UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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In the matter of: :

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METROPOLITAN EDISON COMPANY : Docket No. 50-289

: (Restart)

(Three Mile Island Unit 1) :

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25 North Court Street,
Harrisburg, Pennsylvania

Tuesday, December 23, 1980

Evidentiary hearing in the above-entitled matter was resumed, pursuant to adjournment, at 9:02 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

APPEARANCES:

On behalf of the Licensee, Metropolitan Edison Company:

GEORGE F. TROWBRIDGE, Esq.
THOMAS A. BAXTER, Esq.
DELISSA A. RIDGWAY, Esq.
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On behalf of the Commonwealth of Pennsylvania:

ROBERT ADLER, Esq.
Assistant Attorney General,
505 Executive House,
Harrisburg, 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, IV, Esq.
Office of Executive Legal Director,
United States Nuclear Regulatory Commission,
Washington, D. C.

# C O N T E N T S



EXHIBITS

P R O C E E D I N G S

CHAIRMAN SMITH: On the record.

You may proceed when you are ready, Mr. Trowbridge.

MR. TROWBRIDGE: All right.

Whereupon,

PAUL SHIPPER, JR.

JOSEPH TORCIVIA

resumed the stand, having been called as witnesses by Counsel for Licensee Metropolitan Edison, and having previously been duly sworn, were further examined and testified as follows:

REBUTTAL EXAMINATION -- Resumed

BY MR. TROWBRIDGE:

Q Mr. Torcivia, would you turn, please, to page 4-9 of Mr. Pollard's testimony, beginning about the -- at the end of the sixth line on that -- excuse me, beginning -- the sentence beginning at the end of the sixth line, Mr. Pollard makes the statement, "The TMI 1 design does not provide safety grade isolation devices between the non-safety grade heaters and the safety grade on-site emergency power supply."

Is Mr. Pollard's statement correct?

A (WITNESS TORCIVIA) No, sir.

Q How about the main feeder breaker? Is it fully safety grade?

A (WITNESS TORCIVIA) Yes.

Q How about the distribution breaker?

A (WITNESS TORCIVIA) That in itself is safety grade with the exception that it is not in an area which is seismically, fully seismically qualified.

Q I think you may need that microphone a little closer.

Turning to page 4-5 of Mr. Pollard's testimony, Mr. Pollard refers to IEEE Standard 384 as endorsed by Regulatory Guide 1.75. The version of IEEE Standard 384 referenced in 1.75 is the 1974 version. Has a later version of IEEE 384 been adopted?

A (WITNESS TORCIVIA) Yes, sir.

Q That is officially approved, not just for trial use?

A (WITNESS TORCIVIA) To the best of my knowledge.

MR. TROWBRIDGE: Mr. Chairman, I would offer for identification, I believe it is Licensee's Exhibit 22, a copy of IEEE Standard 384-1977.

MS. WEISS: Are you offering this as evidence now?

MR. TROWBRIDGE: Pardon?

MS. WEISS: Are you offering this in evidence?

MR. TROWBRIDGE: I am asking that it be identified.

(Counsel distributing documents.)

(The document referred to was marked Licensee Exhibit No. 22

for identification.)

MS. WEISS: We have been given a document that starts with page 7. Are the first six pages --

MR. TROWBRIDGE: That is the document I have. I have no explanation for its beginning with page 7.

BY MR. TROWBRIDGE: (Resuming)

Q Mr. Shipper or Mr. Torcivia, can you explain that?

A (WITNESS TORCIVIA) I believe the previous pages is indexing and other -- I don't have it on mine either.

Q Mr. Shipper?

A (WITNESS SHIPPER) Those are the approvals, the approval letters showing the various committees, various persons on the committees.

Q Mr. Shipper, can you confirm that this 1977 version of IEEE 384 has been officially adopted?

A (WITNESS SHIPPER) By the IEEE Standards Committee, yes.

CHAIRMAN SMITH: Where on the document do we see -- I see.

MR. TROWBRIDGE: You have to look at the second page, left hand corner.

BY MR. TROWBRIDGE: (Resuming

Q Mr. Torcivia, does the IEEE 384-1977 standard provide criteria for power circuit isolation devices, including circuit breakers tripped by fault currents?

A (WITNESS TORCIVIA) Yes, sir. Yes, sir.

Q Should we be looking at Section 6.1 on page 15 of the document?

MS. WEISS: I object at this point. Mr. Trowbridge has been leading this witness all through his examination. I think it has become troublesome to the point where the witness is not testifying.

MR. TROWBRIDGE: I would concede the technicality, Mr. Chairman. I think this speeds the process up. If Ms. Weiss really has a technical quarrel, or Mr. Pollard does, with the obvious answer, I would suggest she make her objections then.

CHAIRMAN SMITH: The standard that should be applied in a proceeding like this is the leading of such a nature that the interrogator is supplying the answer to the witness. You don't think that is the case, do you?

MS. WEISS: I do. I didn't object earlier because I thought it was a way of speeding things up, but I do think he has been giving the answers.

CHAIRMAN SMITH: All right.

BY MR. TROWBRIDGE: (Resuming)

Q Mr. Torcivia, can you identify the portion of IEEE 384-1977 which provides criteria for power circuit isolation devices?

A (WITNESS TORCIVIA) I'm looking at 6.1.2.1,

circuit breaker tripped by fault currents. I presume that is what you are referring to.

Q That is a subsection of 6.1?

A (WITNESS TORCIVIA) That's correct.

Q Does 6.1.2.1 -- it is obviously labeled Circuit Breaker Tripped by Fault Currents. To avoid a leading question, I will quote the first portion of 6.1.2.1, "A circuit breaker automatically tripped by fault current qualifies as an isolation device, provided the following coordination criteria are met."

The first criterion, numbered 1, starts, "The breaker time overcurrent trip characteristic for all circuit faults will cause the breaker to interrupt the fault current prior to initiation of a trip of any upstream breaker."

Mr. Torcivia, does the TMI circuit breaker design meet Criterion 1?

A (WITNESS TORCIVIA) Yes, sir.

Q In what respect?

A (WITNESS TORCIVIA) If we may refer to Figure 1 again --

DR. JORDAN: Of your testimony?

WITNESS TORCIVIA: Of the testimony, yes, that is correct.

May I say this? The prompt answer would be that the time current settings of each individual breaker has

been coordinated so as to be able to trip the downstream breaker first, and up down the line in accordance with this, but the Figure 1, the distribution breaker settings are such that it will trip before the main feeder breaker will trip. The main feeder breaker also has been set so as to trip before the main breaker is tripped, so our coordination is in accordance in that the downstream breaker, which is the distribution breaker, will trip first, and the main feeder breaker, and then the main breaker. They are stepped up.

BY MR. TROWBRIDGE: (Resuming)

Q Did you testify yesterday, Mr. Torcivia, that there is a time delay in the setting of the main bus breaker?

A (WITNESS TORCIVIA) That is correct.

Q So that the distribution and feeder breakers would trip before the main bus breaker.

A (WITNESS TORCIVIA) Distribution and feeder breakers are set to trip before the main breaker.

Q Even on a large fault current?

A (WITNESS TORCIVIA) That is correct.

Q Criterion No. 2, Mr. Torcivia, reads, "The power source shall supply the necessary fault current for sufficient time to ensure the proper coordination without loss of function of Class 1E loads."

Does the TMI 1 design meet that criteria?

A (WITNESS TORCIVIA) Yes. The rating and

characteristics of the diesel generator are such as to provide ample power for the performance of the function of the breakers.

Q Thank you.

Mr. Torcivia, is there available today a commercially offered circuit breaker which is designed to trip in the event of a short circuit but which is not dependent on a signal derived from the fault current or an effect of the fault current?

A (WITNESS TORCIVIA) Not to my knowledge.

Q Please turn to page 4-5. I guess we are on 4-5 of Mr. Pollard's testimony. At the bottom of the page, Mr. Pollard correctly quotes from Section 2.1.1.3.1.2 of the Restart Report as it existed at the time he prepared his testimony.

A (WITNESS TORCIVIA) What page did you say?

Q 4.5 I am simply pointing out there, Mr. Pollard has quoted from the Restart Report as it existed at the time Mr., Pollard prepared his testimony.

A (WITNESS TORCIVIA) I see.

Q Specifically, the quotation is that "the 480 volt circuit breaker is the isolation device between Class 1E and non-Class 1E portions of the design."

This statement, Mr. Torcivia, is not repeated in the same section of the Restart Report as subsequently

amended by Amendment 22 to the Restart Report. This revision leads me to several questions.

First, Mr. Torcivia, did you have a major hand in the preparation of Amendment 22 and the revision of that section of the Restart Report?

A (WITNESS TORCIVIA) Yes, sir.

Q What occasioned the Amendment 22 provision?

A (WITNESS TORCIVIA) The original Restart Report was written on a general concept basis. As we developed the design further, we became more detailed in our knowledge, rather, more detailed in our explanation of just exactly what the design would be, and therefore we have incorporated into the new Restart Report the more specific parts of the modification.

Q In amending the Restart Report, Mr. Torcivia, did you mean to retract the statement in the original Restart Report, that the 480 volt circuit breaker is the isolation device between Class 1E and non-Class 1E portions of the design, or is that statement still correct?

A (WITNESS TORCIVIA) The main feeder breaker, which is still correct.

Q The statement is still correct?

A (WITNESS TORCIVIA) That's correct.

Q The circuit breaker to which the statement referred was which breaker?

A (WITNESS TORCIVIA) The main feeder breaker.

Q All right, thank you.

Would you turn to page 4-7 of Mr. Pollard's testimony?

At the bottom of page 4-7, Mr. Pollard refers to page 2.1-7 of the Restart Report as it existed at the time Mr. Pollard prepared his testimony. The Restart Report on that page contained Section 2.1.1.3.1.5, entitled "Safety Evaluation." At the time of preparation of Mr. Pollard's testimony, that section contained the following sentence, "Taking into account the single failure criteria, faults on the BOP system will, at most, cause the loss of one ES system."

Mr. Torcivia, you explained that you had a major hand in the Amendment 22 revision, and what occasioned those revisions?

Was the deleted sentence that I have just read in any way incorrect?

A (WITNESS TORCIVIA) The word "system" in that sentence. The sentence itself -- and I am reading now also from the Restart Report, which is a duplicate -- the old Restart Report, "Taking into account the single failure criteria, faults on the BOP system will, at most, cause the loss of one 480 volt ES system." The word "system" was the disturbing point in that area. We would at most lose a bus

which is that bus which is on Figure 1, is referred to as the feed to the main feeder breaker, but not the entire system. The entire system, from my point of view, was to lose the entire system between the 4160 volt feeding all of the control center buses.

Q So that if the term "ES system" were changed to "ES bus," the statement would be correct?

A (WITNESS TORCIVIA) From my point of view, that is correct.

Q I note that the deleted sentence begins with the phrase, "Taking into account the single failure criteria."

Please identify the single failure referred to in that phrase.

A (WITNESS TORCIVIA) The main feeder breaker.

Q But for a loss of bus to occur, would not the distribution breaker also have to fail?

A (WITNESS TORCIVIA) That is correct.

Q Why was the distribution breaker not included in the single failure criteria?

A (WITNESS TORCIVIA) We didn't take credit for that distribution breaker because, as previously explained, although the breaker itself is qualified, the area within which it is located is not fully seismically qualified, and therefore we did not take credit for it.

Q Mr. Torcivia, turn back now to Mr. Pollard's

scenario on page 4-3 and 4-4. In that scenario, Mr. Pollard, in paragraph 4, has postulated the loss, in this case, failure to start of one diesel generator.

Does that constitute a single failure of a safety grade piece of equipment?

A (WITNESS TORCIVIA) Yes. There is no question.

Q Does the scenario in your view involve a second failure of a piece of safety grade equipment?

A (WITNESS TORCIVIA) Yes, because as previously pointed out, that would involved the main feeder breaker, which is a qualified breaker.

Q Turning to page 4-8 of Mr. Pollard's testimony, in the first full paragraph on that page, in the -- about in the middle of the paragraph, Mr. Pollard refers to the NRC Staff Position No. 4, which is stated on page C8-3 of the Safety Evaluation Report.

Will you look at the double asterisk footnote.

A (WITNESS TORCIVIA) Yes.

Q Does that correctly state position 4?

A (WITNESS TORCIVIA) Yes. It is in quotations.

Q Will you please indicate how the TMI 1 design meets the requirements of the staff position?

A (WITNESS TORCIVIA) Would you repeat that question?

Q Will you please indicate how the TMI 1 design meets the requirements of the staff position?

A (WITNESS TORCIVIA) The main feeder breaker is the qualified breaker that interfaces with the emergency buses.

Q I didn't hear the last part.

A (WITNESS TORCIVIA) It interfaces with the emergency buses. The main feeder breaker is the qualified item.

Q Turn, please, to page 4-11, Mr. Pollard's testimony. In the first full paragraph on that page Mr. Pollard questions the reliability and capability of the TMI 1 on-site power supplies to start and operate the loads added as a result of the Lessons Learned from the TMI 2 accident.

