were referring to the latter two transients, loss of feedwater coincident with loss of offsite power or simply -- oh, dear.

Let me abandon that approach and just ask you a simple direct question: Why is the probability that you report on page 35, is it, and 37 of your testimony -- can you explain to me why the probability of failure of the

emergency feedwater systems at Three Mile Island Unit 1 are unaffected by the loss of offsite power, that the probability is identical for either a simple loss of main feedwater or a loss of main feedwater coincident with loss of offsite power?

A (WITNESS CURRY) They are not exactly identical, but they are very close, because in the second category the diesel generators were available to supply the required AC power.

Q Yes, but I would -- if we have offsite power, which is the first transient you analyzed, I would have assumed that there would be some probability associated with the diesel generator's failing to start.

A (WITNESS CURRY) Well, that is clearly true. Again, three transients were analyzed. There was not an attempt to derive one number for auxiliary feedwater system reliability, because such an attempt would require some estimation of the percentage of time that loss of main feedwater transients occurred coincident with loss of offsite power and loss of all AC.

What was done, however, was specifically to analyze each of those occurrences and to determine the reliability of this system once those initiated events had been postulated.

The case that you are talking about is the third

case, where we did postulate loss of everything, loss of all AC power.

Q Okay. Let me -- I do want to concentrate on the first two cases first. What these graphs on pages 35 and 37 tell me is that both for the mid-1979 design as well as for the proposed design after all requirements are met, that the probability of failure of the TMI-1 emergency feedwater systems in responding to a simple loss of main feedwater is almost exactly the same as the probability of the emergency feedwater system's failing to respond to a loss of main feedwater coincident with loss of offsite power.

And I was -- the question is, based upon your analysis of the reliability or probability of failure of the Three Mile Island emergency feedwater systems, does this mean that the dominant failure modes are unaffected by whether or not we lose offsite power?

A (WITNESS CURRY) Well, there were some assumptions that were used in this study that have been used in the studies of other auxiliary feedwater systems. And for purposes of performing these studies, one diesel generator was assumed available with a probability of one; the other diesel generator was assumed available with a probability of 10^{-2}. And given that assumption, these results were estimated.

Q Thank you. I thought that was the answer to the

question. Let me see if I understand.

When you were calculating the probability of success or the probability of failure of the Three Mile Island Unit 1 emergency feedwater systems for the event, loss of offsite power, you simply assumed that at least one diesel generator would always operate?

A (WITNESS CURRY) That is one way to put it, yes.

Q And you attached no probability or a zero probability of failure of both diesel generators?

A (WITNESS CURRY) That is essentially true.

Q Okay. Now I have the question on the third case, that being loss of main feedwater coincident with loss of AC power. If I compare that case on page 35, which is the proposed design which will be implemented some time after restart, with the same case on page 37, which was the mid-1979 design, I am tempted to reach the conclusion that none of the modifications or additional requirements imposed upon emergency feedwater systems have had any effect upon the reliability of this system for this transient. Is that correct?

A (WITNESS CURRY) Their effect is somewhat shadowed by the reliability numbers, in that if you were to look at the headings of these, each of these events, you will see that there is a scale change in terms of their probabilities of occurrence.

Q There is a scale change from the other two transients, but there is no scale change between the case of the proposed design versus the mid-1979 design for this transient?

A (WITNESS CURRY) That is right. The scales for all three transients are the same, regardless of the periods in which we analyze. There is a difference in the scales between the first two transients and the third.

Q Yes. But please, I do not want to go back to the first two. I want to concentrate on this third transient now.

A (WITNESS CURRY) I think it is necessary to answer your question why there is no difference between the mid-'79 and the proposed design in case three.

Q Okay. If you wish, go ahead.

A (WITNESS CURRY) And the reason is that the reliability number that is presented is a function of dominant failure contributors. In my analysis, in the first two cases where electric feedwater trains were available, it turns out that the system unavailability was dominated largely in mid-1979 by the probability of not getting the feedwater control valves open on demand. That probability, although dominant in a multi-train system, is no longer dominant when one is reduced to a single train system, as occurs in case three.

When reduced to a single train system, that is, the turbine-driven train in case three, there are many contributors to the system's unavailability, not to mention the inherent reliability of the components themselves. So that fixing one dominant contributor, it becomes quite clear that you have fixed it in the first two cases, where it was a heavy contributor; it is not clearly noticeable in the third case, where it is one of many contributors.

Q Okay. What probability of failure for the turbine-driven pump did you use in your analysis for this third event?

A (WITNESS CURRY) Well, let me just look for a second here.

(Pause.)

A (WITNESS CURRY) The turbine pump unavailability that I used was approximately 1.5 times 10^{-2}.

(Pause.)

Q And perhaps you recall what Mr. Rowsome just testified to. He thought perhaps the probability of failure of turbine-driven pumps is 10^{-1}. Was that -- is my recollection correct?

A (WITNESS CURRY) I recall that, and I have no comment except to point out this is a common data base that was used to compare all system reliabilities.

Q Okay. Well, fine. I mean, I understand when you

are comparing one system to another. But what I am trying to pursue now is the reliability of this emergency feedwater system at restart.

Now, you would agree with me that if the probability of failure of the turbine-driven pump itself is 10^{-1}, then the probability of system failure under the case of loss of main feedwater, loss of all AC power, would be greater than 10^{-1}?

A (WITNESS CURRY) Well, it certainly could be no less than that.

Q Okay. Now, am I also correct that for this case of total loss of all AC power we do not have the backup of bleed and feed; is that correct?

A (WITNESS WERMIEL) That is correct.

Q So what this graph shows is -- and correct me if I am wrong -- even using your figures, Mr. Curry, that the probability of total loss of all decay heat removal systems for Three Mile Island Unit 1 lies somewhere between one chance in 10 and one chance in 100 for the event loss of main feedwater coincident with loss of all AC power?

A (WITNESS CURRY) For that event.

Q That is how I phrased the question. Is that correct?

A (WITNESS CURRY) Yes. I just wished to emphasize that is for that initiating event.

Q And now we can ask you both, in your consideration that the system is reliable enough to permit restart, what did you consider to be the probability of total loss of all AC power at Three Mile Island Unit 1?

A (WITNESS WERMIEL) I do not have a figure for that number.

Q Mr. Curry?

A (WITNESS CURRY) No, I have not considered it at all.

Q Then on what basis do you conclude that Three Mile Island Unit 1 should be allowed to restart?

A (WITNESS WERMIEL) I think again we are looking at comparisons, and we compare Three Mile Island Unit 1 with other plants for this event and find that it is as good as many and better than some.

Q Well, excuse me, I do not mean to be argumentative at all. But it sounds to me like the conclusion the public could draw from your testimony just now, that as long as all plants are equally dangerous they should be licensed.

A (WITNESS CURRY) I think -- I think it is a question in terms of plant safety. Your argument I think really hinges on the probabilities of loss of all AC. Now, I have not analyzed the probability of loss of all AC and I'm not prepared to talk about the probabilities of loss of all AC.

It is my judgment that it is a very low probability event. However, that occurrence and the plant risk being tied to that occurrence is not inconsistent with some of the results that perhaps we are beginning to turn up.

(Counsel for UCS conferring.)

BY MS. WEISS: (Resuming)

Q Would you elaborate on that, please, the results that you are beginning to turn up?

A (WITNESS CURRY) Well, in the overall plant risk studies that we have been conducting, we try to analyze what are the dominant sequences that lead to the risk associated with the operation of a nuclear power plant. And such occurrences as station blackout do in some cases contribute to the risk of the operation of the plant.

Q You mean that the probability of station blackout becomes significant enough that you need to look closer at the response of the plant in the event of that initiating event?

A (WITNESS CURRY) Well, it is certainly something we are looking at, yes.

Q Because if you do seriously -- if you seriously consider the sequence and you have included it among the three sequences that you have analyzed, you could hardly come up with a figure that was less encouraging with respect

to the ultimate consequences of a loss of AC power than you have for TMI-1. By that I mean, the chances are really between one in 10 and one in 100 that a loss of AC power results in total loss of, you know, decay heat removal capability.

That is obviously a significant probability, and it is one of your three scenarios. Why did you choose it?

A (WITNESS WERMIEL) We chose it for the purpose of the study in the first place, which was to identify the dominant failure contributors for these scenarios, to try to correct them where we could, and to gain an overall comparative capability to other plants.

Q Have you taken any steps to correct the situation that results at TMI from loss of AC power?

A (WITNESS WERMIEL) We have examined --

A (WITNESS CURRY) In terms of EFWS operation, is that what your question is?

Q (Nods in the affirmative.)

A (WITNESS WERMIEL) We have examined the dominant failure contributors in this scenario and we have corrected the deficiencies that we found for this case in the total loss of AC case.

Q But with all the corrections --

A (WITNESS WERMIEL) With all the --

Q -- there is still a chance, between one in 10 and

one in 100, that you will lose, totally lose all decay heat removal capability if you lose AC power at TMI-1?

A (WITNESS WERMIEL) That is correct, with the single turbine-driven train. This is that probability.

DR. JORDAN: I want to ask one question here to make sure that I am on board. In the case of a station blackout, is there necessarily a loss of main feedwater? Is that -- are those considered independent events?

WITNESS WERMIEL: You have no main feedwater in a station blackout. And there is one other thing. Again, this is a number for the immediate system coming on. There is, again, a recovery time, a recovery capability for the operator to perhaps get the turbine-driven pump train in operation should it not go on automatically.

And it is not reflected in this -- in this number.

CHAIRMAN SMITH: We are going to have to take some time out to take the afternoon break. Is this an appropriate time?

Dr. Little had to leave because she has a conference call on another case, and we wanted the break to coincide with her conference call.

(Recess.)

CHAIRMAN SMITH: Ms. Weiss, before the recess you asked a question on page 39, the last sentence on the large

paragraph. And Dr. Little and I shared the same experience when you read it. Neither of us understood it, but assumed that everybody else did and we would worry about it later. And I do not think I could diagram that sentence on a blackboard or anyplace else, for that matter.

(Laughter.)

CHAIRMAN SMITH: It just is not a parse-able sentence, I do not believe.

MR. BAXTER: I think everything after the colon is the purpose.

MS. WEISS: That is what I was just going to ask.

BY MS. WEISS: (Resuming)

Q Would it be correct to read it as stating that the purpose of the analysis is everything which is subsequent to the colon?

A (WITNESS CURRY) Yes.

CHAIRMAN SMITH: That is --

BY MS. WEISS: (Resuming)

Q And does the sentence say that effort of propagating the various component failure and human error rates through the analysis is unnecessary and cumbersome, in light of the purpose, which is then stated as everything that follows the colon?

A (WITNESS CURRY) It is unnecessary to propagate uncertainties throughout the analysis for the purpose, as

stated after the colon.

CHAIRMAN SMITH: For the purpose of the analysis, which is?

WITNESS CURRY: As stated after the colon, or which is the assessment of the reliability of a given auxiliary feedwater design compared to other designs and the identification of major contributors to a given auxiliary feedwater system unreliability, so that system upgrading can be most effectively undertaken.