What, Mr. Torcivia, is the rating of the diesels?

A (WITNESS TORCIVIA) 3000 KW.

MS. WEISS: Did you say 3000?

WITNESS TORCIVIA: 3000 KW.

BY MR. TROWBRIDGE: (Resuming)

Q Will there, prior to restart, be written procedures in effect which instruct operators not to correct the pressurizer heater to the diesels unless the diesel loads have been reduced to the point where adding the pressurizer heater load would not exceed the rated capacity of the diesel?

MS. WEISS: Objection. I am sure it is not going to do me any good now, but he is leading the witness.

CHAIRMAN SMITH: If it is not going to do you any good, then don't insult the Board by making it.

MS. WEISS: I would like a direction to counsel to cease leading the witness. Objection after the answer has already been said to him is unfortunately not helpful.

CHAIRMAN SMITH: I don't think that the answer is by any means suggested. It is either yes or no.

MS. WEISS: And that is the essence of the leading question, Mr. Chairman, when the witness is given the entire scenario and the answer is either yes or no, I suggest --

CHAIRMAN SMITH: It is a large scenario. I don't question it. I don't have the feeling that Mr. Trowbridge is supplying the answer to this witness. Obviously this man's background and role in the company, it is he, Mr. Trowbridge, who has the information which is being developed in this hearing. However, I do believe that in view of your perception of it, that Mr. Trowbridge should try to accommodate you.

MR. TROWBRIDGE: I will restate my question.

BY MR. TROWBRIDGE: (Resuming)

Q Mr. Torcivia, what, if any, measures will be taken to assure that connecting the pressurizer heaters to the on-site power source will not overload the diesels?

A (WITNESS TORCIVIA) Mr. Trowbridge, rather than answer yes or no, if I may, in view of the situation, I

would like to refer -- and I happen to have a letter with me which I issued to the Plant dated August 11, 1980, as to the changes which will be required in the procedures and which are in the process of being made. I would like to read from this letter.

"As part of the procedures which are to be written, we are to add the following statement, 'Verify that the diesel KW is below 2874 before energizing pressurizer heaters. The total continuous diesel load must be kept at or below 3000 KW.'" Those are the words that would be included in the procedure when it is finalized.

Q What was the figure you used there?

A (WITNESS TORCIVIA) 2874.

Q 2874.

If the diesel is loaded at 2874 or below, would the addition of the one group of pressurizer heaters cause the load to exceed 3000 KW?

A (WITNESS TORCIVIA) No, the pressurizer heaters, the KW rating of the pressurizer heaters is 126, and therefore we are adding 126 to 2874. As indicated n the request as made for the change in procedure, the total KW at any time must not exceed 3000 KW, and the procedures include various loads that could be unloaded safely should that KW by any chance be exceeded.

MR. TROWBRIDGE: Thank you.

I have no further questions on rebuttal.

BOARD EXAMINATION

BY DR. JORDAN:

Q I am sure Mr. Pollard would ask it, but since we are on that particular paragraph, would you address Mr. Pollard's statement that Met Ed has not performed any qualification tests to demonstrate the reliability.

Do you see Mr. Pollard's statement there?

MR. TROWBRIDGE: If Mr. Pollard were asking that question, I would object. Let me explain why.

The question here is whether -- the Contention here deals with the question as to whether adding the pressurizer heater load would affect the reliability or capability.

DR. JORDAN: We will assume it is not meant the qualification test. I will not question this any further.

MR. TROWBRIDGE: I don't think that is a fair assumption. We have not brought a diesel expert with us. We have brought somebody who knows about the connection of the power supply to the pressurizer heaters.

Obviously the Board is entitled to ask any question it sees fit, as germane to this hearing. I did want to make the point that as far as this Contention is concerned, it is only the question of what connecting up --

DR. JORDAN: I understand, and you understand my

position, too.

CHAIRMAN SMITH: Mr. Trowbridge, we have not taken the position throughout this hearing that consistent with your observations, if you wish the Board's concerns about the testimony to go unexpressed, and you want to stand and fall on the evidence you present, I think you are entitled to that approach.

MR. TROWBRIDGE: Mr. Chairman, I am making the observation. I am trying to make the observation, not as well as I might have, that I think Dr. Jordan's question, while a perfectly proper question for the Board to put to the witness, should be understood to be a question outside the scope of the Contention.

(Board conferring.)

MS. WEISS: I wouldn't like this to pass with it perhaps seeming that we concede that that question is outside the scope of the Contention, because we don't.

CHAIRMAN SMITH: It is irrelevant whether it is outside the scope of the Contention when the Board asks questions. You can raise it. If Mr. Pollard asks the question and Mr. Trowbridge objects, then we will decide if it is in the scope of the Contention or not.

(Board conferring.)

MS. WEISS: I take it Dr. Jordan's question will not be answered at this point?

CHAIRMAN SMITH: Dr. Jordan elects not to, and he is making assumptions. That does not foreclose Mr. Pollard from asking whatever he wishes.

MS. WEISS: We may stand on what is in our testimony.

CHAIRMAN SMITH: All right.

MS. WEISS: We would like to see a copy of the letter that Mr. Torcivia was reading from toward the end of his testimony, before we go into the cross examination.

CHAIRMAN SMITH: All right.

MR. TROWBRIDGE: Would it be sufficient for the moment to borrow Mr. Torcivia's copy? We have no other copies.

MS. WEISS: Sure.

(Pause)

CROSS EXAMINATION

BY MS. WEISS:

Q This testimony is presented jointly by Mr. Shipper and Mr. Torcivia. I would like for you to describe the process by which you jointly prepared it, who drafted which sections, if it was divided along any sort of sense of area lines, and who had the final approval.

A (WITNESS TORCIVIA) It was drafted -- correct me if I am wrong, Paul -- probably 95 percent by myself, submitted to Paul who made some more revisions and

additions, and there was a final product. We did not communicate with each other in the drafting of it. I drafted it in our own plant, transmitted it to Mr. Shipper. He reviewed it and made his comments. We arranged it and submitted the final.

Is that correct, Paul?

A (WITNESS SHIPPER) That is correct, a correct statement.

Q Mr. Shipper, you have listened through the rebuttal of yesterday and today.

Do you agree with everything that has been said by Mr. Torcivia in his rebuttal testimony?

A (WITNESS SHIPPER) Yes, I do.

Q You handed out a 1977 version of IEEE 384 without the first six pages. You stated it had been approved.

Is it correct that it has been approved by the IEEE Standards Committee?

A (WITNESS SHIPPER) To the best of my knowledge.

Q Isn't it also correct that it is the earlier version of the IEEE Standard, the version which Mr. Pollard quoted and refers to in his testimony, which is endorsed specifically in Regulatory 1.75?

Isn't it also true that it is specifically the version of IEEE 384 which is referred to by Mr. Pollard in his testimony?

A (WITNESS SHIPPER) I don't think that is a correct statement.

MR. TROWBRIDGE: I don't think she finished her question.

BY MS. WEISS: (Resuming)

Q You handed out a 1977 version. Isn't it true that it is the 1974 version which is endorsed by Regulatory Guide 1.75?

A (WITNESS SHIPPER) That is correct.

Q Do you know if the NRC staff has approved the 1977 version of IEEE Standard 384?

A (WITNESS SHIPPER) I do not know if they have approved or disapproved the 1977 version.

Q Did you serve on the committee which wrote the 1977 version?

A (WITNESS SHIPPER) I did not.

Q Neither of you did?

A (WITNESS TORCIVIA) No, ma'am.

DR. JORDAN: Ms. Weiss, you referred to the 1974 version. My copy of Reg Guide 1.75 says 1971 version.

MR. POLLARD: Keep reading.

MS. WEISS: Page 1.75-2, the first full paragraph refers to IEEE Standard 384-1974.

DR. JORDAN: Thank you.

I was also referring to IEEE 279.

BY MR. POLLARD: (Resuming)

Q Your joint testimony was also prepared on September 15, 1980.

Were there any changes in your testimony as a result of Amendment 22 to the Restart Report?

A (WITNESS TORCIVIA) Were there any changes in the testimony?

Q As a result of Amendment 22 to the Restart Report, is there any change that is necessary to your testimony?

A (WITNESS TORCIVIA) None that I know of, no.

A (WITNESS SHIPPER) I agree with that.

Q Would you turn to page 4 of your testimony, please.

The middle of the first full paragraph states, "Further, the rated capacity of the diesel has been verified as being capable of handling the heaters in addition to the safety related loads required during loss of off-site power events."

Mr. Torcivia, can you describe for me how the rated capacity of the diesel has been verified?

A (WITNESS TORCIVIA) The diesel generator was originally tested for the 3000 KW, fully tested for 3000 KW. It is further tested every month on a full loaded basis of 3000 KW. We have developed all of the diesel loads which are required for emergency conditions, calculated their value, and added on the 126 KW for the unit.

Q In the original qualification of the diesel, can you describe for me that original qualification in terms of how many tests were performed, in what manner the loads were applied to the diesel generator, and what were the results of the tests?

A (WITNESS TORCIVIA) I'm sorry, I don't know the details as you are requesting.

Q Is it correct that you do not know how the capacity of the diesel generator has been verified as being capable of handling the heaters in addition to the safety related loads?

A (WITNESS TORCIVIA) From an engineering point of view, the verification is based on the knowledge of the full rating of the diesel, as developed, the rating of the equipment which is being added to it, and from that point of view, our verification is the calculated verification that we are discussing here at this time. The unit will be tested before startup for that particular load.

Q How many times will it be tested for that load before startup?

A (WITNESS TORCIVIA) That is something that will be determined before the startup.

Q How many such tests will be required to demonstrate that the diesel has this capability?

A (WITNESS TORCIVIA) From my point of view, one

would be sufficient.

A (WITNESS SHIPPER) I would like to add something to that. Monthly tech specs require the diesel to be started and loaded to its fully rated capacity.

A (WITNESS TORCIVIA) I thought I had put that point across. I guess I didn't.

Q Mr. Shipper, on these monthly periodic tests, what is the load applying to the diesel generator?

A (WITNESS TORCIVIA) Would you repeat that question?

Q Excuse me, Mr. Shipper.

A (WITNESS SHIPPER) Fully rated to the 3000 KW.

Q It is your testimony that that is how much is applied in the monthly periodic tests at Three Mile Island Unit 1?

A (WITNESS SHIPPER) That is the tech spec requirement.

Q How is that load applied in a sense? Does it duplicate the loading of the diesel generator in terms of the rate at which the load is applied, the steps in which the load is applied as would occur during an actual event such as loss of off-site power?

A (WITNESS SHIPPER) I would assume no. The reason I would make that assumption is because you do not fully run through an ES actuation test on a monthly basis. I also think that when the plant is brought down for refueling

outage, an ES actuation test is run. I am not sure if it is run with loss of offsite power. Excuse me, with simulated loss of offsite power.

DR. JORDAN: Could I ask, are these diesels new diesels for TMI 1, or are they the same diesels that have been there before? Are these a new set of diesels for restart? They are the same diesels?

WITNESS SHIPPER: These are the diesels that have been licensed with the plant.

DR. JORDAN: I see.

BY MR. POLLARD: (Resuming)

Q Mr. Torcivia, back to the sentence which we began on, where you testified, along with Mr. Shipper, that "the rated capacity of the diesel has been verified as being capable of handling the heaters, in addition to the safety related loads required during loss of off-site power events," as I understood your answer when I asked you how has that been verified, you referred me in part to the tests that were originally done on the diesels for their qualification, and then in answer to a subsequent question, you testified that you did not know the nature of those original tests.

Would it then be also correct that then you do not know in what manner the capacity of the diesel has been verified?

A (WITNESS TORCIVIA) I think it is being twisted a little.

Q You are going to have to use the microphone. I can't hear you.

A (WITNESS TORCIVIA) The acceptance of the diesel generators was done at some time back. The actual tests that took place in accepting these diesel generators, at that point, I do not have the full knowledge of those tests, but they were accepted on the basis of 3000 KW.

Q Accepted by whom?

A (WITNESS TORCIVIA) By Metropolitan Edison Company, I must assume. If you are looking for specific individuals, I don't know.

Q That's fine.

Did the NRC staff accept the diesel generators on the basis of those original tests, or don't you know that?

A (WITNESS TORCIVIA) As I have already indicated, I do not know the detail of exactly what happened. I have the 3000 KW figure, which is the established figure for the rating of that diesel, and that is the rating which we are working with.

Q So that it could very well be, if you went back and reviewed the original qualification tests which form the basis for Met Ed accepting these diesels, you might actually change your mind that those original acceptance tests

provide an adequate technical basis for verifying the capacity of the diesel generator?

A (WITNESS TORCIVIA) I imagine anything is possible.

Q You testified that the rating of the diesel generators is 3000 KW. Is that their continuous rating, their 2000 hour rating, or their short time rating?

A (WITNESS TORCIVIA) That is the 2000 hour rating, as far as I can recall.

Q What is their continuous rating?

(The Witnesses conferred.)

WITNESS TORCIVIA: Mr. Shipper is saying he doesn't believe -- I agree with him -- that there is a definite, specific, full time rating which is done. We have used that rating at all times. There is a 3000 hour rating -- 3000 KW rating.

WITNESS SHIPPER: To the best of my knowledge, the 2000 -- yes, the 2000 hour and the continuous rating came about at some time around the mid-'70s. These diesels were purchased and shipped to the site in the early '70s. They were rated at a rating of 3000 KW. Going back to the manufacturer, the best information we can receive from them is that the 3000 KW is a 2000 hour rating. That is the only rating we can get on the diesel.

BY MR. POLLARD: (Resuming)

Q You have specifically asked the diesel generator

manufacturer for the continuous rating, and he told you that there was none? Is that your testimony?

A (WITNESS SHIPPER) You are misinterpreting what we said. We were looking for the higher rating, the short time ratings. The only rating they would give us was the 2000 hour rating.

Q Let me try one more time.

What is the continuous rating of the Three Mile Island Unit 1 diesel generators?

WITNESS TORCIVIA: Mr. Chairman, may I say this? I did not come prepared with those details, although we do have those details available to us at the plant. As far as the specific data of the diesel is concerned, I don't think we can go much further in this without giving some possibly erroneous answers.

I would like to stick to the scope of the original Contention. You can understand my position.

CHAIRMAN SMITH: Mr. Torcivia, there has been no objection from Mr. Trowbridge, so absent that, you are required to answer the question. However, you should, as you have been, you should clearly identify what you are prepared to say with reliability and be comfortable with it or not.

WITNESS TORCIVIA: That's the problem.

CHAIRMAN SMITH: You just tell what you know and

what you don't know.

BY MR. POLLARD: (Resuming)

Q An acceptable answer, if that is the truth, is I don't know.

A (WITNESS TORCIVIA) It would not be entirely the truth because although I do know, I do not remember the exact figures and date because this has gone back quite a few years.

Now, Mr. Shipper was involved in the original design. I came in at a later date, so I would not be saying the truth to say that I do not know. I do know, but my figures may be a little confusing.

BY MS. WEISS: (Resuming)

Q I take it that neither of you is prepared to say now what the continuous rating of the TMI 1 diesels is?

MR. TROWBRIDGE: I object at this point. This is double-teaming the witness when Ms. Weiss -- it has worker properly when Ms. Weiss starts a line of cross examination and then turns it over to Mr. Pollard and he gets into the technical. I do not think it is proper for Mr. Pollard to cross examine and for Ms. Weiss to jump in and try and help out.

CHAIRMAN SMITH: Double-teaming is very subjective, I guess. It depends upon the timing of the questions which aren't reflected in the transcript, and

other factors. If you perceive it that way, I am sure that Ms. Weiss doesn't want to cause any difficulty. I didn't perceive it as double-teaming.

If Mr. Pollard can ask the questions, then why don't you have him do it without delay?

MS. WEISS: I just jumped in at that point because I thought we were being double-teamed by the witnesses. I don't think anybody can claim that these witnesses are being badgered. I am just trying to get a clear answer to the question.

CHAIRMAN SMITH: Some of the difficulty is we are not allowing the witnesses to state in their own way what their reach of knowledge on the issue is. You can put words in their mouths, which is okay as cross examination, but now I think we have come to the point where they should be allowed to state on their own what they know and what they don't know about the rating of the engines.

MS. WEISS: That's fine. I think that my question -- if we could get an answer and then they could explain why they don't know.

CHAIRMAN SMITH: Mr. Shipper, why don't you tell us what you know about the rating of the diesels?

WITNESS SHIPPER: To the best of my knowledge, the diesels, at the time they were purchased, were purchased as a 3000 KW unit. Subsequent to that, to that purchase and

delivery on site, the diesel manufacturers came up with an eight hour rate, 2000 hour rating and a continuous rating.

CHAIRMAN SMITH: You mean diesel manufacturers in general?

WITNESS SHIPPER: As an industry. At that point they did not go and backfit the previously delivered units. What they did do, they said the rating that we had given you is a 2000 hour rating. That is my understanding of the situation.

BY MS. WEISS: (Resuming)

Q I understood you to explain that.

The next question is do you have any way of knowing now what the continuous rating is for the TMI 1 diesels?

A (WITNESS SHIPPER) As I previously stated, the manufacturers will give you the rating based on 2000 hours.

Q The answer is no, you do not know what the continuous rating is, correct?

A (WITNESS SHIPPER) The answer to your question would -- in yes and no terms, no, I do not know.

Q No, you do not know.

CHAIRMAN SMITH: If you feel a need to explain an answer, you will either indicate to the Board or have confidence in your attorney to --

WITNESS SHIPPER: I think the clarification that I

explained previous to this should clarify the answer.

BY MR. POLLARD: (Resuming)

Q Mr. Torcivia, in your professional knowledge of diesel generators as they now are on the market with continuous ratings, 2000 hour ratings, and short time ratings, would you agree that the continuous rating of a diesel generator is generally less than the 2000 hour rating?

A (WITNESS TORCIVIA) Yes -- pardon me. Would I agree that it is less than a 2000 hour rating?

Q Yes.

A (WITNESS TORCIVIA) Normally it is, yes. I am making a hesitation there because I thought I came across sometime back where one manufacturer said the continuous rating was a 2000 hour rating, things of that nature. So yes.

Q That one exception was not the TMI Unit 1.

A (WITNESS TORCIVIA) No.

Q In determining the loads to be applied to the diesel generators, you have testified that you have added up the loads to make sure that they don't exceed 3000 KW.

Did you determine the magnitude of the loads using the procedures specified in Regulatory Guide 1.9?

A (WITNESS TORCIVIA) Would you refresh my memory on Regulatory Guide 1.9 and what it says?

Q Regulatory Guide 1.9 covers the subject matter of

selecting the diesel generators to have sufficient capacity to carry their loads, and it talks about the various ratings of diesel generators. It talks about methods of determining what the loads should be. One method is given for the CP stage, a different method is given for the operating license stage.

MR. TROWBRIDGE: Mr. Chairman, I ask that if Mr. Pollard is going to use Reg Guide 1.9 in his questioning, that copies be made available to counsel and witnesses.

MR. POLLARD: Mr. Chairman, if that is Mr. Trowbridge's wish, I will have to ask the question in a different way because I did not bring with me sufficient copies of Regulatory Guide 1.9.

On the other hand, this witness is apparently put forward as a professional expert. I would assume that in his knowledge of working with nuclear power plants, in utilizing diesel generators for emergency power sources, he would have run across the NRC's Regulatory Guide 1.9.

MR. TROWBRIDGE: Running across 1.9, Mr. Chairman, is not the same as having a copy here, and counsel is entitled to follow the testimony.

MS. WEISS: The question was whether the witness had used Reg Guide 1.9. He ought to know whether or not he used Reg Guide 1.9 without going at all into the details of what are the requirements of Reg Guide 1.9.

CHAIRMAN SMITH: The question went much farther than whether he used them.

MS. WEISS: The original question was simply whether they had used Reg Guide 1.9 for determining the magnitude of the loads.

CHAIRMAN SMITH: I remember more than that. I don't know. It seems to me he asked about the staging of them, the timing of them, and other aspects.

MS. WEISS: No. The only question is did he use Regulatory Guide 1.9 for determining the magnitude of the load.

MR. TROWBRIDGE: That is not the only question, Mr. Chairman.

CHAIRMAN SMITH: It is now.

MS. WEISS: That is now the only question.

CHAIRMAN SMITH: All of the other questions have been withdrawn, is that right?

MS. WEISS: Yes, that is the question.

MR. TROWBRIDGE: I have no objection to the witness answering that question.

CHAIRMAN SMITH: You have none.

MR. TROWBRIDGE: No objection to his answering that question.

WITNESS TORCIVIA: I am sorry, I didn't hear that.

MS. WEISS: There is no objection to the question.

BY MS. WEISS: (Resuming)

Q Did you hear the question?

A (WITNESS TORCIVIA) Would you mind repeating it, please?

Q Did you use Regulatory Guide 1.9 for determining the magnitude of the loads to be applied to the diesels?

A (WITNESS TORCIVIA) Regulatory Guide 1.9, if I recall correctly, does not apply to an operating condition. It does apply to a new installation. I am speaking from memory now. If the question is did we take Regulatory Guide 1.9 and follow it step by step, no, ma'am.

CHAIRMAN SMITH: At what time? Mark in time your answer.

The question, as I remember it, does not adequately identify the time. Maybe it does. Would you bring it out again, what time?

BY MS. WEISS: (Resuming)

Q The time that we are referring to is the time during which you did the evaluation for restart of Three Mile Island Unit 1.

A (WITNESS TORCIVIA) That is the time I am referring to. That's why I say not prior to its installation, before the initiation of the plant, operation of the plant prior to restart.

Q Yes.

A (WITNESS TORCIVIA) The original design of the plant, I was involved in that.

Q But you understood me to have asked you did you use Reg Guide 1.9 during this restart evaluation? I understood your answer to be no.

A (WITNESS TORCIVIA) That's correct.

BY MR. POLLARD: (Resuming)

Q Mr. Torcivia, then, would you please describe for me the procedure you used to determine what the magnitude of each device added to the diesel generator during a loss of off-site power would represent?

A (WITNESS TORCIVIA) We made a list of all of the loads required at that time, the horsepower of the motor involved, investigated the curves where the curves were so involved for loading, such as pumping, air flow, whatever it may have been, and made to the best of our judgment an engineering detailed analysis of the KW required to operate under an ES condition, added them all up and came up with the KW which would be involved in loading that diesel at that time.

Q Did you use the name plate ratings of the motors?

A (WITNESS TORCIVIA) We used the name plate rating as an initial point and then referred it back to the actual test data, where that was available, and then referred back to the curve which required that so many gallons per minute

would require so much horsepower, and then the required horsepower for that particular application, and then determined the KW on that basis.

We did what we feel is a detailed analysis of the loads.

Q What service factor did you assume for motors?

A (WITNESS TORCIVIA) One, we used one service factor.

(Counsel for UCS conferring.)

(Counsel for UCS Conferring)

DR. JORDAN: Mr. Torcivia, what do you mean by a service factor?

WITNESS TORCIA: The capability of a motor to operate without endangering the life of the motor at a higher service factor, 1.15, is -- in other words, 15 percen overload is an acceptable unit without endangering the insulation of the motor.

We used one.

BY MR. POLLARD:

Q Considering the periodic tests which you referred to as being done on a monthly interval and the additional tests that you mentioned done during a refueling outage, assuming that all such tests are successful and they disclose no failures, can you give me as quantitatively as possible what the reliabiity that would demonstrate for the diesel generators?

MR. TROWBRIDGE: May I have that question again? I am sorry.

(The record was read as requested.)

MR. TROWBRIDGE: I object to the question. I have not objected to the series of questions which seemed to go to the capacity, the rated capacity, demonstrated capacity

of the diesels.

We are now into an area of examination which I think goes to the reliability of the diesel, a subject of obvious interest to nuclear power plants, but not germane to the contention, which is strictly a contention related to the effect of conntecting the pressurizer heaters to the reliability and capability of the diesels.

CHAIRMAN SMITH: Ms. Weiss?

MS. WEISS: Would you like a response to that? Let me begin at the contention; contention number four, as quoted on the front page of these gentlemen's testimony: "Rather than classifying the pressurizer heaters as safety grade, the staff has proposed simply to add pressurizer heaters to the onsite emergency power supplies.

"It has not been demonstrated that this will not degrade the capacity, capability, and reliability of these power supplies in violation of general design criterion 17.

"Such a demonstration is required to assure protectin of the public health and safety."

If you go to page four of the testimony of these witnesses, the sentence --

MR. TROWBRIDGE: You are talking about your testimony?

MS. WEISS: Page four of the testimony of your witnesses. The sentence we have been questioning about is

as follows: "Further, the rated capacity of the diesel has been verified as being capable of handling the heaters in addition to the safety-related loads required during loss of offsite power events."

Now, these witnesses testified that in order to analyze whether the pressurizer heater loads could be safely added to the current safety loads, they relied at least in part on the original test done to verify the capability of the diesels and on the periodic testing.

Now, if that is what they relied on, that is what they came in here and said today, then the question of whether they were entitled to rely on tests, the question of what were those original tests -- did they indeed verify the capability of the diesels to handle their original loads -- is the first question that needs to be answered before you can define --

CHAIRMAN SMITH: Wait a minute. You say -- you have a right to inquire into whether the diesels are required to handle their design loads before adding the pressurizer heaters.

MS. WEISS: Because the witnesses came in and said they were basing their testimony, that the diesels can handle the additional loads on their original analysis.

CHAIRMAN SMITH: And this is where Mr. Trowbridge believes we are getting outside the scope of the contention

and the hearing even.

MR. TROWBRIDGE: That is correct.

MS. WEISS: There is no way that is outside the scope of the contention. I think the licensee does not want to inquire into this.

CHAIRMAN SMITH: Let's argue it on the evidence. As a matter of fact, I have been coming to the point where I am going to request restraint from some of the editorial remarks that are beginning to pop up with more frequency. I think that we just caught you on one there.