CHAIRMAN SMITH: Okay.

BY MS. WEISS: (Resuming)

Q And I would just ask, finally, whether it is -- isn't it true that all of the analysis which you have provided is a comparative analysis of the TMI auxiliary feedwater system compared to other designs?

A (WITNESS CURRY) It is indeed a comparative analysis. I tried to emphasize that by putting it on the chart with other aux feed designs.

BY MR. POLLARD: (Resuming)

Q If we resume on the transient of loss of main feedwater coincident with loss of all AC power, and if I looked at the testimony on page 35, where we are comparing the TMI-1 design with other plants, I notice that there are five Westinghouse plants where the probability of failure of emergency feedwater is one for this particular event. Those

plants are still permitted to operate, aren't they?

A (WITNESS WERMIEL) Yes.

I guess now is a good time to perhaps put case three into perspective.

Q Well --

A (WITNESS WERMIEL) Case three is a postulated event which is beyond the design basis currently for nuclear power plants, the event being a station blackout. GDC 17 only requires that we postulated a single failure in power supplies. We included the station blackout here to gain an insight into this particular event and the AC dependencies within the turbine-driven pump train.

BY MS. WEISS: (Resuming)

Q Is that perspective which you have just offered us on the loss of all AC scenario, was that the topic of discussion between you and your counsel during the break?

A (WITNESS WERMIEL) I discussed it with counsel, yes.

Q Let me ask you this: If you had found as a result of your analysis that the probability of total loss of decay heat removal capacity at TMI upon the initiating event loss of AC power were one, would that have changed your conclusion at all with respect to whether it is appropriate to allow this plant to restart?

MR. BAXTER: Are we still talking about the

five-minute time frame?

BY MS. WEISS: (Resuming)

Q I am talking about the terms of your analysis, that is correct.

A (WITNESS WERMIEL) In terms of this analysis, I believe it would. I think we would want to have corrected the AC dependencies in this train prior to restart. Again, in dealing with the overall station blackout scenario, the recovery capability of the turbine-driven train, the recovery of the diesel and the recovery of the loss of offsite power are not reflected in the number that is shown here.

Q What is the probability of a loss of all AC power at TMI-1?

A (WITNESS WERMIEL) I do not know the specific number for TMI-1. It is a low probability event in general.

Q Well, you are comparing in some sense at least the risk at TMI-1 with the risk associated at other plants.

A (WITNESS WERMIEL) No, we are not, because this is not an attempt to show how this event might lead to core damage or impact on public health and safety. It is merely an attempt, as I characterized already, to eliminate dominant failures in the particular turbine-driven pump train we are talking about.

Q Do you know whether, for any of the other plants listed -- and maybe I would particularly direct your attention to the five which do have a probability of one, loss of AC power, loss of decay heat removal capability, whether the probability of loss of AC power is any greater or less at those plants compared with TMI-1?

MR. BAXTER: Mr. Chairman, I'm going to object at this point. I did not understand this to be the focus or even a part of the Board's interest expressed in Board question 6, and that is the likelihood of station blackout at TMI-1. And as a matter of fact, I can recall having Witness Torcivia here and told he could go home last fall when he was here to testify on Board question 6 as to the reliability of our offsite power supplies, because that simply was not what the Board was interested in, it was the emergency feedwater system and its reliability.

(Board conferring.)

CHAIRMAN SMITH: This is a gray area. The Board itself would not be asking these questions, but the testimony is produced and the findings can be based upon the testimony, and it should be subject to cross-examination.

MR. BAXTER: The testimony says absolutely nothing about the probability that these initiating events will occur. In fact, they already said they do not have such or have not made such analyses. And so now we are asking for

comparisons of TMI-1 versus the other.

MS. WEISS: I am trying to inquire into the usefulness of this analysis and the purpose to which the witnesses put it in determining whether it is appropriate or whether they would recommend that TMI should be permitted to restart.

They have said that, at least with respect to this AC power scenario, Mr. Wermiel said the dominant reason in his mind was that there were some plants that were worse and there were some that were no better. And I am trying to get a fix on how far that went. Did they really look at to any extent what the risk was comparatively between TMI and the other plants for loss of AC power.

CHAIRMAN SMITH: Mr. Brenner has pointed out to me that Board question 6-H is: "Can the turbine-driven pumps involved be operated on direct current or are they dependent upon the alternating current safety buses," which is the next step down from this case.

DR. JORDAN: That is true, and the reason was I wanted to find out if it would survive a loss of -- a station blackout, because I know that there are some plants that could not.

CHAIRMAN SMITH: So that objection --

MR. BAXTER: I understand we are looking at what happens after station blackout. That is what case three

is. That is what the question is.

But now we are exploring the probability for station blackout.

MR. CUTCHIN: Mr. Chairman, I might interject here as well. I am not objecting to these questions. But I think one thing the Board could keep in mind, and that is that we have not often, if at all, objected to Board questions, even though we may have viewed those questions to carry beyond what we view to be the scope of the proceeding, in the desire to give the Board whatever information it wanted. But to carry that too far in allowing other parties to bootstrap on that puts us at somewhat of a disadvantage.

CHAIRMAN SMITH: Yes, it does. But under Commission rules, precedent, other parties can participate fully on Board questions and develop the record, and anything that is produced as a Board question can be proposed as a finding against the interests of the Union of Concerned Scientists.

MR. CUTCHIN: Then maybe, Mr. Chairman, I guess for the future the question may have to be posed as to whether, in response to Board questions that come out of the blue, the Board believes that they have identified a serious, or whatever the new term is, safety concern that warrants hearing in this proceeding.

I am not pressing it. I am just making the point

that if we carry this too far we can stay here forever.

CHAIRMAN SMITH: You are right. You are right as far as that is concerned. There just has to be, of course, some cutoff point. I think that we would probably make the cutoff point on the Board question closer than on a contention raised by the Union of Concerned Scientists. I will just have to simply go by the judgment of Dr. Jordan whether he wants the answer or not, and Dr. Little.

DR. JORDAN: Well, I certainly do not feel that there is a close nexus between the loss of AC power, loss of all power, and the TMI-2 accident. And I do not expect to explore that avenue with my questions at all.

I did want to know, and I did find out, that they do have turbines and they are DC-operated, and that was the extent of my interest. Now, I do not mind -- I think if the witness can answer this question, do they know how this grid and these generators compare in reliability with others, fine.

But I suspect that we are just not going to make any headway on this. This is what I think.

MS. WEISS: I think the witness was indicating before the objection that he did not have any information on it, anyway.

CHAIRMAN SMITH: I try to remind myself, before we entertain a lot of arguments we should always ask if the

witness knows the answer to the question, and we can get directly to it.

So you do not have an answer to the question?

WITNESS WERMIEL: No, I have no answer to that question.

CHAIRMAN SMITH: Okay.

BY MR. POLLARD: (Resuming)

Q In the course of our discussion on this particular transient, Mr. Wermiel, I think you mentioned that there was the possibility for the operator to take action and correct the difficulties. And I seem to get from your testimony the feeling that you think this operator action would be successful in some time period longer than five minutes; is that correct?

A (WITNESS WERMIEL) The operator's action would be successful in the five minutes?

Q In some period of time longer than five minutes, in restoring some type of decay heat removal system?

A (WITNESS WERMIEL) Yes, I do, I do think his action would be successful over a period of time.

Q Are you familiar enough with the actual accident at Three Mile Island Unit 2 to recall how long it took the operators to correct the mistake of shutting off high pressure injection flow?

A (WITNESS WERMIEL) No, I am not familiar enough

with the accident sequence to recall when he realized he needed his high pressure injection.

Q Are you familiar enough with the accident to be able to say that in fact it was operator actions which compounded the accident, rather than led to mitigation of it in the early stages?

A (WITNESS WERMIEL) I am aware that operator actions did have an effect on the end result in the TMI-2 scenario.

Q Would you agree that in addition to simply loss of or collapse of the offsite grid or failure of the diesel generators to start, that there could be other events that would result in total loss of AC power to the systems at Three Mile Island Unit 1, for example such as a fire?

A (WITNESS WERMIEL) y understanding is that if you have such a severe fire it could engulf all AC power systems, I would presume. I have not looked at fires specifically to determine this.

(Counsel for UCS conferring.)

CHAIRMAN SMITH: Mr. Pollard, I think the time now has come where you are going to have to make some choices. We are going to have limited appearance statements at 5:00 o'clock, which means that we will not have further opportunity after that. We cannot go much more than an hour and a half, if that much, of hearing time left.

So to the extent that you use the time, you are not going to be present when other people ask questions of this panel.

MR. POLLARD: Yes, I understand that, Mr. Chairman.

(Pause.)

CHAIRMAN SMITH: Oh, yes. Reading my statement in a void suggests that we are saying that you cannot come back. I am just taking your own restriction.

MS. WEISS: Mr. Brenner --

CHAIRMAN SMITH: We have --

MS. WEISS: He watches you like a mother hen.

(Laughter.)

MR. POLLARD: In fact, it is this pause where I am trying to exactly consider the factors which you remind me of, in looking at my cross-examination plan, to decide exactly the point you raise.

(Pause.)

BY MR. POLLARD: (Resuming)

Q Mr. Curry, beginning at the bottom of page 36 of your testimony, you list the dominant contributors to unavailability of the emergency feedwater system for the mid-1979 design. Can you tell me what the dominant contributors are to the unavailability of the system in the proposed design case?

A (WITNESS CURRY) In the proposed design case, there really are not any contributors to that -- that contribute significantly more to the availability of the system than many others. In other words, the proposed design case represents a conglomeration and there are not, in the term that we use, dominant contributors. I do not recall any that are clearly head and shoulders above the rest.

DR. JORDAN: I will be asking you, perhaps tomorrow, as to why it is that some of the Westinghouse designs seem to be quite a lot superior. But that is not a question from me today.

(Pause.)

BY MR. POLLARD: (Resuming)

Q When you prepared your testimony and you listed the dominant failure modes for the mid-1978 design, I can see from your testimony you have had some consultation with Mr. Capodanno. And in his testimony, in Licensee Exhibit 15, he listed different dominant failure modes for that design, including potential plugging of the emergency feedwater pump suction strainers.

I use this as an example to ask: Did you attempt to compare your analysis of the mid-1979 design with that performed by the Licensee to try and identify why you found different dominant contributors than the Licensee did?

A (WITNESS CURRY) Okay. I believe the Capodanno testimony is based on the B&W analysis that was submitted to the staff for review. I do not have the testimony in front of me, but I believe that is the case.

Q Well, I can loan you my copy of Licensee's Exhibit 15. But where I picked out the example from is an introductory sentence on page 10 of Licensee Exhibit 15, which states: "For TMI-1, the three major component failures which contribute to system unavailability are," and he lists three, one of which is potential plugging of the pump suction strainers.

I just use that as an example.

A (WITNESS CURRY) I understand.

Q And the question was, did you make any attempt to compare your analysis to the Licensee's analysis for the purpose of trying to determine why you reached different conclusions regarding the dominant failure modes?