Let's keep it right to the evidence and to the contention.

MR. TROWBRIDGE: Mr. Chairman, the contention and the sentence on page four of licensee's testimony both refer to the capabilities and in the case of the contention to the case of degrading the capability of the diesel.

I think the reliability of the diesel, independent of the connection of the pressurizer heaters, is not an issue in this contention.

MS. WEISS: May I respond to that, Mr. Chairman? If you could take as a given -- even if you could accept as a given, that as originally qualified the diesels were capable of handling all of the emergency safety loads, you would need to inquire into what is the effect of adding the pressurizer heaters.

CHAIRMAN SMITH: The effect in the quantitative effect in kind?

MS. WEISS: I am not sure I understand that question.

CHAIRMAN SMITH: Do you understand it, Mr. Pollard?

MR. POLLARD: No.

CHAIRMAN SMITH: I am saying the effect of simply adding so much load, or is there a kind of load and a circumstance of adding a load that you believe goes to the capacity of the generators. Are we just counting or are we analyzing?

(Board Conferring)

CHAIRMAN SMITH: Ms. Weiss?

MS. WEISS: Yes. As to the question that you asked, I am not sure that I still understand it.

CHAIRMAN SMITH: The point I am trying to make, if it should be our ruling that the licensee can enter into this contention with the assumption that the installed diesel generation will continue its tech spec rated capacity capability and reliability, then we would want to know if your contention and your argument is that you are simply adding load.

Or is it question of adding or subtracting load? Or is there an effect upon the -- on the diesel generating system by the particular type of load that is added and

subtracted, perhaps, which will degrade it?

That is the way that I am approaching it, but I have not talked thoroughly with the members, and I have not even decided that. I am just asking the question.

MS. WEISS: I will ask Mr. Pollard to think about the answer to that. Let me just say, to backtrack, ho we got to this question: we have contended that the licensee has not adequately verified the capability of the diesels to carry the other engineered safety features loads plus pressurizer heater loads.

Now, their answer, at least -- I think their full answer to why the licensee believes that the diesels have been so verified is on the basis of the periodic testing. That is the answer which we received in the testimony. "We have done periodic testing which shows that we could hold the loads before. And we have done some calculations which show that we can carry the loads after."

Now, I think we are entitled to inquire into what is shown by the periodic testing. What reliability is demonstrated by the periodic testing? What was tested and how? You cannot separate, because their answer is based on the testing program that they have been doing all along. YOu cannot separate, it seems to me, one from the other.

MR. TROWBRIDGE: I pursue my objection largely because I can foresee that we are going to have a series of

questions about diesel tests from two witnesses who are not as familiar with other Metropolitan Edison personnel are with the actual diesel performance over a period of years.

Let me continue to state my objection: first, the contention continues to be a contention regarding the degradation as a result of the addition of the pressurizer heaters. I do not understand how talking about reliabilty of the diesels themselves, independent of that connection, is germane to the contention simply because these witnesses testified that, one, assurance they had as to the capacity, capability of the diesels was the periodic tests.

That does not in my mind open the period tests up for examination on any other subject than did -- than their use in establishing that the diesels were capable of carrying their design load.

CHAIRMAN SMITH: How about the observation that I made that the correct -- for discussion, the correct bounds of the contention as it relates to diesel generating reliabiity, capacity and -- reliability, capability, and capacity should be that the assumption is made that the diesels perform as they would before any changes and at least that these witnesses have a right to address the testimony from that point of view, if not -- at least, that is a reasonable, even if incorrect, approach to the contention.

So we are not faulting the witnesses for not knowing about diesel reliability. But now let's address the contention itself. What the board is going to consider in recess is: should we begin the contention with the presumption that since this is not a show cause order, operating license, that the normal operating capacity, capability and reliability of the generators is given. And unless it is shown that these factors are changed by the proposed changed, either in quantity or in kind, that we accept -- we accept that as a given.

MR. TROWBRIDGE: Mr. Chairman, it is essentially my view that to decide the objection that is before it, the board need only decide that however the diesels operate as to reliability, the only question is are the questions sought to be asked by UCS germane as to whether that reliability, whatever it is, is being degraded.

CHAIRMAN SMITH: Right. And that is what we want information on, information that it is degraded by overloading or by a different sequence of loading or a different type of load, which I don't understand if there can be such a thing, a different type of load.

MS. WEISS: As you go in to think about this, I want to direct your attention to the sentence in the testimony which occasined this questioning: that is, on page four, "The capacity of the diesel has been verified as

being capable of handling the heaters in addition to the safety related loads required during loss of offsite power events."

CHAIRMAN SMITH: If I just took that, you would lose right there because it is a very limited sentence: the rated capacity --

MS. WEISS: "As being capable of handling the heaters in addition to the safety related loads."

CHAIRMAN SMITH: Then we will take that into account.

MS. WEISS: The question is: how has it been verified? If the answer is: we used the old tests plus we did some calculations --

CHAIRMAN SMITH: What if we should find indeed they did say that on that statement, but it is a superfluous statement and it does go outside the scope of the contention?

MS. WEISS: Mr. Chairman, it does not go outside the scope of the contention.

CHAIRMAN SMITH: We have to break it down. We need to approach it with some kind of organization and standard.

MS. WEISS: It is taken as a given that when a licensee proposes to add an additional engineered safety feature load to the diesels, some sort of analysis must be done in order to determine that the diesels can handle

that. That is the unspoken, implicit assumption in the contentio, and I do not think anybody would argue with that.

You cannot just add additional loads into the ES.

CHAIRMAN SMITH: He described the calculations.

MS. WEISS: I know. We are entitled to know what is the basis of his statement, that it has been verified -- the diesels have been verified to be capable of handling that load. Calculations on the basis of old tests -- if it is calculations on the basis of old tests, we are entitled to know what those tests are.

MR. TROWBRIDGE: The witnesses have explained exactly what they meant by "verified as being capable." They explained that this was in terms of the capacity of the diesels and I do not understand that because they relied, as I have said before, in part on manufacturers' tests, in part on periodic tests, as well as the rating of the diesel itself, that does not explain to me why we should be involved in the reliability of the diesels.

DR. JORDAN: Have the witnesses addressed the question, will there be any effect on the reliability of the diesels by adding these extra loads?

MR. TROWBRIDGE: Would you like to ask that question now?

DR. JORDAN: I guess I think this is the point we

are talking about.

MR. TROWBRIDGE: Yes. This is my view of the point. That is not the question that UCS asked. I have no problem at all with the question as you put it.

DR. JORDAN: I see. So that question you say would be all right?

CHAIRMAN SMITH: Do you want to ask it?

Mr. Cutchin?

MR. CUTCHIN: In the interest of trying to help the board here to decide something, the staff in approaching its review of a lot of matters related to restart has taken things that were viewed at the time of initial operating license as givens and built on that review.

Referring back to the safety evaluation report that was issued at the time of the operating license review, as I have done on a couple of occasions before, that document being dated July 11, 1973, in section 8.0, the major section, electric power, there is a statement under criteria for electric power system, and I am quoting the pertinent words: "The electric power system for Three Mile Island Unit 1 has been evaluated to ensure that the guidelines of Regulatory Guide 1.9" -- the guide in question -- "are met."

And in referring to the diesel capacity, the words are as follows: "Maximum diesel generator loading in the

event of an accident is 2513 kilowatts, which is below the 2000 hour rating of the diesels in accordance with Regulatory Guie 1.9."

With respect to the review at the operating license stage, the staff did indeed evaluate the diesel loading in accident situations against Regulatory Guide 1.9 and concluded that there was sufficient margin between the then accident loadings and the 2000 hour rating.

DR. JORDAN: But I guess that it is true that the staff did conclude that there was sufficient margin. Now that margin has been reduced.

MR. CUTCHIN: I would assume that that margin has been reduced and in looking at the situation to evaluate the availability of margin in the diesels for adding additional loads, it is my understanding the staff did not go back and start at step one and do the complete Regulatory Guide 1.9 review all over again with respect to reliability testing, and the like, but took those matters as a given and looked to see if indeed at the time of interest the new loads could be sufficiently accommodated.

MS. WEISS: I appreciate that explanation of what the staff did, but I do not believe that that is binding on the scope of the inquiry that UCS is permitted to make.

CHAIRMAN SMITH: We have consistently from th very beginning of this proceeding, unless we could demonstrate a

circumstance has -- is a reasonable analog to the accident, we hadve barred inquiry into the basic operating license circumstances.

We have accepted that as being perhaps subject to another proceeding, but not this one.

MS. WEISS: And there is no question -- when this contention was admitted. And now the question is how far can we probe in our questioning.

CHAIRMAN SMITH: That is what we are going to decide.

MR. POLLARD: Could I add one more factor which I think is important and you ought to consider in your ruling? When we had witnesses here on UCS three, they were computer experts. This was whether or not the heaters are needed.

Now we have here the power supply question, the reliability of the power supply. The factor I think you ought to consider is one of the lessons learned from the accident: is that the pressurizer heaters, the PORV, the block valves, et cetera, ought to be upgraded to improve their reliability by connecting them to the onsite power supplies.

I would think then it would also be an important factor whether that upgrading is sufficient to know what the reliabiity is of the onsite power supplies. With Mr.

Cutchin's recent statement, that at the OL they evaluated for 2513 kW, and now Mr. Torcivia has testified they are going to run up to 3000 kW, I think it is an immportant question to inquire just what is the reliability of the onsite power supply with the addition of the new loads as a result o the TMI-2 accident.

CHAIRMAN SMITH: With the addition or because of the addition?

MS. WEISS: Both.

CHAIRMAN SMITH: I understand.

MR. TROWBRIDGE: The Chairman's question, because of with, is exactly what we are talking about. It may be that Mr. Pollard believes the reliability of diesels ought to be examined in this restart proceeding. If so, he should have tried a contention that talked about the reliability of the diesels. And we would have been on notice and prepared testimony and proper witnesses prepared to talk to that subject.

CHAIRMAN SMITH: Mr. Adler, do you have a position or comment?

MR. ROBERT ADLER: No, sir.

CHAIRMAN SMITH: Let's have our mid-morning break now.

(Recess)

CHAIRMAN SMITH: The board has agreed upon a

standard for receiving evidence on the particular point being discussed before the recess. We will accept the capacity, capability, and reliability assumptions at the operating license stage as a given. We will permit inquiry into general areas, and that is, given the reliability, capability, and capacity assumed at the operating license stage, is the nature of the added load or the function of the added load consistent?

That is, is the function of the pressurizer water heaters to important that the assumed reliability, capacity, and capability is inadequate for that purpose? Not that you would inquire that way, but that would be one way in which the assumed reliability could be addressed.

We are not suggesting that is the case. We are recognizing that the very idea of the emergency loads is for important safety functions. The other one is the one that was postulated before; the other category of inquiry, the one that was postulated before the recess, and that is, will the amount of the load and the sequence of the load, of adding a load, and the nature of the added load, if there be such a thing, affect reliability of the diesel generator system.

This would include, necessarily, then, whether the margin of capacity is acceptable. And then the third we discussed, we do nto believe it is a part of the question,

although it may be part of the contention, is the nature of the loads dipped with the pressurizer water heaters, that is outside the question we were considering.

MS. WEISS: If that is the ruling of the board, we would like the record to be clear on exactly how far we were permitted to go, where we stopped, and what we had intended to inquire about. And that may require a series of questions in order to do that. And we will find out where the stopping point is.

CHAIRMAN SMITH: Before you continue, however, without renewing your old arguments, is there anything about our ruling that should be addressed and discussed?

MS. WEISS: We have a general question about the ruling which I do not intend to reiterate arguments already made, but -- and that is that we do not understand why in contrary distinction to other issues raised in this restart proceeding, why it is required to take as a given that the original tests on the diesels and qualifications of the diesels in fact achieved the objective of qualifying them to 2500 kW or 3000 kW.

We do not understand how that is any different from the -- for example, the assumption that operator training was efficacious in achieving the original goals.

CHAIRMAN SMITH: I do not have any problem with operator training; that is part of the notice of hearing.

I can go farther, but I do not have to go any farther than that.

MS. WEISS: The question before the board --

CHAIRMAN SMITH: There may be circumstances, Ms. Weiss, where we allowed an inquiry into the assumptions of the operating license. Wrong. Maybe we made a mistake. Furthermore, each of these,where are you -- you stop and you say this is inquiry into the operating license assumptions. That is a question of judgment which is bound to be colored one way or the other by the board members individually, so -- and this is where we decided it was a reasonable place to stop the inquiry into the operating license assumptions.

But the one example you gave is not a good example. If you want others, we will try to explain our ruling or even reconsider.

MS. WEISS: I obviously do not want to open the door to reconsidering what I thought were correct rulings originally. Let me just remind the board the question pending before the objections was: what is the quantitative reliability of the diesels demonstrated by the periodic tests and the refueling tests described by the witnesses? That was the question pending to which objections were made.

If those objections stand, I think we are entitled to have stricken the witnesses' testimony, that the reliability of the diesels was demonstrated to carry their

additional load, was demonstrated by periodic tests and refueling tests. In other words, if the door is not opened, then it is not open for either side.