A (WITNESS CURRY) I understand the question, and I am just trying to establish the fact that I believe that Licensee's analysis is the B&W analysis that was submitted to the staff. And if indeed that is the case, yes, I have made a comparison.

Okay. Yes, I do have a copy of the testimony, and I see on page 9 that the Licensee did refer to the B&W analysis. So that is his -- I conclude that is his analysis

that he is referring to.

So the answer to your question is, yes, I have reviewed the Licensee's, quote, unquote, "analysis."

Q Can you explain to me, then, why the Licensee concluded a dominant contributor was plugging of the strainers, which you did not conclude?

A (WITNESS CURRY) Okay. Well, once again it is probably a reflection of differences in assumptions that the Licensee made and I made. In the B&W report, there was identified a common mode failure or a potential for the common mode failure to open both normally-closed feedwater control valves, in that they were both controlled by the ICS and the ICS was not separated in its entirety to both control valves.

I in my analysis found that to be the dominant failure, since in a five-minute time period I did not credit any operator recovery to reopen such a failure. I suspect -- well, I do not know if you want me to draw conclusions why I differ from the applicant. But my unavailability number for TMI-1 at that time was higher than that predicted by B&W, and that assumption about a nonrecoverable failure within five minutes due to the single ICS failure is, I am sure, largely the reason why.

(Counsel for UCS conferring.)

Q When you did your fault tree analysis, can you

point to me in the fault tree, if you did, where you inputted the possibility that one main feedwater train was out of service, as permitted by the technical specifications?

A (WITNESS CURRY) Okay. The fault tree that you have is one for the proposed design. But what you are talking about would be entered under the test and maintenance unavailability event.

Q Can you tell me, please, what probability you assigned to that box?

A (WITNESS CURRY) I used 2.6 times 10^{-2} as an unavailability.

Q And that was on the assumption of how often would this loophole or this provision of the tech specs be used?

A (WITNESS CURRY) It was my understanding -- and I think the actual words were read earlier -- but I based that estimate on the words, essentially, if two 100 percent capacity paths were unavailable for 72 hours, the plant must be placed in a condition not requiring steam generator cooling. That was NUREG-0680, page C.2-6.

Q Excuse me. Let me state the question more specifically. From my experience there have been instances in the past where technical specifications allowed a particular component to be out of service, let's say, for 48 hours. They restore the component to service in 47 hours,

and then the next day it was out of service again, and they allowed it to remain out of service for another 47 hours, and then had it in service for an hour and then out of service again.

Now, that is -- the question I am asking is, in computing the probability for the box of test and maintenance availability, what percent of the time in a given calendar year, as an example, did you anticipate that one train of the emergency feedwater system would be unavailable because of this technical specification provision?

A (WITNESS CURRY) Because of the technical specification provision, which is essentially what I think I just quoted, the number that I arrived at, that is the fraction of time which the system is unavailable due to tests or maintenance, was 2.6 times 10^{-2}.

That is, in 100 hours it would be unavailable for 2.6 hours.

(Pause.)

Q And that data came from?

A (WITNESS CURRY) That was calculated assuming that indeed they did have a system out for the maximum 72 hours allowed by the tech specs. And it was -- took into account the average time between component failures or maintenance that was used in WASH-1400.

(Counsel for UCS conferring.)

Q I have just a few questions on the actual fault trees.

MR. POLLARD: At this point I would just like to bring up, Mr. Chairman, my concern that the copies of these fault trees that are physically in the record are illegible.

CHAIRMAN SMITH: Yes, we noticed that.

MR. POLLARD: Perhaps that can be corrected at some future time.

BY MR. POLLARD: (Resuming)

Q On the second page of the fault trees, under the subtrain of turbine pump failure, can you explain to me the significance of the note underneath the diamond labeled "support system faults"? And if I am correct, that reads: "DC power assumed available, forced air cooling after two hours."

Am I correct in interpreting that note that you assigned no probability to DC system failure, or a zero probability of DC system failure?

A (WITNESS CURRY) No. DC support system failures, again these transients by definition assume that DC power is available.

Q So the answer to my question is, yes, you assigned a zero probability to DC power system failure?

A (WITNESS CURRY) Well, to give the right perspective, I did not have to assign it. It was an assumption of the initiating transient.

Q And it is correct that if DC power was unavailable, that the success of emergency feedwater would be lower, the success rate or the probability of failure would be higher than what you have reported?

A (WITNESS CURRY) Well, of course, I would have to take into account whether you are assuming we have AC power available.

Q Well, yes, you are quite correct. I am talking about the transient in which we are looking at the turbine-driven pump under the conditions of loss of all AC power. For that analysis you simply assumed that there was DC power available?

A (WITNESS CURRY) Yes. If you wish to postulate a transient where all AC power --

Q I do not wish to postulate a transient other than the question I asked.

A (WITNESS CURRY) If you wish to query the question about loss of all AC power, certainly loss of DC power could contribute to the unavailability of the system in that transient.

Q But you did not consider that?

A (WITNESS CURRY) No, sir.

(Pause.)

Q On page 5 of the fault trees -- I am sorry, my notes are wrong. Page 6. I have a question on the footnote that is on that page, which reads, quote:

"With control valve ESV-8C full open, EST-2B will provide 385 gpm."

Just that part of the footnote; what is the source of that information?

A (WITNESS CURRY) I would like to check. I believe it is the B&W report that had been submitted. I can check on that if you like.

Q In other words, am I correct that the source of information is not a test of the system?

A (WITNESS CURRY) I am not sure how the number in the B&W report came about.

Q Do you know whether the number assumes delivery to one or both steam generators?

A (WITNESS CURRY) I am not sure it is material. I think --

Q There has been previous testimony that the flow rate would be different if you were delivering to one or both steam generators.

A (WITNESS CURRY) I would have to look at the B&W number. Like I said, I am not quite sure of the reference.

(Counsel for UCS conferring.)

Q I have just two other questions. For the event loss of main feedwater, total loss of AC power, when you calculated the failure probability for that transient did you assume the availability of the river water system as an alternate source of water? That is the first question?

A (WITNESS CURRY) No.

Q Did you assume the availability of water from the hot well?

A (WITNESS CURRY) I would have to look on the fault tree. I believe there was some AC valve associated with that, securing flow from the hot well. So in that case I would not have assumed it.

Q You would not have assumed it?

A (WITNESS CURRY) Not if it was an AC dependency

Q Now --

(Counsel for UCS conferring.)

Q On page 41 of your testimony, where you are discussing how the maximum reliability achievable could vary for plants with differing nuclear steam supply systems, you list several factors: smaller inventory in the steam generator, the number of loops or the number of steam generators.

Am I correct, those are the two main factors that you discuss there?

A (WITNESS CURRY) Well, those were two that were

clearly used for an example. Yes, those were the two that were in there, right.

Q Now, looking at the charts on pages 35 and 37, it does not matter which one for this question, are you aware that the Point Beach plant is a two-loop plant?

A (WITNESS CURRY) Well, I am aware that there are some Westinghouse two-loopers, if that is your point. I did not mean to imply that all Westinghouse plants were either three or four-loopers.

Q Well, for a plant, a Westinghouse plant with two loops, what would you say is the reason for not having as high a reliability of the Three Mile Island Unit 1 emergency feedwater system as compared to the emergency feedwater systems in a two-loop Westinghouse plant?

A (WITNESS CURRY) Well, probably the dominant reason is -- and once again, it is tied to the success criterion, in that we analyze for the possibility of steam generator dryout, and in general in Westinghouse plants the probability of steam generator dryout are longer.

Q In other words, then, it is your opinion, if you extended the time available for emergency feedwater to be successful, that the operator could correct it and therefore the probability at Three Mile Island Unit 1 would be comparable to Point Beach?

A (WITNESS CURRY) Well, without looking at Point

Beach, I cannot say. But --

A (WITNESS WERMIEL) I think you have to understand some of the differences in the Point Beach design. Their auxiliary feedwater system is somewhat different in design than TMI's.

Q Okay. Thank you.

MR. POLLARD: We have no further questions of these witnesses at this time.

CHAIRMAN SMITH: Mr. Dornsife?

BY MR. DORNSIFE:

Q Mr. Curry, the figure you handed out, which you call attachment 3, I think we had a discussion that the improvement in reliability between the restart and the proposed design is a factor of 18, I believe, or something of that order. Maybe it is 9, I am not sure. But it is much larger than the improvement over the previous design.

Can you tell me what is the dominant contributor to that increase, because there are very few things that are being added?

A (WITNESS CURRY) Once again, for the securing of flow to the steam generator within five minutes, the automatic safety grade actuation makes a big difference.

Q Does the level indication on the condensate pump have any contribution to that improvement, the redundancy in the condensate level tank?

A (WITNESS CURRY) It would probably plan some role in assuring that there was water in the condensate storage tank to start off with. But I believe the major increase in improvement is due to the automatic actuation of the system.

Q Mr. Wermiel, concerning the condensate level tanks, without assuming a normally-opened valve being closed, is there any way the condensate tanks will not drain down equally?

A (WITNESS WERMIEL) No. In their normal configuration, they would -- they should drain down in an equal manner.

Q And are the current level indicators supplied from redundant power sources?

A (WITNESS WERMIEL) No.

Q Diverse power sources?

A (WITNESS WERMIEL) My understanding is the level indicators on the tanks now are powered from the same bus.

(Pause.)

Q Do you have the restart SER, NUREG-0680?

A (WITNESS WERMIEL) Yes, I do.

Q Look at page C.1-8, Item No. 1. Is that --

(Witnesses reviewing document.)

A (WITNESS WERMIEL) Yes, sir.

Q Doesn't it say that they are supplied from

separate redundant power,supplies?

A (WITNESS WERMIEL) This is talking about the new ones, I believe.

Q This is required prior to restart, it says.

A (WITNESS WERMIEL) Where does it say that?

Q The last sentence up above: "We require the Licensee to implement the following items prior to restart."

A (WITNESS WERMIEL) That is going to have to be corrected in the supplement.

Q Okay.

A (WITNESS WERMIEL) Because I indicated in my table that is now -- when this was written, NUREG-0737 was not out. We did not -- we were under a different impression at that time.

Q Would the major problem with the reliability or the availability of those level indicators be due to the fact that they are powered from the same power supply?

A (WITNESS WERMIEL) I do not know if it is a major factor. It is certainly one source of failure in the indicators, but it may not be the major source of failure.

Q Was that considered in your study, Mr. Curry?

A (WITNESS CURRY) Yes, it was. I do not believe it is a major contributor. I found -- my concern in terms of major contributors was the miscallibration of those level

indicators.

Q But that could occur if you had three level indicators. As far as correctable types of design deficiencies, that would probably be the major contributor.

A (WITNESS CURRY) Which would?

Q The power supply, diverse power supply, redundant power supplies.

A (WITNESS CURRY) In terms of hardware changes, philosophically, you will get improvement, obviously, if you have separate power supplies. It is less likely to fail two power supplies than one power supply. So you will get some improvement.

Q So under the existing scheme of having a level indicator on each tank and just by the fact of adding a diverse power supply could probably very measurably improve the reliability of that system with a fairly simple change, changing the power supply.