MR. TROWBRIDGE: There was no testimony by these witnesses about the reliability of the diesels. They testified as to its capacity.

CHAIRMAN SMITH: The answers about the reliability, as I recall, the monthly tech spec tests on capacity and emergency sequences on fueling outing -- fuel outage were a response to cross examination. They were not, as I understand it, given as the witnesses' basis for their testimony.

I want you to go back to your point because it is complicated and I have a hard time sorting it out.

MS. WEISS: Well, perhaps it is worth attempting some explanation of what our position is anyway. There is at least a portion of the lessons learned work produced by the staff to decide to connect certain equipment to emergency power. And that includes the pressurizer heaters which are not an insignificant load --

CHAIRMAN SMITH: This is amount of load. You are talking about amount of load.

MS. WEISS: It is not a significant -- and the PORV. We believe that raises two questions: one is whether the provision to connect them emergency power will achieve

the stated objective of making that equipment more reliable; that equipment being the pressurizer heaters; in this case, the PORV.

In other words, do the diesels have the capacity to handle those loads?

CHAIRMAN SMITH: Capacity?

MS. WEISS: That is right. But you cannot separate reliability from capacity. Inherent in the question of whether the diesels can handle loads or whether -- is whether they can reliably handle the loads.

CHAIRMAN SMITH: Our first category. We will allow you to inquire into whether the importance of the added load is consistent with the added assumptions of reliability at the operating license stage.

MS. WEISS: Let me state what I think the second question is: the second question flows from the lessons learned required, is whether the connection of these loads to the diesels will degrade the reliability, inherent reliability of the emergency power supply itself.

In other words, if the diesel is incapable of handling this load, the result is not just that the pressurizer heater will not function. The result is that the diesel generator may totally become unavailable to handle all the rest of the emergency safeguards features.

CHAIRMAN SMITH: That is the second category. The

amount of the load -- will the amount of the load -- will the amount of the load, the sequence of the added load -- will the amount of the load and the way it is added and dropped affect the reliability.

We will permit that.

DR. JORDAN: Particularly, the way it is added, which we realize is an important part of your contention.

CHAIRMAN SMITH: We included also whether there is an unacceptable margin of capacity as a result of the added load.

MS. WEISS: Let me go on a little bit.

CHAIRMAN SMITH: We will not permit a litigation into will the generators do what they were found to be capable of doing in the operating license stage unless you can demonstrate something about this contention or the accident or something else, that they will not --

MS. WEISS: We do not see how you can answer a question about what margin remains without being able to ask the question of whether you can believe the original qualification.

CHAIRMAN SMITH: You are going to have to approach it through a show cause order or something else, but you are not going to do it in this litigation. We are going to go back --

MS. WEISS: I am trying to make the record as

clear as I can on what we intend to do.

CHAIRMAN SMITH: The proper forum for you, if you do not believe that the original assumptions at the operating license stage are valid, is a show cause, I would think. We think we have given you plenty of latitude to contrast the effect of the nature, the sequence, and the amount of this load.

MS. WEISS: If I may just continue, I do not want the board to think that I am continuing to challenge you; I just want to make this record clear.

CHAIRMAN SMITH: I understand. I forget that at the moment, but I understand when you remind me.

MS. WEISS: If the licensee has answered those two questions which I outlined by assuming the validity of the original qualification tests and by assuming that the periodic tests and refueling tests continue to demonstrate that level of reliability and if that assumption is incorrect, then it is UCS's position that the lessons learned objective will not only not be achieved, but it may create a worse safety problem than existed before.

That is, in attempting to improve the reliability of the pressurizer heaters and the PORV, we may have ensured that other important engineered safety features will not be available when needed.

And by way of offer of proof, let me say that UCS

intended to ask questions to demonstrate that the original qualification tests do not adequately demonstrate that these diesels are qualified to the levels which the licensee assumes they are qualified to.

I am still not sure --

CHAIRMAN SMITH: Your position is going to be -- would your position be even without the adding of the additional load and the changes,then,that the plant would not be safe to operate on this account?

MS. WEISS: We would concede that if these loads were not being added that we would not be able to inquire within the scope of this hearing into what the reliability is and what the capacity is of the diesels.

Our personal opinion may be that, yes, the original qualification tests at the time this plant and other plants were licensed were defective. We would concede that we could not come in and raise that issue, had the lessons learned not required a connection of this equipment to emergency power supplies.

I guess I am still not --

CHAIRMAN SMITH: There may be one other category which we are not looking at: that is the nature, the type of the load is to different, so completely different than the types of load that have ever existed than were serviced by the diesel generator; that that in itself is a

difference.

But we gave you that opportunity, I think.

MS. WEISS: It is not our contention --

CHAIRMAN SMITH: So they are consistent with the types of loads that have already been on.

MS. WEISS: Except for the provisions for connecting them. That is another part of the testimony.

CHAIRMAN SMITH: We are not getting to that.

MS. WEISS: At this point we are simply looking at it as a given amount of load, like any other amount of load, on the diesels.

DR. JORDAN: It is largely resistive in capacity; that is not an important issue, I think you are saying, and I agree.

MS. WEISS: That is correct. The question before the board at the original objection was what was the quantitative reliability -- what is the quantitative reliability demonstrated by the periodic tests and the refueling tests? If that question is stated, what is the quantitative reliability of the diesels to carry the additional loads -- in other words, existing plus additional loads demonstrated by the periodic tests and th refueling tests, I think that is a proper question within the bounds that the board has layed out.

CHAIRMAN SMITH: Would you do that again?

MS. WEISS: The question pending before the objection -- of course, I do not have it written down exactly. This is how I recall it to be, and if what I now state differs in any way from what the question was, then it will substitute for the original question.

But the question that we would like to have answered is: the witness has stated that periodic tests and refueling tests are done to verify the diesel's capability to handle all of the loads, the existing loads plus the new loads. And are question was: what is the quantitative reliability demonstrated by this periodic testing and refueling test, reliability to carry all of the loads which they are now called upon to carry, including the pressurizer heater loads.

CHAIRMAN SMITH: That seems to be, as I understand it, within the --it seems to be within our second category of permissible questions for this reason: I do not know if it is clear that the witnesses testified that they in their calculations and in their opinions presented in their testimony, that they relied upon the monthly and annual tests rather than -- or that they relied upon the operating license assumptions.

However, as I understand the testimony, is that the monthly and annual tests are confirmatory of the operating assumptions I do not know what the difference is.

MR. TROWBRIDGE: You lost me with the operating assumptions, Mr. Chairman. The testimony at this point has been that the predelivery testing and the periodic testing establishes the capacity or the capability of the diesel generators to deliver 3000 KW, and that has been the sole testimony relating to --

CHAIRMAN SMITH: Do they rely upon it? Is that essential to their testimony then?

MR. TROWBRIDGE: I don't know how essential it is, Mr. Chairman.

CHAIRMAN SMITH: Or is it a material part of the basis for their testimony?

MR. TROWBRIDGE: I think it is material. They testified to 3000 KW rating, and then they backed that up with, in addition to the manufacturer's say-so, there were tests before delivery and there have been tests since to establish the 3000 KW is in fact deliverable.

DR. JORDAN: Isn't that a matter of saying that the capacity and the capability to handle the load is there and is demonstrated by these monthly tests? But that does not address the question of has the reliability been affected by this change in load? And we agree that if the reliability has been changed, that would be important, an important item.

On the other hand, I presume that they are relying

on the original reliability figures if there is even -- whether they state them or not.

MR. TROWBRIDGE: I think, Dr. Jordan, you say "if." If the answer to the question "Has the reliability been affected" is "Yes," we probably got quite a long piece of cross-examination testimony and redirect ahead of us. But if the answer to that question is "No," and no one can establish that the reliability has been affected, or, to use the word "degraded" of the contention, then I think that the increase stops.

I am attaching importance to the distinction between the capability and the capacity and the reliability. As a matter of fact, I would point out to the Board that this contention, which talks about degrading the capacity, capability, and reliability of these power supplies in violation of GD-17, if you read GD-17, you will find only capability and capacity mentioned. You will not find reliability.

MS. WEISS: You will find that NUREG-0578 refers to reliability. I would like to press the question and have the record be clear on whether I am allowed to get an answer or whether it is ruled that I cannot get an answer.

(Board conferring.)

CHAIRMAN SMITH: We understand that the witness' testimony is that the added tests are relied upon to confirm

that the added load will not degrade the capability and the capacity of the system. And that falls within our second category of permissible inquiry.

MS. WEISS: That means that you are permitted to answer.

MR. TROWBRIDGE: Excuse me, Mr. Chairman. Then I would like to hear that question again. You just indicated capability and capacity. The question was in terms of reliability. I don't think that there is a meeting of the minds here.

CHAIRMAN SMITH: It does. At least that, if nothing more, that qualifies it for the inquiry into the contention. But I agree that the question should be clarified to go to all of the issues. If they ran the test and they rely upon it, the test for confirming the reliability of the system with the added load, then that is an appropriate area of inquiry, too.

If they are using these tests either to determine that the added load will not affect the capacity, the capability, or the reliability of the generator system, then I think the Intervenor has a right to inquire.

MR. TROWBRIDGE: The testimony was simply testimony to establish the capacity of the diesel.

CHAIRMAN SMITH: For what purpose?

MR. TROWBRIDGE: For whatever load is put on it.

CHAIRMAN SMITH: You just stated that they rely upon that. I didn't hear them say that, but you said it.

MR. TROWBRIDGE. I indicated that when questioned about the capacity, they did mention -- and I assume this is a form of reliance on the tests before and after delivery to establish that the diesel is capable --

CHAIRMAN SMITH: Let me inquire of the witnesses a little bit for my own --

MR. TROWBRIDGE: I think that would be helpful.

BOARD EXAMINATION

BY CHAIRMAN SMITH:

Q When you contemplate adding the pressurizer heaters to the system and you want to know if they are going to degrade the ability of the system to produce its capacity or degrade its reliability or degrade its capability, did you take into account the monthly and annual tests?

A (WITNESS TORCIVIA) I am a little confused. Did we take into account the monthly and --

MS. WEISS: Use your microphone.

BY CHAIRMAN SMITH:

Q Did you take that into account?

A (WITNESS TORCIVIA) Did we take into account the monthly tests to determine the reliability of the diesels?

Q Either the reliability, either -- it is a little bit more than that. It is in determining whether the added

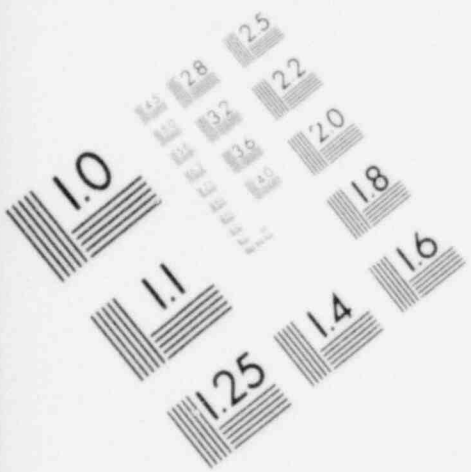
load from the pressurizer water heaters will degrade, will or will not degrade, either the reliability or the capacity or the capability? Did you take into account the monthly and fuel shutdown tests?

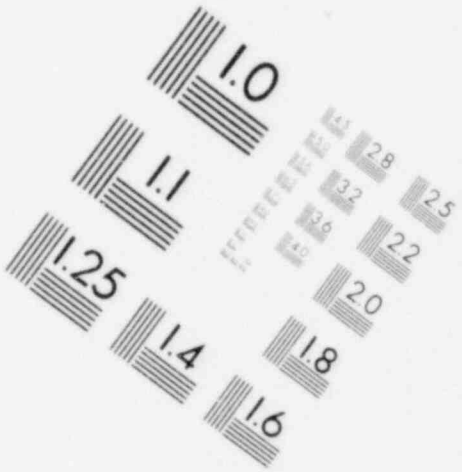
A (WITNESS TORCIVIA) Taking into account the monthly tests, at least in my opinion, does not affect how calculations are reviewed.

Q My next question: What use did you make of that information? First I want to know if you addressed the test, if you included information in your overall approach to the problem; did you include information taken from the monthly and -- I keep saying "annual tests," but you dropped that in your response. I am talking about the monthly tech spec tests and the emergency feature tests during fuel shutdown.

A (WITNESS TORCIVIA) What the monthly tests verify, in my opinion, is that the diesel was able to be loaded up to a 3000 KW load, which has been specified and is the rating of the diesel. It has done that during that test period, during the time of the testing. That is all that test has verified. So that 3000 KW is accepted as the basis on which we feel we can safely go to for loading that diesel.

Q That entered into your engineering judgment that you could add the heaters, the tested --

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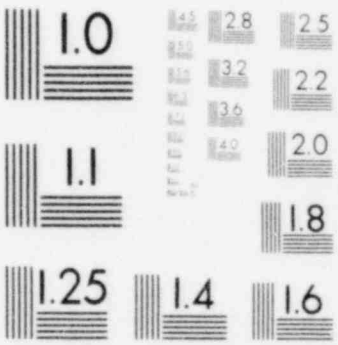


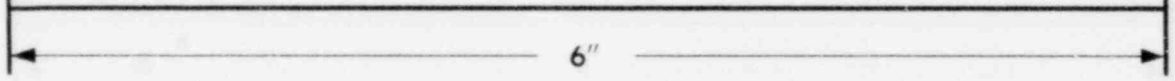


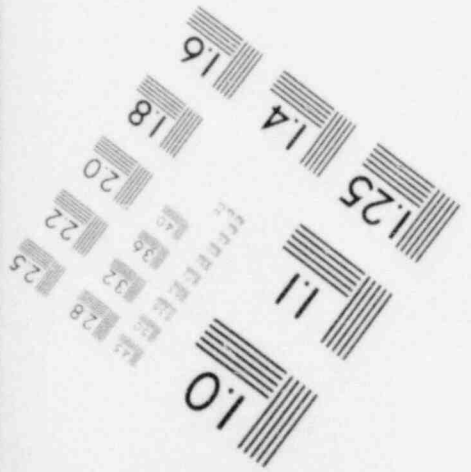


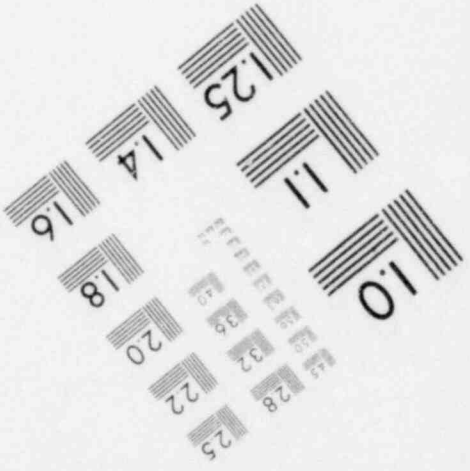

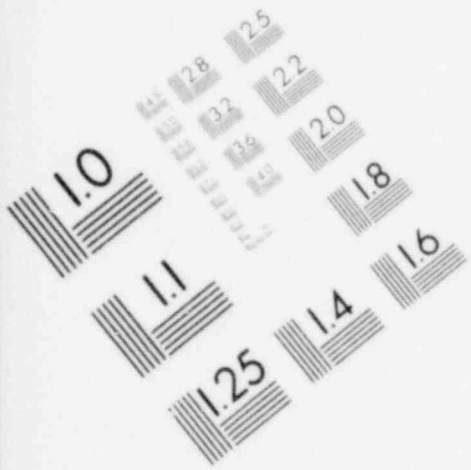


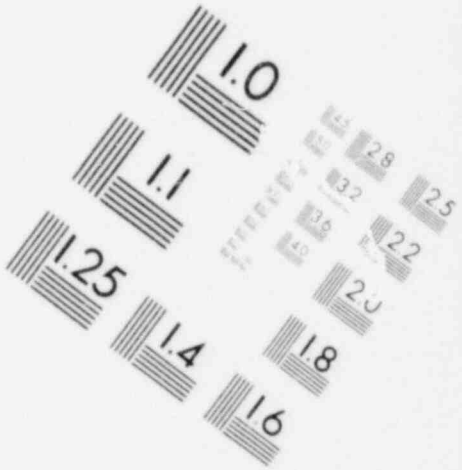


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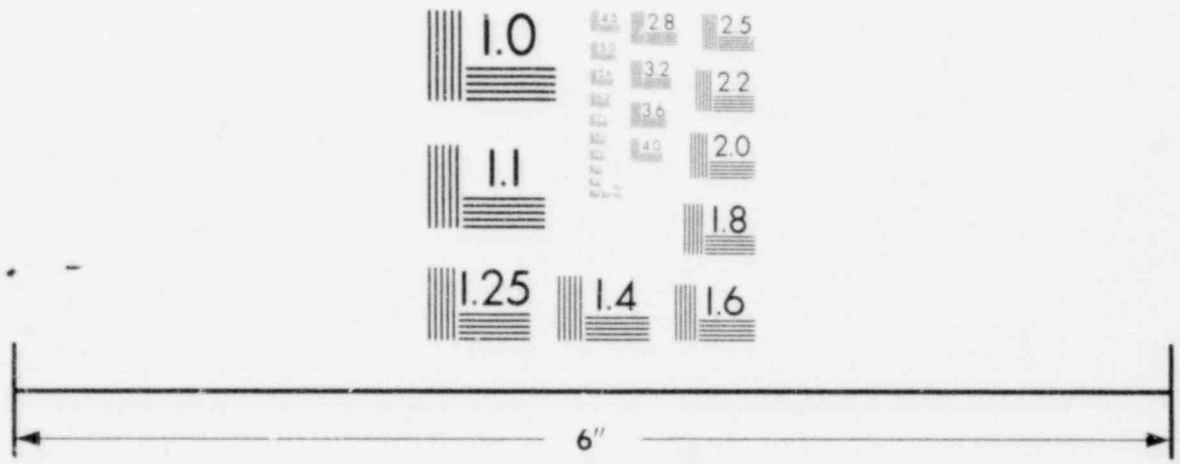


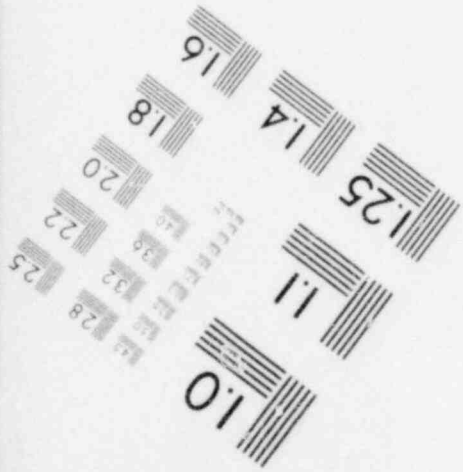


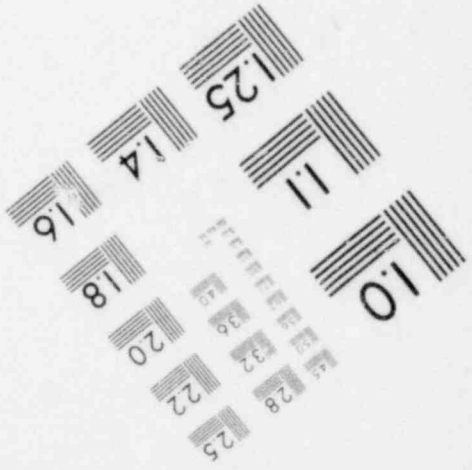

A (WITNESS TORCIVIA) Yes.

Q Would you describe the relative importance of the test, in your judgment, as compared to your calculations?

A (WITNESS TORCIVIA) The importance of the test in my calculations again --

Q Well, okay. My question made an assumption that you had two things: You had calculations, and you had tests.

A (WITNESS TORCIVIA) That's correct. It has been established through these various monthly tests that the diesel was capable of carrying 3000 KW. On that basis, we continued to say that if we limit ourselves to the 3000 KW, we will not in any way degrade the diesel or change any characteristics of it; we still will have the full 3000 KW available to us to use as we may.

Q So the tests were confirming your calculations?

A (WITNESS TORCIVIA) Yes.

A (WITNESS SHIPPER) What we would use those for, it provided the upper limit of the loading.

A (WITNESS TORCIVIA) That we can go to.

BY DR. JORDAN:

Q Did you try to address at all the question of whether the extra load of these heaters would at all affect the reliability?

A (WITNESS TORCIVIA) As indicated in previous

testimony, we specifically set up the procedures so that we would not exceed the 3000 KW. And when those pressurizer heaters were to be applied, we would not exceed those 3000 KW, so we did limit ourselves to the so-called upper limit.

A (WITNESS SHIPPER) When you mention the word "extra load," we don't really consider that as extra load, because we are still under the 3000 limit. If I was going to 3001, that 1 KW would be extra load. We may be cutting into the margin, but we are not -- we are not exceeding the capability of what that diesel generator is rated for.

Q The tests are done at 3000 kilowatts, and the original qualifications, I presume, are done at 3000 kilowatts, too?

A (WITNESS SHIPPER) Yes.

A (WITNESS TORCIVIA) Yes.

Q Your presumption is that the original qualification tests do not have to be done again?

A (WITNESS SHIPPER) That's correct.

A (WITNESS TORCIVIA) That's correct.

At the risk of probably getting involved in something else, may I say this to the Board: Before our studies were completed, we had made detailed analysis, computer analysis, of not only the loads but the voltage drops associated with those loads, as each block went on. And the dips that were developed during the start of motors,

at one point it went down on our dips. And we have detailed computer studies on that.

We also recognize, and I think the Board recognizes, that the pressurizer heaters ar purely resistive type loads, and, as such, we do not have that other unfortunate situation where you have large in-rushes that may disturb the system. So that we felt comfortable in adding that extra 126 KW on the diesel after we were assured that it was down at the 2874, whatever figure I had given, that the diesel was to be kept at.

(Board conferring.)

CHAIRMAN SMITH: Ms. Weiss, is that of any help?

MS. WEISS: Yes, I think that has been of help. And I would like to know, purely as a matter of information, what is the quantitative reliability associated with the testing program?

MR. TROWBRIDGE: Objection to the question.

CHAIRMAN SMITH: If for no other reason, it has come to a point where the ruling is almost the flip of a coin, and for no other reason, the answer should be in the record as part of the proffered proof. And also for review.

My opinion is it has probably gone somewhat beyond, but it is close enough that I think it should be in the record. As determined from the tests -- are you talking

about that -- as determined from the tests?

MS. WEISS: Yes. They have described the tests. They stated they relied on them. We are entitled to know quantitatively.

MR. TROWBRIDGE: Mr. Torvicia also said he did not have detailed information about the tests. And I simply ask the Board to bear in mind, and for the witnesses to bear in mind, that they should answer what they know, and if they are not the proper persons, don't have knowledge that they are sure of, that they need not -- that they simply say so.

CHAIRMAN SMITH: That's fine. That is fine. There is no problem there. But that is not a basis for objection. That is something for the witnesses to bear in mind.

MR. TROWBRIDGE: It is the reason why I have been objecting. It is not a basis in itself for an objection.

DR. JORDAN: One more observation. Of course, Mr. Pollard and Mr. Torcivia both know that the tests that they are doing will not give quantitative data on the reliability of diesels. That has been explored in many other tests, many other experimental -- much experimental evidence.

There is question about the reliability of diesels. This was a matter of concern to the Appeal Board, as you remember, in St. Lucie. But that is the thing we are not going to go into now is the original reliability test.

And the quantitative reliability data that was gotten, we know essentially that the number of tests was limited, whatever the regulatory guide said, if I remember, something like 100 tests or something. But that was part of the original licensing, and we think is not, therefore, part of the data right now.

CHAIRMAN SMITH: You may answer the question. Do you recall the question?

WITNESS TORCIVIA: I would appreciate having it repeated.

CHAIRMAN SMITH: Include in the question the certainty that you are asking about, the reliability which has been demonstrated or not demonstrated by the tests which were referred to in the testimony.

MS. WEISS: That's the question exactly.

BY CHAIRMAN SMITH:

Q Did you learn in the tests which you looked at in arriving at -- whether you could add this load -- did you in those tests, did you make any determination as to the quantitative reliability of the diesel system?

A (WITNESS TORCIVIA) Not in terms of quantitative reliability, no. It was a test that told us that the diesel had consistently carried 3000 amps during that period of time. But as to its reliability tomorrow morning, I don't know.

BY MS. WEISS:

Q Addressing yourself to page 4 of your testimony, please, the first full paragraph, the last sentence states as follows: "Further, the rated capacity of the diesel has been verified as being capable of handling the heaters in addition to the safety-related loads required during loss of off-site power events."

Would you tell me, please, each and every way in which the rated capacity of the diesels has been verified as being capable of handling the heaters in addition to the safety-related loads?

MR. TROWBRIDGE: I suggest this question is repetitive of questions that were asked before. I have no objection to the question then. My objection now is we are simply going to go over the same ground of calculations.

(Board conferring.)

MS. WEISS: I am not sure, Mr. Chairman, whether the witnesses have given each and every way in which they have done this verification. But I am trying to do this so that the record will be absolutely clear.

MR. TROWBRIDGE: I would not object to a question whether there is any way which they have not already discussed.

CHAIRMAN SMITH: Let her ask. Overruled.

WITNESS TORVICIA: How we verified the test?

BY MS. WEISS:

Q I want you to tell me each and every way in which the rated capacity of the diesel has been verified as being capable of handling the heaters in addition to the safety-related loads required during loss of off-site power events.

A (WITNESS TORCIVIA) I believe we have established a 3000 KW rating of this diesel is an accepted value. As such, what we did, as previously indicated, was summed up the total KW rating of all of the loads which were to be put on the diesels during emergency condition, added them up, came up to a number, and then added on 126 KW, which kept us within the 3000 KW.