A (WITNESS CURRY) I am not sure that adding an additional power supply, if that was your question, will make a great difference.

Q My question was to, first of all, make them vital power supplies, put them from diverse power supplies -- in other words, the A condensate storage tank would come from the A power supply. The B would come from the B power supply.

A (WITNESS CURRY) And that certainly would improve the reliability of the system. It is, again, I do not believe, a major contributor now to the unavailability of the system.

Q But as far as that particular change, it would be a major factor, that particular item.

A (WITNESS CURRY) Well, again, I do not believe you are buying much in terms of reliability by adding it. Certainly philosophically you are, though, adding reliability, but it does not seem to make quantitatively a great difference.

Q But with that particular problem it would make a

difference, and that is something that could be done prior to restart.

A (WITNESS CURRY) Which particular problem is that?

Q The problem of level indication on the condensate storage tanks.

A (WITNESS CURRY) Well again, if one were concerned with the level indication failing, I believe that the major reason it fails would be due to some miscalibration, common mode miscalibration of both levels. So the thing to do there is to make sure there are administrative procedures to try to minimize that common mode. In other words, don't have the same man with the same instrument check both level indicators.

Q But that could be done with just two indicators in the current scheme.

A (WITNESS CURRY) Yes.

Q You say that the major contributor, which is the flow control, the automatic flow control -- is that correct -- as far as existing restart to proposed, would be required a year after restart; is that correct?

A (WITNESS CURRY) Okay. The major contributor to the unavailability of the system as it was --

Q I am talking between restart and what it will be.

A (WITNESS CURRY) The biggest change or improvement in reliability will result from the automatic -- at this

five-minute time period in terms of securing flow within five minutes will occur due to the addition of automatic actuation, safety-grade actuation of the system.

Q Okay.

A (WITNESS CURRY) I might add, safety grade, the concern that I have is the separation from the reliability. It is the separation that gives real meaning to that term.

Q Is it the current control system through ICS and also the current start system through ICS? Isn't that true? So I am not sure why their contributions would be a major difference in terms of --

A (WITNESS CURRY) There is a single failure in the ICS, as I am lead to believe from the information I have, that will prevent you from opening those normally closed valves.

Q As far as improvement in overall risk reduction to the life of the plant, how much would allowing that system to operate for a year as designed at restart or as anticipated at restart be compared to having the thing fully comply with all long-term requirements over its lifetime? How much would it change the risk?

A (WITNESS CURRY) Well, without a detailed study of the risk of the plant of the caliber of the IREP-type studies that Mr. Powsome had mentioned before, I cannot quantitatively tell you how the risk would change. I should

point out that is the key question in that it talks about or includes the integrated response of the plant.

Certainly I would expect that plant operators would be well aware of their system during that year and in a time frame related to the uncovery of the core and core damage sequences, I do not find the reliability of the system unacceptable.

Q Let's just say from the numbers you have given, the restart design unavailability of 3×10^{-3} per demand, and if the feedwater demands were three times a year, which number was thrown around, that gives you a total failure rate of 10^{-2} per reactor year.

A (WITNESS CURRY) Okay. Let's --

Q Then also compare that with, for one year, compare it to the 40-year lifetime. It seems to me it is no more than a factor of 2 overall increase in risk to allow that one additional year of operation. Is that not a rough --

A (WITNESS CURRY) Well, there is a little bit more to be taken into account because, again, it is not fair to consider that the auxiliary or emergency feedwater system reliability in terms of mitigating accidents is the same at 20 minutes as it is at 5 minutes. So that, and in consideration of other mitigating systems and in consideration of the fact that while we use three transients per year at the Commission, it may be a conservative number,

so I would have to sit down and think about the difference in risk.

But your line of reasoning is in the right direction, anyway.

Q But that is one of the considerations you used as far as accepting a year as being an acceptable time period for making this.

A (WITNESS CURRY) Clearly --

Q Is there any number that would have told you it was unacceptable?

A I would probably be concerned if -- and this is strictly judgment, my judgment -- I would not like to see this unavailability at 20 minutes. Such an unavailability would take into account operator action, and if it was still this high when it could be fixed I would not be unhappy -- happy with it, nor would I like to see it significantly higher than it is now at 5 minutes.

Q Mr. Wermiel, you said in a question from Mr. Pollard that as far as loss of emergency feedwater occurring as a result of a steamline break, that the acceptable probability as far as you were concerned was 10^{-6} for that steamline break, and I am wondering are the consequences of a loss of all feedwater any different than the consequences of a main steamline break as far as removing decay heat?

As a follow-on, in your opinion why is it

acceptable to have a proposed design of 4×10^{-4} as a total EFW reliability or unavailability in terms of loss of main feedwater, but 10^{-6} in terms of main steamline break?

A (WITNESS CURRY) Just as a point of information, I am not sure that we said anything about 4×10^{-4} as a design for loss of main feedwater mitigation systems.

Q But that is the unavailability of emergency feedwater.

A (WITNESS CURRY) It is the unavailability of emergency feedwater, the proposed design of emergency feedwater at 5 minutes, emergency feedwater only. It has nothing to do with other systems involved.

A (WITNESS WERMIEL) That is right. I cannot compare what you have postulated with respect to these numbers to the overall concern of core melt because there again are mitigating systems which have not been included in your accident scenarios that are available to you.

Q For a main steamline break aren't they also available?

A (WITNESS WERMIEL) That is what I am trying to say; they are. Certainly feed and bleed is available in the event of a main steamline break.

Q My question is: You said anything above 10^{-6} would be unacceptable, I believe. Maybe you did not mean to say that.

A (WITNESS WERMIEL) I do not remember what I said exactly. I thought what I was trying to say was that I was under the assumption and belief from what I have heard that 10^{-6} is a number that we use for the probability of a main steamline break.

Q But I think you said that anything below that would be unacceptable to you as far as --

A (WITNESS WERMIEL) I believe I said as far as environmental qualification of the equipment, though, as much as I recall. I think that is what we were saying. I think from that standpoint we would want to qualify the equipment.

CHAIRMAN SMITH: Mr. Dornsife, may I have just a moment. If we are going to get to offsite emergency planning tomorrow, it would be very helpful if Mrs. Moran could call up those intervenors and advise them, so I would like to take just a moment and compare notes and see how much more examination there is going to be with this panel.

MR. DORNSIFE: This is my last question.

CHAIRMAN SMITH: That was not the purpose of my interruption, however.

(Laughter.)

CHAIRMAN SMITH: Mr. Baxter, could you be helpful?

Is this one of your usual one more questions, or

is it really one more question.

MR. DORNSIFE: One more question.

CHAIRMAN SMITH: Okay.

Mr. Baxter.

MR. BAXTER: I did not say one more question. I haven't started.

CHAIRMAN SMITH: Okay.

MR. BAXTER: I would estimate 15 to 20 minutes.

(Board conferring.)

CHAIRMAN SMITH: All right. We are advising the lead intervenor that emergency planning may begin at 1 o'clock tomorrow afternoon. I would appreciate it if counsel would advise the cognizant counsel of that.

Mr. Dornsife.

BY MR. DORNSIFE: (Resuming)

Q I guess maybe you may have misunderstood my question. It seems that you are using a different criteria for judging the system when it is unavailable due to a main steamline break or when it is unavailable due to its unavailability from other things that are identified by Mr. Curry's work.

It seems that in either case if you have a loss of main feedwater or a main steamline break, you have to remove decay heat, and you need the system -- you have the same backup systems in either case, but in one case you are using

a criteria 10^{-6}, but in this case you say it is acceptable to have 4.5×10^{-4} as an unavailability with loss of main feedwater.

A (WITNESS CURRY) May I just comment on the probabilities? I do not think it is a matter of accepting or not accepting. It is just that there are contributors to the unavailability of the EFWS that add up to 4×10^{-4}. If yoiu add to that a main steamline break as a contributor, 4×10^{-4} plus 10^{-6} is not discernible.

Q No, I am talking about two different events. I amk talking about the system being available, assuming you have a main steamline break in the intermediate building.

A (WITNESS WERMIEL) I may have -- I hope I did not mislead you into thinking that we are licensing based on the number. The GDC is specific. The system required to mitigate a particular event must be qualified for the environment it will see from that event. It is a deterministic approach. There is no number attached to it.

Therefore, because you need emergency feedwater to mitigate a main steamline break, if that environment from the main steamline break can affect the system, it must be qualified to that environment. That is a deterministic requirement.

What the number was meant to imply was in backfitting a plant where we had found - noncompliance, we

had to consider other things, and other things than are the probability of such an event over an interim period of time where the system may not be in compliance. And I believe the number 10^{-6} was used only in that that is -- I believe that is still the currently acceptable probability of a main steamline break.

I did not mean to imply that that was acceptable as opposed to 4×10^{-4} being acceptable.

Q My concern was I believe that in answer to Mr. Pollard's question you said that if the probability of a main steamline break were greater than 10^{-6}, then you would want to take some corrective action.

A (WITNESS WERMIEL) Yes, I think I would, but I do not know how much greater. You know, we would have to look at that. The context of that I remember clearly. If there was a flaw in the steamline or something in the steamline that led us to believe 10^{-5} was erroneous, I think we would then have to take that into consideration and I think we would want to do something about it. That is what I was trying to say.

MR. DORNSIFE: I have no further questions.

CHAIRMAN SMITH: Mr. Baxter.

BY MR. BAXTER:

Q Mr. Wermiel, yesterday on your direct examination when you were correcting the table we started testimony

about the installation of safety grade auto initiation of emergency feedwater not taking place prior to restart. Mr. Capadano on behalf of the Licensee testified here earlier that there will be in place prior to restart safety grade automatic initiation of the emergency feedwater pumps.

So, what are you describing when you say there will not be a safety grade automatic initiation system?

A (WITNESS WERMIEL) I believe NUREG-0737 and the Lessons Learned document, 0578, are explicit. They state you must have safety grade automatic initiation of emergency feedwater system function. The function of the emergency feedwater system is not to turn on pumps. It is to deliver water to the steam generator. I will agree you will have safety grade pump initiation, but that does not assure you that the flow control valves will also be open when the pumps come on.

Q I understand. I was just trying to clarify what you meant.

A (WITNESS WERMIEL) That is what I mean by that.

Q Mr. Curry, there was some examination of UCS by you about using Attachment 3 to your testimony as a measurement of the improvement in reliability from hardware changes up to the time of restart and then afterward.

Isn't it true that since your analysis uses five minutes and this attachment uses five minutes as a success

criterion and therefore, as you testified, allows no credit for operator recovery action, the analysis also does not show improvements in reliability associated with new hardware being installed at TMI-1 which will allow for manual option by the operator to correct problems?

A (WITNESS CURRY) Well once again, that is the same thing. There is no credit for the operator action.

Q Or new hardware that has been installed but will facilitate that operator action?

A (WITNESS CURRY) No, no credit for operator action at all in that interval.