As indicated by the previous memo, the procedures will so be set up. As also previously indicated, we not only developed a loading in terms of the KW which was going to be put on, but we also developed complete voltage studies during each period of time at which those loads were put on the diesels. They are put on in blocks.

We have developed through computer studies and analysis that we can safely put on those loads during those various blocks, as required, and the pressurizer heaters on them, when and if so required.

Q Does that complete your answer?

A (WITNESS TORCIVIA) So far.

Q I think you stated earlier -- Mr. Shipper stated -- that the addition of the pressurizer heaters will constrict the margin, lessen the margin, between 3000 KW and the loads represented by all of the engineered safety features plus the pressurizer heaters. Can you tell me what the margin was before and what the margin will be now?

A (WITNESS TORCIVIA) Using that gentleman's figure of 2513, I think it was, which was the load at that time, assuming that is the full safety loads, and we add 126 KW, we have reduced the margin between the 3000 accepted value or whatever value it may be, by 126 KW. If that is what is meant by "margin."

Q The letter that you read from earlier -- or it's a memorandum, I guess -- dated August 11th, 1980, signed by you, to C. Hartman, subject, Emergency Procedure 1202-29, pressurizer system failure. It is labeled "Inter-Office Memorandum, GPU Service."

It states that, quote: "The operator is to verify that the diesel KW is below 2874 before energizing pressure heaters. The total continuous diesel load must be kept at or below 20,000 KW."

Can you tell me, please -- let me just state that question slightly different. When I read -- 2874 plus 126 is 3,000. That appears to me to leave no margin. Am I misinterpreting this in some way

A (WITNESS TORCIVIA) I don't know that we are looking for any margin. We are using the generator to its full capabilities. It has been accepted and verified. And we are using it to its most efficient and full capability.

A (WITNESS SHIPPER) I think you have a difference between design limits and operating limits. When you go and design something, you design into it a margin. When you go and operate it, you operate it to its capability. It is capable of 3,000 KW.

Q What was the meaning of the word "margin" if, during the time it will be operated, it will be operated to have no margin?

A (WITNESS TORCIVIA) He's told what to do.

Q You are telling the operators that they can connect the pressurizer heaters when the diesel kilowatt, KW, is below 2874, meaning that they can connect the pressurizer heaters so that the total load on the diesel is 3,000. That does not provide a margin.

That allows the operator to use the full capacity, is that correct?

A (WITNESS TORCIVIA) That's correct.

A (WITNESS SHIPPER) It's like going down the highway using 50 miles an hour. You have five miles margin. If you want to go 55, you still can go 55, conditions permitting. It is the same analogy.

(Counsel for UCS conferring.)

Q Assuming that Mr. Cutchin correctly read the original safety evaluation report for Three Mile Island Unit 1 and the staff reviewed the diesels against a maximum load of 2513 KW, and assuming in addition that the maximum loading on the diesels will now be 3,000 KW, does this increase from 2513 to 3,000 KW affect the reliability of the disel?

MR. TROWBRIDGE: Mr. Chairman, I object to the question. I have to have a repeat. There was an assumption in there which I would ask Ms. Weiss to restate, something about Mr. Cutchin's reference to the maximum capacity.

Would you state that again?

MS. WEISS: Will the reporter please read it back.

(The reporter read the record as requested.)

MR. TROWBRIDGE: My objection stands. Mr. Cutchin's -- Mr. Cutchin did read from the safety evaluation report, where he described the safety load for -- for emergency conditions to be 2513, I believe. He certainly did not refer to that as the maximum load on the diesel.

MS. WEISS: That is not correct. Let me read the language exactly from the safety evaluation report. Quote: "Maximum diesel loading in the event of an accident is 2513 KW, which is below the 2,000 hour rating of the diesels and in accordance with Regulatory Guide 1.9."

"Let me state, this procedure makes it absolutely clear that maximum diesel generator load may be as high as 3,000 KW."

CHAIRMAN SMITH: Is there any question that the two assumptions are not -- are you satisfied the two assumptions are comparable, that there would be no more than 2513 load and safety conditions in an accident condition?

MS. WEISS: All we are saying is, assuming the staff reviewed a maximum load on the diesel generators of 2513, I think that language clearly states that was the maximum reviewed.

CHAIRMAN SMITH: You complicate the question so

much by putting in "assuming the staff reviewed." If you could just go directly to the question. However, do it your way.

MS. WEISS: Maybe I will try it that way.

BY MS. WEISS: (Resuming)

Q Is increasing the maximum diesel generator load from 2513 to 3,000 KW, does that affect the reliability of the diesel generators?

A (WITNESS SHIPPER) In my opinion, it does not. The piece of equipment has a nameplate rating on it, and that is 3,000 KW. And if I run that piece of equipment at 3,000 KW, I have not changed the capacity, the capability, nor the reliability of that piece of equipment.

MR. POLLARD: I want to go back with one follow-up question.

CROSS-EXAMINATION -- CONTINUED

BY MR. POLLARD:

Q Is it your testimony, Mr. Shipper, if you have a piece of electrical equipment such as a diesel generator that is rated for 3,000 KW as its 2,000 hour rating, that running it right at its rating, its reliability under those conditions is no different than if you operated a diesel generator at substantially less than its rating?

A (WITNESS SHIPPER) Now we get into life --

Q No, sir. I want to talk about the reliability of

the diesel generator performing the function of carrying the load on it. As I understood your last answer, you testified that the reliability of the diesel generator in terms of its probability of successfully carrying the load would not be affected if the load was increased from 2513 KW to 3,000 KW; is that correct?

A (WITNESS SHIPPER) In my opinion, that's correct.

Q You made an analogy before of the car and the margin. Is it your testimony also, with respect to a car, that if you drive it at 55 miles an hour, its reliability of carrying you safely would be no different than if you held the accelerator to the floor, to the maximum capability of the car?

MS. WEISS: You can answer the question. There hasn't been any objection.

WITNESS SHIPPER: I would say it depends on the circumstances.

B POLLARD. (Resuming)

Q It would not depend upon the circumstances in the case of the diesel generator?

A (WITNESS SHIPPER) The set capacity or capability of the car is set at 55 miles per hour in my analogy.

Q Back again, Mr. Torcivia, to the portion of your rebuttal testimony where you were discussing the trip and circuit breakers on Figure 1, and your testimony that in

order to verify the capability of the diesel generator to carry the heaters, in addition to the safety-related loads during loss of offsite power events.

First, when you summed up the loads, what power factor did you assume?

A (WITNESS TORCIVIA) I believe that was 85 percent. I do not recall the exact figure. We did use a power factor rating.

Q The 85 percent power factor or the .85 power factor, was that applied to all loads or did you use different power factors to different loads?

A (WITNESS TORCIVIA) It was applied across the board, as I recall.

Q Including for the pressurizer heaters?

A (WITNESS TORCIVIA) No. I have already stated, that is a resistor load.

Q That's why I asked you the question. Did you use .85 as a power factor for all loads connected to the diesel generator while you were summing them up?

A (WITNESS TORCIVIA) The loads we summed up for connected to the generator were the original loads. That's what I assumed you were talking about, which was the emergency loads. The pressurizer heaters were added to that load.

Q So it is within the 2874 KW, for all those loads

you assumed a power factor of .85?

A (WITNESS TORCIVIA) That's about right.

Q The devices used to trip the distribution breaker and the main feeder breaker on overcurrent, can you describe for me the types of devices they are and how they operate?

A (WITNESS TORCIVIA) Those are the Westinghouse DB breakers, which is -- they're a particular type. Those breakers are operated through a combination of air and oil type trip units.

Q You can continue, but I am only interested for you to describe how the devices which trip the breaker on overcurrent work. You do as much as you want.

A (WITNESS TORCIVIA) How the breakers trip mechanically? I thought that's what you were referring to.

Q I am trying to figure out how does the breaker sense overcurrent, and then subsequently -- I am primarily interested in how the overcurrent is sensed, rather than physically how the breaker is tripped open.

A (WITNESS TORCIVIA) All right. The breakers have three trip devices on them. Each one of those trip devices, the mechanical trip devices, is surrounded by a winding, copper winding of wire coil or what have you which is sufficiently large to carry the amount of continuous current for which the breaker is designed. As the current is -- goes through that coil, a magnetic field is developed within

that unit, which in turn actuates a plunger within the mechanical device for which the breaker is operated.

Q You say they have t' e trip devices. You have described one. Can you describe the other two, please?

A (WITNESS TORCIVIA) They are all the same. There is one for each pole.

Q This is what is commonly referred to as a shunt trip device?

A (WITNESS TORCIVIA) No, sir.

Q Is there a name for what you have just described?

A (WITNESS TORCIVIA) The device I just described? Magnetic-type devices, long-term and short-term type designations.

Q And what you have described is applicable to both distribution breakers and main feeder breakers?

A (WITNESS TORCIVIA) Not the distribution breaker.

Q Can you describe it?

A (WITNESS TORCIVIA) The main feeder breaker and the main breaker.

Q Thank you.

This magnetic device, is that also sensitive to reactive current?

A (WITNESS TORCIVIA) Is that the question?

Q Yes.

A (WITNESS TORCIVIA) As far as the breaker is

concerned, it has no respect for any type of current, except current, be it what it may.

Q So that reactive current would trip the breaker just as well as real current?

A (WITNESS TORCIVIA) That's correct.

DR. JORDAN: Just as well as what current?

MR. POLLARD: I used the phrase "real."

DR. JORDAN: I still can't hear.

MR. POLLARD: Real.

DR. JORDAN: By "real" you meant in-phase?

MR. POLLARD: Yes, the power current, as opposed to the -- the current associated with the phrase "kilowatt," and the reactive current being the current associated with kilovolt, amperes.

BY MR. POLLARD: (Resuming)

Q You understood it that way, too?

A (WITNESS TORCIVIA) I assumed that much.

Q Am I correct that in summing up the loads, had you used a service factor of 1.15 instead of 1.0, you would have come up with a higher kilowatt rating or a higher kilowatt total?

A (WITNESS TORCIVIA) Would you repeat that, please?

Q In summing up your loads, you testified earlier that you had used a service factor of 1.0. Am I correct that if you had used a service factor of 1.15 your total

kilowatt load would have been higher?

A (WITNESS TORCIVIA) If I had used that service factor.

Q In that sense, using a service factor of 1.0 is in a non-conservative direction?

A (WITNESS TORCIVIA) No. I don't think the question is conveying the right thought. We did not use the service factor of 1.0 as a convenience. All of our motors are rated 1.15, but their loads have been limited to within the service factor of 1.0. The service factor of 1.15 is an extra margin which is available to us should that be required under degraded voltage condition or other conditions which may require to maintain the torque to provide the necessary power for the flow of water, whatever it may be.

Q Under such degraded conditions, those motors would in fact operate at the higher service factor?

A (WITNESS TORCIVIA) That is correct.

CHAIRMAN SMITH: Under what kind of conditions?

MR. POLLARD: Under the degraded conditions.

CHAIRMAN SMITH: Degraded voltage conditions?

MR. POLLARD: Degraded conditions he referred to in his previous answer.

BY MR. POLLARD: (Resuming)

Q Turning to page 4 of your prepared testimony, item

one at the bottom of the page, it says, quote: "There are three separate and independent signals that produce this safety action (accident) signal which will trip the pressurizer heater loads." Quote.

Can you tell me, what are those three separate and independent signals?

A (WITNESS SHIPPER) I think I am correct in stating the signals are 1600 pounds in the reactor coolant system, 4 pound pressure in the building, and 30 pound pressure in the building.

DR. JORDAN: I'm a little unclear. Are you saying that those three things are the signals that trip the engineered safety feature actuation signals, ESFAS, and that in turn trips the pressure, trips the pressurizer heater loads?

WITNESS SHIPPER: Correct. Either one of the three will trip, and any one of the three will trip the pressurizer heater breaker.

DR. JORDAN: Any one of the three will trip the ESFAS?

WITNESS SHIPPER: Yes, which in turn will trip the breaker.

DR. JORDAN: Right.

BY MR. POLLARD: (Resuming)

Q During your deposition by UCS on the 26th of

March, 1980, you referred to the ES trip signals, and I asked a similar question.

MR. TROWBRIDGE: Mr. Pollard, would you mind waiting until we collect a copy of that deposition?

MR. POLLARD: Perhaps it is a good time to break for lunch, then.

CHAIRMAN SMITH: All right. We will return at 1:00.

(Whereupon, at 12:02 p.m., the hearing was recessed, to reconvene at 1:00 p.m. the same day.)

AFTERNOON SESSION

(1:04 p.m.)

MR. TROWBRIDGE: Mr. Chairman, I have a short preliminary matter.

MR. POLLARD: Mr. Adler is not here.

CHAIRMAN SMITH: We don't have anyone from the Commonwealth.

Go ahead. If it concerns them, we will bring it up later.

MR. TROWBRIDGE: Yesterday the Board indicated it would treat ECNP's December 15 letter as a motion, indicated that if we had not taken it as a motion, we might ask for it, yesterday to be treated as the day of service. It turns out that neither I nor Mr. Zahler, nor Ms. Ridgway did consider it as a motion. Therefore we would like to take advantage of the Board's order which Mr. Zahler calculates would make our reply due on January 5.