Q In NUREGs-0635 and 0611 which you referenced, the statement appears that the staff recognized it would be very difficult and subject to large uncertainty if an attempt was made to quantify the reliability improvement inherent through implementation of the recommended actions.

Do you agree with that statement, and would you advise the Board to utilize your Attachment 3 as a measurement of the improvement in the reliability obtained from the improved actions and modifications the Commission has directed with respect to EFW reliability?

A (WITNESS CURRY) I certainly recognize the fact that there are uncertainties in the numbers. It was a point that I thought important enough to mention in my written testimony. However, if I were asked to estimate the

system's unavailability at this time period, this would be my point estimate, and I think it is a reasonable basis for making comparisons between systems or among systems.

Q Mr. Wermiel, in your first piece of testimony in response to Board Question 6, you concluded that the proposed short-term modifications described in the TMI-1 restart SER will improve EFW system reliability to the point where restart can be permitted. You also testified on examination that the NRC staff does not have a quantitative reliability goal for the EFW system. Is that still your testimony?

A (WITNESS WERMIEL) Yes, it is.

Q Is at least one of the purposes, then, of your portion of the testimony, supplemental testimony, to explain why you feel justified previously and now in reaching your conclusion the reliability of the EFW system for restart without a quantitative reliability standard?

A (WITNESS WERMIEL) That is exactly right. I felt and I believe other people felt there was some confusion on parts of certain parties as to exactly what went into the evolution of our thinking that drew us to that conclusion, and that is what I attempted to do in my part of this supplemental testimony.

Q Taking into account what you know about the other pressurized water reactors that are operating and their

emergency feedwater systems, I would like each of you to answer this question: In your judgment is there a special circumstance with respect to TMI-1, either with respect to the challenge rate to its EFW system or the likelihood that it will fail such that it will be appropriate to apply a different regulatory standard, i.e., a quantitative number to the restart of this unit?

MS. WEISS: I am going to object to that, just to the form. I think you have asked two questions in one. I think the witness just answered they would have no quantitative reliability criteria. You have assumed that he can supply different ones.

MR. BAXTER: I am sorry. I phrased the question inartfully. I will do it again.

BY MR. BAXTER: (Resuming)

Q Is there a special circumstance, in your judgment, at TMI-1 with respect to either the challenge rate to the EFW system or with respect to the likelihood that it will fail, such that you think it is appropriate to apply a regulatory standard here, i.e., any quantitative reliability number, which you have testified you do not use for other plants?

A (WITNESS CURRY) I am not sure that the question as phrased is meaningful with respect to the numbers that we are talking about. In terms of plant risk, while there is

no Commission numerical goal, plant risk being defined as the probability of core damage, there perhaps is some movement in that direction. The role of any particular system in mitigating initiating events that lead to plant risk or core damage should be considered in the light of those overall Commission goals in terms of probabilities of core damage.

The vendor or the particular utility does not stand out in any way toward the ultimate goal. It would apply equally to anybody.

A (WITNESS WERMIEL) I would like to answer that question in two parts. I am not aware of anything peculiar about TMI-1 that would cause it to have any more challenges to its emergency feedwater system than any other plant. But secondly, I do recognize this ICS dependency in the opening of the flow control valves as somewhat unique and as something that is different from the majority of operating PWRs.

Other B&W plants, from what I understand, do have a similar dependence, and I believe this is -- this is peculiar, but I believe the analysis and the evaluation that we have done supports our conclusion that even with this dependence, we are still satisfied that the system at restart can be reliably operated and will be available.

(Counsel for the Licensee conferring.)

Q We had earlier testimony that in your analysis of the TMI-1 system, a dominant contributor to unavailability is ICS failure which prevents the opening of both the EFW flow control valves. Do you know mechanistically that this in fact will occur or is this an assumed failure?

A (WITNESS CURRY) Who is the question addressed to?

Q Either.

A (WITNESS CURRY) My assumption -- I have not done an analysis of the ICS. It is based strictly on the conclusion in the B&W report submitted to the staff that there was a common point of vulnerability in the ICS actuation of the control valves.

A (WITNESS WERMIEL) I have been told by people at NRC in the Instrumentation and Control Systems Branch who are familiar with the failure modes and effects analysis for the ICS NNI system that such a vulnerability does exist.

Q Is it your impression that B&W found that it exists mechanistically or they simply assumed it in their FMEA to study the consequences of it?

A (WITNESS WERMIEL) I do not know the details of the FMEA and how this conclusion was drawn.

A (WITNESS CURRY) It is my impression, having looked at other B&W reports, there was not always such a common point of vulnerability identified.

Q Looking at other B&W reports?

A (WITNESS CURRY) B&W did analyses for a number of plants, six similar emergency feedwater system analyses, and in looking at the other emergency feedwater system analyses, I do not recall such a single point vulnerability always idenntified. So, if you are asking for impressions, it is my impression that B&W found something or had some concrete basis that there was such a single point vulnerability.

DR. JORDAN: At TMI?

MS. WEISS: At TMI?

WITNESS CURRY: At TMI-1, right.

BY MR. BAXTER: (Resuming)

Q Prior to restart is there going to be the capability for operators manually to respond to such a failure?

A (WITNESS CURRY) It is my understanding that there will be.

A (WITNESS WERMIEL) Yes, yes, both from the control room and, of course, locally at the valve itself.

Q Did the reliability of the ICS NNI power supply play any role in your analysis, Mr. Curry, and if so, did you consider recent improvements that have been made by Licensee to that power supply?

A (WITNESS CURRY) Once again, I did not investigate the ICS system, and my estimate of that contributor was based largely on the single-point vulnerability identified.

Q I would like to understand a little bit about your view as to the extent to which we should compare the reliability analysis results which B&W obtained some time ago and which you have presented now here on TMI-1 versus those in NUREG-0635 and 0611 for Westinghouse and Combustion Engineering plants.

There is a sentence common to both of those reports which I can show you if you would like which says time and personnel limitations imposed on this study precluded a complete and extensive review of each EFW system.

Can either of you tell me how many people and how much time was spent on those two studies?

A (WITNESS CURRY) All right. The initial Westinghouse and CE studies were done in -- each plant study was done in a period of days by a group composed of staff members from what is now the Division of Systems Reliability Research, from the Office of Nuclear Reactor Regulation, and some utility representatives.

The purpose of that review again was in direct response to TMI, the occurrence at TMI, and to assess whether there were outstanding vulnerabilities in each of the utilities' EFWS systems.

Now, in terms of what was done for the analysis presented here, the number derived in my Attachment 3 for

the mid-1979 design was based on the review essentially of myself of the B&W report submitted to the staff. Those B&W reports for TMI as well as the other B&W plants were submitted to the staff at the request of the staff to have the utilities perform them.

My number is based on information in the report submitted for TMI-1, essentially review of that information, and an indepedent estimate of the system's availability.

Q The B&W analysis which was referenced in earlier Licensee testimony reports that each utility with a B&W NSS furnished plant-specific system drawings, electrical schematic diagrams, operating tests and maintenance procedures and technical specifications for the auxiliary feedwater system and pertinent support systems from which B&W extracted information necessary to prepare a detailed EFW system description and from which a fault tree was constructed for each utility based on the detailed system description.

Did the staff do a comparable effort for the CE and Westinghouse plants?

A (WITNESS CURRY) The staff effort for the CE and Westinghouse plants was probably not to that level, as I interpret those words.

Q You have in your testimony on page --

MR. BAXTER: Am I holding up the limited

appearances?

CHAIRMAN SMITH: How much longer do you have, Mr. Baxter?

MR. BAXTER: It will be very short, I think.

CHAIRMAN SMITH: Whatever your preference is. It is not very late.

MR. BAXTER: Okay.

BY MR. BAXTER: (Resuming)

Q In your comparison on pages 35 and 37 you only compare TMI-1 to Westinghouse plants. How would TMI-1 compare with the Combustion Engineering plants? In particular, were any of them in the high range?

A (WITNESS CURRY) Were any of the CE plants in the high range?

Q That is correct.

A (WITNESS CURRY) If you will hold on for a moment, let me check.

(Pause.)

CHAIRMAN SMITH: While Mr. Curry is checking, I want to bring to Mr. Pollard's attention our ruling this morning as to the tech specs might be questionable. I understand that you are happy with the explanation, but I wanted to point out to you that in the Order and Notice of hearing by incorporation -- well, in Short-term Item I.A, the Licensee is required to upgrade the timeliness and

reliability of the emergency feedwater system by performing the items specified in enclosure 1 of the Licensee's June 28, 1979 letter.

Going to enclosure 1 of the letter, there is a requirement number 4 or a commitment that there will be an incorporation of EFW auxiliary feedwater in TMI-1 technical specifications as specified in I&E Bulletin 79-05A, Item 8 and verification that the technical specification requirements of EFW capacity are in accordance with the accident analysis and will be conducted, more than usual bringing into the scope of the hearing and the Board's purview the actual technical specifications, I believe.

MS. WEISS: Thank you for drawing that to your attention.

CHAIRMAN SMITH: Are you ready with your answer?

WITNESS CURRY: Yes.

While depending on the transient, and since you quoted the high range, only in transient 3, which is the station blackout transient, are there any CE plants in the high range.

BY MR. BAXTER: (Resuming)

Q Are the Westinghouse plants that appear in the high range in your figures for the most part four-loop plants?

A (WITNESS CURRY) I am not sure that I can make the

statement that for the most part they are four-loop. I think the characteristics that tend to make them as a group in the high range are the fact that they are automatically initiated and there is significant separation among the trains of the systems.

Mr. Wermiel informs me that most of them are four-loop.

Q I think we understand from your testimony what the purpose of these various reliability studies were, that is, for comparison purposes between plants and to identify major contributors to unavailability. In fact, there is a statement in both NUREG-0635 and 0611 which I would like you to react to in terms of whether you agree with it or not that the results should be viewed in terms of the general conclusions and insights and not as an absolute reliability analysis of generic or plant-specific EFW systems upon which the acceptability of these EFW system designs may be judged.

A (WITNESS CURRY) I would agree that the acceptability of a design should not be based exclusively on its numerical estimate of reliability.

Q Is that at least one of the reasons why the numbers were not printed with 0611 and 0635?

A (WITNESS CURRY) Well, the reasons the numbers were not printed in those two NUREGs is due to the uncertainties associated with them in some respects. But to

answer your question: yes.

(Counsel for the Licensee conferring.)

MR. BAXTER: That is all I have for now.

CHAIRMAN SMITH: Is Dr. James Spang present? Dr. Spang. Is Mr. Don Hossler present?

You both are scheduled for about 5 o'clock. Do either of you prefer to wait or go forward? Does either of you have a time problem?

MR. SPANG: I have somewhat of a time problem. I have an appointment for 7 o'clock this evening.

CHAIRMAN SMITH: We are ready right now to receive your statement. Just between you, I wondered who had a time problem.

Why don't you proceed, Dr. Spang. Could you take a microphone. The one right in front of you works all right.

Dr. Spang, do you have a written copy of your remarks?

MR. SPANG: I do.

CHAIRMAN SMITH: Do you have an extra copy?

MR. SPANG: I do.

CHAIRMAN SMITH: It is very helpful if the reporter has your written statement as you read it.

Mr. Hossler, do you have an extra written copy of your statement?

MR. HOSSLER: No, I don't.

MR. SPANG: Shall I proceed?

CHAIRMAN SMITH: Yes, sir.

LIMITED APPEARANCE STATEMENT OF DR. JAMES R. SPANG
AMERICAN SOCIETY OF UTILITY INVESTORS

MR. SPANG: Mr. Chairman, members of the Board, my name is James R. Spang. I am here today representing the American Society of Utility Investors. The Society is a Pennsylvania nonprofit corporation organized for the purpose of advocating the interests of utility investors. Our membership currently stands at 3,422.

The Society had initially planned to address the Board at the second meeting scheduled for the William Penn Museum. Since that meeting was not held, we are pleased to have the opportunity to make our views known to you at this time.

The questions before you these past few months have been whether TMI-1 (a) meets current safety standards, (b) can be safely operated in conjunction with the ongoing cleanup of TMI-2, and (c) whether Met Ed has the financial resources to safely operate the reactor, and by financial resources I mean personnel.

Your decision, of course, is of the utmost importance to the continued confidence of the investor and the financing pattern of investor-owned utilities. We believe that Met Ed has already shown that TMI-1 meets

current safety standards, that it can be safely operated in conjunction with the cleanup of TMI-2, and that Met Ed does have the financial and human resources to safely operate the reactor.

However, since this is a highly technical subject requiring expert judgment and questions of fact, the Society will not presume to second guess this Board, the utility and the expert witnesses. Instead, we would like to take this opportunity to address the equally important question of the context in which the technical questions are framed, namely, what decision is in the best long-term interest of the rate payers, the community and the nation. To answer this question, we will need to briefly review the history of nuclear power, its relative safety and its cost-benefit ratio.

The age of atomic energy really began with the dropping of the bomb on Nagasaki and Hiroshima in the closing days of World War II. It not only brought that war to a timely end, but scientists and energy-producing practitioners everywhere soon looked upon the phenomenon as the key to unlocking a world of unlimited energy abundance for all mankind.

It only remained for a combination of government and industry leaders working together to develop the scientific and engineering knowledge for practical energy

applications. Progress in the field, however, was not without its critics. From the beginning, serious questions were raised regarding the safety and morality of using a source of energy that could conceivably destroy whole populations, if not all civilization.

Even those who favored the continued development of nuclear energy worked hard to reduce the potential threat of nuclear war through the introduction of veils of secrecy and nonproliferation agreements. Meanwhile, the Atomic Energy Commission led the field in developing and promoting the peaceful use of atomic power.

Its activities were crowned in part with the passage and subsequent extension of the Price-Anderson Act in 1957, which limited liability for commercial users to $560 million. Language in the Act made it clear that the Federal Government would accept responsibility for protecting the public and utility companies in the unlikely event of an accident.

On March 28, 1979, the unlikely event happened. The area surrounding TMI witnessed three days of severe uncertainty regarding the status and the danger of a reactor failure. The reactor met the test. The fuel core was safely contained and the emergency passed without any material damage to offsite property or health. Psychological stress, however, was immediately apparent, and

the critics of nuclear energy wasted little time in capitalizing on the opportunity.

Corporations were chartered, committees were formed, rallies were held and funds were raised to stop forever the further development of nuclear energy. Tremendous pressure was exerted on the politicians and the regulatory agencies to proceed with initiatives that would bankrupt the company, close TMI and signal the industry that the nuclear option was dead.

Still the factual remains: Are nuclear reactors safe, and if not absolutely safe, are they as safe or safer than any other currently acceptable energy source? We believe that they are, at least in relation to coal.

In terms of general safety to the population, an article appearing in the Harrisburg Patriot on April 23, 1980 reviews a recent Federal Environmental Protection Agency study. The article quoted the study as finding that emissions from coal-fired plants present a greater radioactive air pollution hazard to large populations than emmissions from any other manmade source.

It further notes that the study shows that the population of a suburban community situated near a new 1100 megawatt coal plant incorporating the newest pollution control technology is subject to a 20 times greater risk of developing a fatal cancer than if the facility were an 1100

megawatt nuclear generating station.

Even if we were to discount the immediate health threat to unsuspecting populations, we cannot ignore the safety of miners, the tens of thousands of cases of miners' athsma and 4000 deaths each year directly attributable to black lung disease, in addition to innumerable mining accidents. So much for coal.

More recently, Bernard J. Snyder, reporting for the staff of the NRC in presenting the final report on the environmental impact of TMI, noted that the total dose of radiation received by the entire population within a 50-mile radius of TMI would be a tiny fraction of the radioactive dose in the natural environment, an amount Mr. Snyder called totally insignificant.

Nevertheless, if we could all agree that the radiation danger to the surrounding population of a normally operating reactor is almost nonexistent, the question still remains: is there or was there any real danger to the community surrounding TMI after the accident?

Once again, the answer is no. Commonwealth Edison has extensively advertised the fact that even the much touted hydrogen bubble could not explode because there was not nor could there be any oxygen. That fact never made headlines. Indeed, on May 1, 1979 the NRC admitted the scare was all a mistake.

Roger Matson, Director of its Systems Safety Division, told a congressional committee that there never was any danger of a hydrogen explosion in that bubble.

Commonwealth Edison further reports that even if the fuel core had melted, it would not have spelled disaster, for a number of reasons. First of all, the fuel core in the reactor vessel was surrounded by a containment building, not just any building, an immense fortress with an enormously thick floor, 11 feet of solid concrete reinforced with steel.

Second, for a molten mass to eat through it, that concrete and steel floor could not be covered with water. That water is what is used to cool the core. And when the relief valve on the pressurizer stuck open sending several hundred gallons shooting out, the law of gravity gave it only one place to go, down to the floor right under the reactor vessel, right in the path a molten mass would take. That is the fallacy of the meltdown theory.

As for any sudden burst of steam pressure that might be released when the molten mass hits the water, it would not be nearly powerful enough to rupture the walls of the building, walls capable of withstanding almost twice as much force. In other words, there was no way for significant radioactivity to reach the outside atmosphere.

In summary, if these accounts are even half true,

the chances of any harm to the community are almost nonexistent. The concept of safety therefore is more psychological than it is real.

Now, let's turn for a moment to the cost-benefits. The Intelligence Journal carried an interview on March 5, 1981 in which Congressman Robert S. Walker is quoted as saying: "Nobody who has testified before our task force and in Congress could see a scenario in which the economics of TMI could be worked out without a reopening of Unit 1. I think it vitally important that we get on with the cleanup there."

In speaking of bankruptcy, Congressman Allen Ertel's March report to his constituents states: "Quite simply, bankruptcy is not a solution. The underlying financial quagmire will remain regardless of who owns the plant. In fact, bankruptcy would add litigation and other administrative costs to the already huge price of cleanup and would threaten to interrupt service to Met Ed's customers." In other words, bankdruptcy could worsen the situation and does not hold any solutions.

In the same vein, the March 29, 1981 issue of the Harrisburg Sunday Patriot quotes PUC Chairman Susan Shanaman as saying: "I think only a minor percentage of people are stilling calling for bankruptcy because they view it as a means of punishment for the utility, but who will be

punished is the ratepayer."

In closing, let me add that the Reagan Administration is solidly committed to nuclear power for good reason. In their estimation, America cannot continue to keep pace with the world community without nuclear power, and they do not want to see America weakened by an impossible demand for a totally risk-free society.

In relation to risk, Admiral Hyman Rickover, in an address to the Annual Convention of the International Platform Association in Washington, D.C. on August 1, 1979 notes that one of the most widely distorted risks is radiation. He states that the word "radiation" has come to connote danger. It is often described as so dangerous that any amount is unsafe, and the question worth addressing is how fast will radiation harm you.

Because you cannot see, feel, taste, hear or smell radiation, it has an aura of mystery, but this same aura of mystery appears to be absent from other potentially hazardous things for which we have a lack of sensory perception, such as radio waves, carbon monoxide or small concentrations of numerous cancer-causing substances.

"In radiation as in other areas," Admiral Rickover continues, "a most effective way to frighten people is to state that no one knows what the effects of low level radiation are. By the same token," he points out, "no one

knows what the effects are of smoking a few cigarettes or, for that matter, our exposure to carbon monoxide on the way to this hearing."

The point is that the effects, if any, are extremely small. What we should be emphasizing is how much we do know about these small actual effects. The Society submits that the above examples and discussion clearly represent the context from which the questions before you stem.

In view of the above considerations, the Society calls for the restart of TMI-1 for the following reasons. One, the half-dozen similar reactors to TMI are currently operating in the United States. Two, TMI-1 has been functionally separated from TMI-2. Three, substantial savings would accrue to GPU ratepayers through reduction in the cost of energy.

Four, restart would help to reestablish the badly tarnished image of the Federal Government as a responsible partner in the promotion of commercial nuclear power. Five, restart would be a signal to the financial community that the Federal Goverament is committed to advancing the nuclear option. Six, restart would give official recognition to the fact that commercial nuclear reactors have been and continue to be safe.

Finally, let me add that among all the things the

Federal Government might do to aid GPU, the most important is simply to approve the restart of TMI-1. Anything less is unconscionable, in our judgment.

Thank you.

CHAIRMAN SMITH: Thank you.

MR. SPANG: I have additional copies here if you would like some.

CHAIRMAN SMITH: Yes. You are free to pass them out to the parties present. This is actually bound into the transcript of today's hearing. I mean this is actually read into the transcript just as if you are testifying. It is not evidence, of course, you realize.

MR. SPANG: That is correct.

MR. CUTCHIN: Mr. Chairman, before we move to the next statement, are these witnesses going to be heard further this afternoon or may they get up and move around?

CHAIRMAN SMITH: Mr. Pollard, it looks like there is going to be very little, if any, time for anything further. I know you are eager to get back. I think we should allow just a few minutes for very important cross-examination if you have it.

(Counsel for UCS conferring.)

CHAIRMAN SMITH: In any event, you gentlemen can get up and walk around if you wish, or take a break.

Mr. Hossler.

LIMITED APPEARANCE STATEMENT OF DONALD HOSSLER

MR. HOSSLER: There are several things that I would like to talk about regarding the TMI-1 hearings; however, I sort of have broken them into three different areas. One is a response to the NRC staff's recent attempt to create what I would call a frenzied atmosphere of brownout fever to the local citizenry, two, a review of capacity figures to show that electrical generation is available in the area, and three, several issues related to the psychological well-being of area residents living near TMI.

Before I get into what I want to start off with, I want you to know that I realize that maintenance of electrical generation equipment is necessary. It may take 5 to 12 years to build a power plant. Unplanned outages can occur and power plants must come on-line to replace those that are retired.

As we all know, GPU is a member of the PJM Interconnect, and NUREG-0689 states that without TMI in service, the PJM would experience no problem in at least the next two years. Senate Report 96-14, July 1980, states that without TMI-1 or 2 on line and no new capacity added, the Pennsylvania-Jersey-Maryland Interconnect would have a reserve margin of at least 25 percent until 1989. That is on page 395.

The utility industry says reliable service implies reserve margin of a certain amount above peak demand. The PJM has a reserve margin requirement above peak set at 22 percent. GPU has a reserve margin requirement above peak set at 24 percent. Estimates of PJM above peak for 1981 is 27 percent reserve margin, 1982, 27 percent reserve margin without TMI-1 or 2 operating.

Also, using several documents I have been able to uncover that GPU capacity is about 14 percent of the PJM Interconnect and a lot of the information I get is coming from a report put out by the Pennsylvania Public Utility Commission, the Present and Future Electric Demand and Capacity, July 1980.

What I did is I added up just some figures. I am not a technician but I just found it very interesting, and I found out that GPU's installed capacity for summer 1980 was 6,399 megawatts. The estimated peak demand for GPU summer 1980 was 6,153 megawatts. So basically you get a theoretical GPU excess capacity of 246 megawatts for the summer of 1980 without TMI-1 or 2 operating.

To take a different look at it, from 1981 until 1985, Met Ed without TMI-1 or 2 will average a shortfall of 384 megawatts below estimated peaks. In the same time-frame, 1981 to 1985, Penelec willl average a reserve of 189 megawatts over estimated peak demand.

The result through 1985 is a combined Met Ed and Penelec shortfall of about 195 megawatts below peak demand each year without TMI-1 or 2. I did not include Jersey Central Power and Light because I could not get ahold of their statistics.

But what I found amazing was simply that there was a theoretical excess. Of course, if some are off-line for maintenance, you do not know the excess. There was an excess in summer of 1980 looking at just Met Ed and Penelec.

Now let's see what type of replacement power is available to GPU now and in the future. Keeping in mind and estimated Met Ed-Penelec shortfall each year, 1981-85 of 195 megawatts below peak, GPU presently has contracts for 200 megawatts from Ontario Hydro, 200 megawatts from PP&L, and 40 megawatts from Jamestown-York.

Also, 1000 megawatts is available from systems west of here. Also, direct current intertie under Lake Erie by Ontario Hydro is expected to be completed by 1985 and should have about 1000 megawatts available.

Also, GPU proposed conservation and management program is expected to reduce Met Ed peak load by 300 megawatts by the year 2000. In February of 1981, negotiations for 254 more megawatts of coal power from Ontario Hydro were being conducted by GPU. It appears there is plenty and will be plenty of replacement power available

to GPU now and through the 1980s, it seems to me, without TMI-1 while the company concentrates on the decontamination at TMI-2.

The problem, of course, is the cost of replacement power, as I see it. It looks to me like Jersey Central Power and Light is the real problem for GPU because it is 66 percent oil and gas fired, 25 percent nuclear and 8 percent coal. That 25 percent nuclear is one power plant, Oyster Creek, which will be down in August 1981 because large leaks must be repaired.

Also, Oyster Creek was out in January 5, 1980 to July 19, 1980. The New Jersey Public Advocate Commission study found management weak in tackling problems with relatively unsophisticated planning methods. Another point is that major additions to Penelec's capacity are anticipated for 1987 and then 1994. Major deletions to capacity for Penelec are 1994 and then in 1998. For Met Ed, first major additions to capacity are slated for 1991 and major deletions to capacity are slated for 1994.

These additions do not reflect anything from Susquehanna, the Susquehanna Nuclear Power Plant. And of course I realize that the financial circumstances might mean that the utility cannot build any further energy generation. But I am simply making the case here, basically, that power is available outside of the system.

Another interesting statistic from the Senate report 96-14, July 1980 speculates on GPU's summer of 1980 energy requirements with TMI-1 and 2 on line summer of 1980. Met Ed would have 50 percent excess over peak demand. Penelec would have 35 percent excess over peak demand. Jersey Central Power and Light would have 2-1/2 percent excess over peak demand.

The GPU system would have a 20 percent excess over peak demand with TMI-1 and 2 operation in the summer of 1980. Information I have seen indicates a 15 to 20 percent excess reserve over peak is adequate.

Several facts I would like to leave you with are that Pennslylvania used .4 percent less total electricity in 1980 than in 1979. PP&L from January 1977 through January 1981 experienced a 1.8 percent growth in electric use. In 1981, PP&L is expected to have 42 percent reserve above peak demand. If Susquehanna 1 and 2 go on line, PP&L would have an estimated 60 percent excess capacity over peak demand.

Ten percent of the world's oil goes to generate electricity. That oil is generally bottom of the barrel oil that would wreck your car engine or your furnace. In 1979 oil-fired kilowatt hours were down 18 percent -- that is 300,000 barrels of oil a day -- even though nuclear output was down 8 percent. West Penn Power Company in Pennsylvania is all coal and hydro and has the lowest electric bills to

consumers in the state.

When the NRC staff raised a question about brownouts several weeks ago, I immediately wrote a letter to Mr. Richard Wiener, Director, Division of Power Supply at DOE, and just some things I would like to share with you. I realize that the media can take information and print what they want, but I think that the DOE did us a disservice by not specifying when the brownouts were and how severe they were.

I got that clarification from Mr. Wiener, and what I found out was that the brownout conditions occurred on July 21, 1980 and September 2, 1980. The conditions existed for approximately four hours on July 21 and five hours on September 2. Voltage reduction and customer load appeals were accomplished in the eastern areas of the PJM.

I believe the point is clear that there is an excess of power; however, replacement power costs must be dealt with, however possibly in another forum.

CHAIRMAN SMITH: Mr. Hossler, are you aware that that information from the Department of Energy was submitted by the NRC staff with respect to the need for --

MR. HOSSLER: Expedited hearings?

CHAIRMAN SMITH: The need for low power testing. And that was referred to the Commission, and now the Commission has already ruled on that point, and it is

totally outside our jurisdiction entirely. There is nothing in our Notice of Hearing which allows us to look at need for power in our hearing. I thought you might appreciate that information.

MR. HOSSLER: I appreciate that; and I think that a lot of the comments I make are very similar to what Mr. Spang has made, but I appreciate that.

I believe here that the emphasis should be on applying GPU and Met Ed's ability to concentrate on decontaminating Number 2 and not operating Number 1 while it is being decomtaminated. Can the NRC expect the TMI area population, already overly traumatized by commercial nuclear power, have confidence in the utility's ability to operate a plant and decontaminate a plant, as well as the NRC's ability to regulate?

The Lessons Learned from TMI are always espoused as being helpful to the nuclear industry and the NRC. In the Washington Post on February 11, there was an article about the NRC's study which showed a clear failure of Met Ed to collect, analyze and rele e information about what was going on in the plant. The NRC study said that there was no system in Met Ed for gathering and evaluating all the information that everyone had.

Morris Udall's committee also released a report which found Met Ed officials were "presenting state and

federal officials with misleading statements that conveyed the impression that the accident was substantially less severe and the situation more under control than what the managers themselves believed and what was in fact the case."

Udall expressed concern in a letter to the NRC that the report does not provide adequate support for its conclusions. Victor Stello of the NRC characterized the management attitude of Met Ed as hesitancy about casting thing[illegible]n the worst light, especially if you really thought that things were just about to get better, but said that the management did not lie.

The NRC report also said that much potentially frightening information, including high temperature readings and the sudden burst of pressure in the containment building, indicated serious problems that were outside the operator's training and experience. As a result, they were written off as a faulty instrument measurement.

The Udall report said that the TMI plant managers were aware of information indicative of a situation much more perilous than was reported to state and federal officials.

Another problem occurred at Indian Point which I think reflects on how the area population views the NRC's control of things since the TMI accident and thereby instills in them certain ideas about how that plant would be run if the NRC Commissioners vote to allow it to reopen.

Indian Point was shut down since October 17, 1980 when 100,000 gallons of water leaked into the containment. It has been determined that tests must be conducted to ascertain whether the water caused thermal stress weakening the reactor vessel. On October 17, Con Ed told the NRC of the flooding, said nothing of 50 workers exposed to radiation.

On October 20, Con Ed restarted the plant without detailed safety checks and decided there was possible reactor damage. On October 28, the Con Ed PR chief admitted

that Con Ed executives did not tell him of the accident until October 21. The New York Times on December 27 reported that NRC transcripts showed that the stationing of technical advisers of the plant which resulted from the Lessons Learned at TMI was inneffective.

Furthermore it showed that a regional section chief for the Commission found Con Ed employees' actions comic when they looked at the diminished flow of the pumps and thought that the leaks had diminished.

In discussions leading up to the ratification of Mr. Victor Stello's proposal to the Commission, Commissioner John Ahearne asked what the shift technical adviser was doing amid the confusion. This is a technical person assigned to nuclear power plants following the Three Mile Island accident.

Mr. Ahearne asked was he analyzing the stuff. Thomas Martin, the Commission's regional section chief, said no, sir, he was not. "The shift technical adviser is stationed but not really trained. They have a lot of nitty gritty of the plant to learn. They are using the system descriptions," which are out of date, by the way.

Moving to the issue of evacuation, which I believe you will be looking at very soon, I would like to say that the Middletown area has done an outstanding job of preparing for an evacuation for all emergencies. You can look at

evacuation or you can look at sheltering. To my mind it does not matter.

I think there is a difference in evacuating people in St. Louis, Missouri and evacuating people in Middletown, and what I mean is at the first instance of a problem, even though the ruling is going to be sheltering or evacuation, I will go to the school, I will pick up my children, I will take the quickest and most direct route to get out of the town because I feel that I cannot trust the utility nor the NRC because of what I went through and have been going through because of the accident.

I think it is very difficult to instill in me very much confidence that the information coming out of there will be accurate, whether it is the news media's fault, the state's fault, the NRC's fault, the utility's fault. If you are going to shelter people, I do not think it will work. I think they will leave anyway.

I think if you have evacuation routes, I think that is great that they are set up. I do not think they are going to work. People are going to go to the schools, they are going to get their children. If they are 15 miles from home, they will go home and get their families. They will do that. They will not meet them in Wilkes Barre or anywhere else.

I guess perhaps some of us should take the

description of what Herman Dieckamp of GPU suggested as was printed in the York newspaper on June 19, 1979, in the York Daily Record where he said, "If a given individual finds reopening of TMI-1 unacceptable, then he has the freedom to move, to change something."

I also found out that the Jersey Central Power and Light, which is part of GPU -- and I know you are not studying that but once again I think the whole thing comes down to the fact that you need to gain the confidence of the people -- Jersey Central Power and Light is part of the GPU group, and it appears that a management study was recently done which says that the management of GPU contributed to a prolonged shutdown last year that cost about $50 million more than expected, according to an outside investigation done by Greg Miner and Dale Bridenbaugh.

The outage began January 5, 1980 and was scheduled to last 10 weeks, but inspectors found reactor safety defects. The time needed for extra repairs, coupled with unanticipated problems, prolonged the outage until July 19. However, management was depicted in this study as weak in tackling these problems.

This was compounded by relatively unsophisticated planning methods that lag far behind these of other utilities, the report said. For much of the life of Oyster Creek, which started in 1970, it was an above average

record. However, since 1977 this record has deteriorated.

People boast about TMI-1's record since 1974, and I think there are some comparisons here to make with Oyster Creek. Four or five weeks have been set aside beginning April 1981 for the installation of devices intended to prevent an accident like the one at Three Mile Island. For about six months this fall, the difficult task of replacing the cracked cooling pipes --

CHAIRMAN SMITH: Mr. Hossler, I think our reporter -- you are speaking very, very rapidly, and I am not sure he is getting it all. Could you slow down your pace a little bit?

MR. HOSSLER: Sure.

For about six months this fall, the difficult ta[illegible] of replacing the cracked cooling pipes, core spray spargers with an altogether new system will have to be done. A six-month shutdown could cause repairs upwards of $70 million in substitute power expenses. The company has repeatedly underestimated -- this is from the report, now -- "the company has repeatedly underestimated the problems with the core spray sparger," and this continues.

Another newspaper article, February 11, 1981, indicates that a spokesman for Jersey Central Power and Light said there is no public danger posed by the estimated ten gallons of water that is believed to have leaked through

a wall of three feet of concrete into the soil. The ten gallons seeped outside when 25 gallons of waste water spilled onto a floor within the radiation waste treatment plant, the NRC said.

The NRC spokesman said -- I am sorry, the Oyster Creek spokesman said the room was "designed to be leak-proof" but would have to be modified. The rad waste facility which opened in 1978 is about 100 yards north of the reactor.

Another example --

CHAIRMAN SMITH: Mr. Hossler, could I inquire, how much more do you have?

MR. HOSSLER: About five minutes.

CHAIRMAN SMITH: You are eroding the time that we hoped to complete cross examination of this panel. The Union of Concerned Scientists will not be able to return. We hoped to have some time left for them to do it.

MR. HOSSLER: I will cut through it. Okay.

CHAIRMAN SMITH: If you could summarize, we are quite familiar with much of the material that you have already given us.

MR. HOSSLER: Okay, fine.

I would like to turn to a letter which the NRC is getting on turning TMI-1 on, and I would just like to point out in the letter it points out that 58 percent of those in

cities near TMI have favored restart. I would like to just add that I have a poll that was done at the Hershey Medical Center that indicates that 60 percent of those living within five miles would like it closed.

There have been several studies which I want to just share with you here. A study done by Cynthia Flynn at the University of Kansas showed that 50 percent of those surveyed living within a five-mile radius of TMI stated the disadvantages of TMI outweighed its advantages.

Peter Houtz of the Hershey Medical Center said 60 percent of those living within five miles of TMI opposed its reopening. The Middletown Press and Journal did a survey that found over 60 percent are opposed to the restart of TMI-1. Oralton Borough, which is about one mile from TMI, found out that 50 percent of the people were in favor of a conversion of the plant. Lower Swatara Township did a survey. They are located three miles from the plant. They found out 64 percent of the respondents did not want TMI as a nuclear facility.

Senator George Geekis of Pennsylvania did a newspaper poll and found out that 63 percent of those responding did not want TMI open as a nuclear facility. Swatara Township did a poll. That is five miles from TMI. They found out that 64 percent of the people did not want TMI reopened as a nuclear facility.

Local governments, High Spire Borough, four miles from TMI, voted in 1979 to permanently shut down TMI as a nuclear facility. Mechanicsburg Borough councilmen, 14 miles from TMI, voted a permanent shutdown of TMI as a nuclear facility. Lower Swatara Township, three miles from TMI --

CHAIRMAN SMITH: Mr. Hossler, are you aware that another member of the public has given us the same information, has come in here and read the same list of informal polls and resolutions? Maybe it is not identically the same, but many of them I identify as being the same.

What I suggest that you might want to do is to be assured that we do have them and have them accurately, why don't you reduce it to writing and give it to us or mail it to us and we will most assuredly read it and make sure it is a part of the public record, if that will be helpful to you.

MR. HOSSLER: Perhaps I could give it to the reporter, okay, before I leave.

CHAIRMAN SMITH: All right, you can do that. We will do it just that way if you want to. That would be quite convenient.

MR. HOSSLER: Then finally I would just like to say I reviewed a letter of February 13, 1981 from R.C. Arnold of the utility to John Ahearne of the Commission, and in that letter he talks about milestones for the restart,

possible restart, and he also talks about different things which should be done. And I notice in here he says things like no additional prerestart requirements as a result of the ASLB decision, no delay due to FEMA certification of state and local emergency plans.

He goes on with several things here that he feels the utility should do to speed up what he feels is going to be a restart.

I would just like to tell the three judges that I believe the people in this area really deserve more than the treatment of this plant as any other B&W reactor in the country. We have had an accident here. It is a continuing accident. And I would hope that this kind of documentation which is being sent to you, which basically says things like overlook this or overlook that --

CHAIRMAN SMITH: That document, incidentally, was sent directly to the Commission, and the Commission, as I indicated before, has ruled and has decided not to accept the recommendations made in that document.

MR. HOSSLER: Okay, fine.

In that case I would just like to say that in your recommendations to the Commission this summer, I would hope that you treat this as a unique operating reactor and not as other B&W reactors. I really believe that we deserve all the operators being 100 percent certified, 100 percent

certification, no variances, no things like that. I think we deserve that. I think if something should happen, if you should suggest a restart to the Commissioners, I think it would not shed a good light on the ASLB for the hearings.

With that, I will conclude.

I have several questions that I was going to direct to you about limited appearances and in what form you are going to send your recommendations to the Commission. I would like to briefly say that I would hope whatever is written out of your determinations and the NRC Commissioners, that it could be written in such a form that people would understand what the contentions were and what the decision was and why it was made in such a manner, because I find it very difficult in digging through a lot of this information, and I would hope that you could make it easier for a lot of us to understand why you decided what you decided.

CHAIRMAN SMITH: Well, we certainly hope we can do that, and we will try.

MR. HOSSLER: Thank you.

CHAIRMAN SMITH: Thank you very much, Mr. Hossler. You have on several occasions written and called and have given us quite helpful suggestions on limited appearance statements. You are going to give a portion of your statement to the reporter

Now, would you like to have a brief cross-examination?

MS. WEISS: I think I may have just one short line of questions.

CHAIRMAN SMITH: I thought we could bind this into the transcript. What I will do is tomorrow I will read the parts into the transcript that you did not get to, and I am sorry I interrupted because I see you were almost completed with that list of resolutions and polls. In fact, let's do it right now.

The only one you did not get to was Marietta Borough; is that correct?

MR. HOSSLER: Yes.

CHAIRMAN SMITH: Marietta Borough, 9/20/79, permanent shutdown of TMI as a nuclear facility.

The next one, Columbia Borough, 9/21/79, permanent closing of TMI as a nuclear facility.

Lower Paxton Township, October 16, 1979, kept closed unless or until more comprehensive, stringent and fail-safe methods of operating the plant are developed.

Now I think that your statement is probably complete, then, Mr. Hossler; is that correct?

MR. HOSSLER: No. I did not hear Middletown Borough.

CHAIRMAN SMITH: Middletown. You had had Swatara

Township. Middletown Borough, July 2, 1979 adopted several items. The major one was nuclear exclusions must be removed from all insurance policies before TMI-1 is reactivated as a nuclear facility.

Okay. When I had asked that you put it in written form, I was not aware it was substantially complete; otherwise, I would have allowed you to complete it. Do you think we have it now?

MR. HOSSLER: Yes. Could you bind it in with --

CHAIRMAN SMITH: I do not think it will fit into the transcript very well. That is the problem. I do not think we can do it. It will not work. You review it. If you think we left something out, you write it and we will put it in. We cannot reliably promise you that this will end up in the transcript in the form that you have submitted it.

MR. HOSSLER: Send it to you?

CHAIRMAN SMITH: Yes, sir. You better take this back, then.

MR. HOSSLER: I have a copy.

CHAIRMAN SMITH: Do you? Okay. Yes, if you think there was something left out, you send it in.

MR. HOSSLER: When can I review the transcript?

CHAIRMAN SMITH: At the public document room.

Mr. Hossler, do you understand that we have

intervenors who are carrying a very heavy burden in trying to present a position against the utility? They are waiting to cross examine these witnesses after you get done with your business, and they cannot return and we are intruding upon their time.

MR. HOSSLER: Sure.

CHAIRMAN SMITH: I mean these people --

MR. HOSSLER: I waited too. I was there March 5.

CHAIRMAN SMITH: Do you understand that they have an interest almost identical to yours?

MR. HOSSLER: Thank you.

CHAIRMAN SMITH: Sure.

Ms. Weiss.

BY MS. WEISS: (Resuming)

Q There was some discussion in Mr. Baxter's cross-examination about NUREGs 0611 and 0635, the staff reviews of the Combustion Engineering and Westinghouse plants and staff's review of the B&W analysis of its own plants.

Can you just tell me what conclusions the staff reached upon consideration of all those studies after they were completed with respect to the relative reliability of B&W emergency feedwater systems and/or the relative number of challenges to emergency feedwater systems among and between the vendors?

A (WITNESS CURRY) Well, the reports are issued for a particular vendor. The staff, with respect to your question about challenges to each system, there is an additional NUREG, which is NUREG-0560, I believe, which discusses the staff's conclusions about feedwater transients in terms of the conclusions about the relative reliabilities of B&W systems.

The results that I presented today are being prepared for inclusion in a NUREG which presents the results of the staff's review of the B&W-submitted analyses of six or seven auxiliary feedwater system designs. That NUREG is not finished yet and there is no one particular document that compares them vendor by vendor.

That is what I tried to make an attempt to do in my testimony.

Q I understand that there is not any such document, but didn't the staff take actions with respect to B&W that were guided by your feeling about the relative number of challenges to EFW and/or the relative reliability of EFW between and among the various vendors?

A (WITNESS WERMIEL) I am not sure what actions you are referring to. All the recommendations or criteria that I have identified in my testimony have been applied to all plants.

Q When were the B&W plants shut down?

A (WITNESS WERMIEL) They were shut down right after the TMI-2 accident, but I do not recall the exact date.

Q I think it was some months after.

A (WITNESS WERMIEL) I do not recall exactly when.

Q Do you remember what precipitated that?

A (WITNESS WERMIEL) No, I do not specifically.

Q And none of the other -- the Combustion Engineering plants or the Westinghouse plants were shut down.

A (WITNESS WERMIEL) No, not that I am aware of.

(Counsel for UCS conferring.)

MS. WEISS: I have no further questions. Thank you.

CHAIRMAN SMITH: Is there anything further this evening? If there is nothing further this evening, we will adjourn until 9:00 a.m.

(Whereupon, at 6:00 p.m. the hearing was adjourned, to reconvene at 9:00 a.m. the following day, Thursday, April 2, 1981.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

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in the matter of: METROPOLITAN EDISON COMPANY(TMI Unit 1)

Date of Proceeding: April 1, 1981

Docket Number: 50-289 (Restart)

Place of Proceeding: Harrisburg, Pa.

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

David S. Parker

Official Reporter (Typed)

(SIGNATURE OF REPORTER)