MR. CUTCHIN: I have a short preliminary matter, too, Mr. Chairman.

CHAIRMAN SMITH: Is it about this?

MR. CUTCHIN: I'm sorry, I thought he was through.

MR. TROWBRIDGE: I am through.

CHAIRMAN SMITH: You are stating correctly that we had stated that we would regard it as a motion because it requested relief, but if you think that we are incorrect in

that viewpoint, too, you should make your arguments.

MR. TROWBRIDGE: It was a request of the Board. It was served, as far as I can tell, at least on us and the other parties.

CHAIRMAN SMITH: We will set January 5 as the -- is that the date that you gave, January 5?

MR. TROWBRIDGE: January 5, yes.

CHAIRMAN SMITH: That is the date for timely response.

MR. CUTCHIN: Yesterday, Dr. Jordan asked a question to see if the staff could assist him in finding out the applicability of Reg Guide 1.6 at both the operating license stage and now.

Preliminarily, as best as I am able to determine, as Mr. Pollard indicated, the guide has not been reprinted, and the words are the same as they were in that original guide labeled Safety Guide 6.

With regard to whether the Guide was applicable to TMI 1 at the time of operating license issuance, I can only read again from the Safety Evaluation Report at the operating license stage wherein it states, "The electric power system for Three Mile Island Unit 1 has been evaluated to ensure that the guidelines of Regulatory Guide 1.6 is met in the appropriate portion." I am reading from again Section 8.0 entitled "Electric Power."

With respect to the on-site power system, 8.3 of that same document, it states that the "AC portion of the on-site system is redundant and split throughout in accordance with Regulatory Guide 1.6, with the exception of one swing bus at the 480 volt level for one containment ventilation fan." There it refers to Section 7.2 of the report wherein the words read, "There is one exception to the independent (split bus) design. One containment ventilation fan automatically swings between two redundant AC emergency buses in order to satisfy the single failure criterion under non-accident conditions. The swing feature is bypassed under accident conditions. We reviewed the design and conclude that no single failure will permit the swing bus to interconnect the two redundasnt and non-synchronized emergency buses or otherwise precipitate a loss of all on-site power. On the basis of our review, we conclude that this exception is acceptable since it satisfies the single failure criterion."

Now, with respect to the question yesterday as to whether an automatic bus transfer switch such as that agreed by Mr. Correa to be within his understanding of what exists at TMI 1, that being one that enables the engineered safety features valve control center 1C to be powered from either diesel generator, the question was does that comply with Regulatory Guide 1.6. The staff at present has not focused

on the details of that design. When we initially reviewed it, we had understood it was a manual transfer, so we would now have to go back and look at the details of that design to see if it is of the type that was referred to in the Safety Evaluation Report I just read from, that being one that is cable of being bypassed under accident conditions.

But to answer your question directly, a swing bus provision which interconnected the two diesel power supplies during accident conditions would not, in the view of the staff, be acceptable.

DR. JORDAN: Thank you, Mr. Cutchin. That is very helpful.

Whereupon,

PAUL SHIPPER, JR.

JOSEPH TORCIVIA

resumed the stand, having been called as witnesses by Counsel for Licensee Metropolitan Edison, and having previously been duly sworn, were further examined and testified as follows:

CROSS EXAMINATION -- Resumed

BY MR. POLLARD:

Q Before we get back to the question we were pursuing before lunch, I would like to ask you, Mr. Torcivia, do you have with you the calculations which you described in terms of summing up the loads on the diesel

generator, identify the loads, identifying what service factors and power factors you used? Do you have those calculations with you?

A (WITNESS TORCIVIA) No, sir.

Q Do you have them back in your office?

A (WITNESS TORCIVIA) Yes, sir.

Q Would it be possible for you to provide me with a copy of those calculations?

MR. TROWBRIDGE: Objection to the question. Such questions should be addressed to counsel.

MS. WEISS: Go ahead and answer it, then, Counsel.

MR. TROWBRIDGE: Would you repeat again what it is you wish?

MS. WEISS: Yes, Mr. Pollard.

MR. POLLARD: Mr. Torcivia has described some calculations he has done to assess the loads on the diesel generators to make sure that they will not exceed the 3000 kilowatts.

MR. TROWBRIDGE: You are asking whether we will produce from Parsippany for this proceeding those calculations?

I object on the grounds of timeliness, Mr. Chairman. I see no reason why we shouldn't dispose of this issue on the schedule that we have been on. This is material that could have been asked for before. I don't see

why -- I hope not to have to bring these witnesses back again on this issue.

(Counsel for UCS conferring.)

MS. WEISS: On the timeliness question, we did depositions of the Licensee's witnesses on this subject on March 26, 1980. Mr. Shipper was in that deposition. Mr. Torcivia was not. We had no knowledge of Mr. Torcivia's personal calculations until we heard that today, and we had no reason to believe that he had done them until we heard that today. They are certainly not disclosed in the direct tstimony.

MR. TROWBRIDGE: I just reread the depositions. Since it is going to be apparently referred to, I don't recall any request for Mr. Torcivia or information on this subject.

MS. WEISS: We didn't know Mr. Torcivia existed.

MR. TROWBRIDGE: Mr. Pollard asked -- if he asked a question to which we didn't give a proper response, I would like to hear the question.

MS. WEISS: I am not alleging any such thing. I am simply alleging we had no reason to believe that such calculations had been done or any person had done them, or that they were going to be relied on in the direct testimony.

MR. TROWBRIDGE: You didn't seek to inquire as to whether such calculations had been made or were being made.

I object again. I see no reason why we should protract this piece of the hearing to go back over calculations and resume hearings and call back witnesses.

MS. WEISS: We don't have any particular reason to believe it is going to delay the hearings any. If we get a copy of those calculations, as soon as we get back in our office we can look them over. We hadn't asked that the witnesses appear and discuss them. If we see the calculations and if this -- if we think it is necessary to question the witness about them, and if we can persuade this Board that it is necessary to question the witness about them, that can be done the first day we are back here. I assume these witnesses will be here at that point anyway. I am quite sure we won't be finished with this Contention.

CHAIRMAN SMITH: We will take it under advisement.

MR. TROWBRIDGE: This is a late discovery request. I have not heard the good cause for lateness adequately addressed.

CHAIRMAN SMITH: We will take it under consideration. We will announce a ruling either at the end of the recess or later tonight.

MS. WEISS: All right.

Mr. Trowbridge keeps coming up with new grounds. I don't consider it a late discovery request. It is a motion to produce a document which -- the existence of which

was disclosed for the first time today.

CHAIRMAN SMITH: That is why I said we would defer ruling. I would like to look at the testimony and see how much notice you might have had, either directly or implicitly, that there would be calculations.

BY MR. POLLARD: (Resuming)

Q Mr. Shipper, if I can summarize where we were before the break and get back to the questioning, I had directed your attention to Item 1 on page 4 of your direct testimony about the three separate and independent signals that produced the safety action, the signal which will trip the pressurizer heater loads, and then you told me that those three independent signals were 1600 pounds in the reactor coolant system, and either four pounds or 30 pounds pressure in the building.

A (WITNESS SHIPPER) Let me state one thing. I a almost positive the 1600 and four pounds. I am not one hundred percent sure of the 30 pound signal. I was trying to get clarification on that over the break, over lunch, and I could not reach the engineer, the responsible engineer that would be available to give me that information.

Q Is your concern over whether or not it is a signal from building pressure or is it your concern about the actual set point?

A (WITNESS SHIPPER) It is concern whether it is

building pressure. 30 pound signal is a set point within the actuation system as far as I know, but I am not sure if it triggers the actuation. I am not sure of how the 30 pound signal interfaces.

Q Is it that you can't recall when you wrote this sentence in your testimony what those signals were? Is that what the difficulty is?

A (WITNESS SHIPPER) Correct.

Q Do you have some estimate of how long it will be to get this answer? If we took a five minute break, can you get the answer?

I don't know how toi proceed?

A (WITNESS SHIPPER) I could possibly. I have to get ahold of the engineer that designed the system.

A (WITNESS TORCIVIA) What bearing do those values have on this testimony? Could I ask that? They are three ES signals that involve, that trip our breakers. That is all that concerns at least me from the electrical point of view. As to the value, I don't quite understand what bearing that has on the testimony.

MS. WEISS: We would be happy to explain that.

Why don't you explain that, Mr. Pollard.

MR. TROWBRIDGE: For my clarification, I may have misunderstood.

Mr. Shipper, did you say it was only the value

that was in question in your mind, or whether there were in fact three signals?

WITNESS SHIPPER: No, there are three signals.

MR. TROWBRIDGE: All right.

WITNESS SHIPPER: It is the value and the parameter it is measuring.

MR. TROWBRIDGE: Thank you. I misunderstood your statement.

BY MR. POLLARD: (Resuming)

Q Mr. Torcivia, the concern is not whether it is 30 pounds of 29 pounds, but as Mr. Shipper said, he is not even sure it is a signal from the reactor building.

My further concern is whether or not in fact there really are three separate, independent signals.

A (WITNESS TORCIVIA) There are three signals.

MR. TROWBRIDGE: Mr. Chairman, at this point we would suggest a break. We think we can get a quick answer.

CHAIRMAN SMITH: Right now?

All right, we will take a five minute break, or until you knock on the door.

(A brief recess was taken.)

CHAIRMAN SMITH: On the record.

MR. TROWBRIDGE: Mr. Chairman, it turns out we do not have a confident answer and may not have a confident answer until the next break to the question put by Mr.

Pollard.

DR. JORDAN: For the three signals that actuate the emergency --

MR. TROWBRIDGE: That's correct.

DR. JORDAN: I thought they would be in the Restart Report.

WITNESS SHIPPER: I don't think they are in the Restart Report. They may be in the FSAR. I am sure they are in the FSAR.

DR. JORDAN: There have been changes made for restart.

WITNESS SHIPPER: That's what I'm not sure of.

DR. JORDAN: I think there have been, but all right. Let me not try to tell the Licensee what is in the Restart Report.

MR. TROWBRIDGE: When we give the answer, I would like to be sure to give it right.

MS. WEISS: Let's go on to another line of questioning and return to that after the next break.

BY MR. POLLARD:

Q I will turn then to some questions, Mr. Torcivia, on your rebuttal testimony.

(Pause)

Mr. Trowbridge directed your attention to pages 4-3 and 4-4 of my testimony, specifically item three, which begins at the bottom of 4-3 and continues on 4-4.

And in answer to his question, as I recall your answer, you said the short circuit would not result in loss of the power supply.

Was that correct?

A (Witness Torcivia): A short circuit at the pressurizer heater terminals.

Q And then you discussed the overcurrent devices on the distribution breaker, the feeder breaker, and the main bus breaker.

As I recall your testimony, you testified that with respect to the main bus breaker, that its overcurrent trip set point was in the range of -- perhaps you did not.

Can you tell me what is the set point of the main bus breaker?

A (Witness Torcivia): You are asking what is the set point?

Q The overcurrent that was required to trip the main

bus breaker.

A (Witness Torcivia): Under what conditions? The breaker characteristics lend themselves to tripping out within certain time periods under various conditions. Are you referring back to the short circuit condition that you previously stated?

Q Let me back up.

You described for me earlier how the overcurrent was sensed for the main feeder breaker and for the main bus breaker, and you described a magnetic trip.

A That is correct.

Q Could you then go on and describe the various set points for that overcurrent trip for the main bus breaker, and if you need to, tell me both the current and the time delay.

A (Witness Torcivia): I think if we refer back to figure one, the main breaker, which we consider the upstream breaker, has a time curve characteristic curve which can be adjusted within range so as to obtain a certain trip point for a certain amount of current.

I do not know if I am making myself clear. This is a type of a curve which, as the current is increased, the time required for the breaker to trip will decrease constantly down the line.

Is that clear?

The setting of that main breaker, as related to the setting of the main feeder breaker, is such on the curve that the main breaker will trip at a time longer than the main feeder breaker, and further down the distribution breaker panels, which are not electromagnetic -- those are the thermal magnetic type, and they too have definite characteristics, which when associated to each other, each curve is given a time delay in a sense as the current begins to increase.

Q Let's see if I can be more specific. According to my notes, your answer with respect to the main feeder breaker was that the instantaneous overcurrent trip was in the range of 1200 to 1250 amps and it would trip in approximately .2 seconds.

A (Witness Torcivia): That is about right.

Q Can you give me the corresponding trip set point for the main breaker, the instantaneous trip?

A (Witness Torcivia): I am now reading from a coordination curve for the corresponding point; if you are saying 1250 amps, if you are picking that particular point, at that rating, as far as a main breaker is concerned, it would not trip.

It does not recognize that level of current.

Q How high would the current have to be to trip the main bus breaker within .2 seconds?

A (Witness Torcivia): It would have to be in the vicinity of, I would say, about 8000 to 12,000 amps. And that would be about .2 seconds. I am using rough figures there.

Q Can you briefly describe how a magnetic trip device can incorporate within it this current time characteristic?

A (Witness Torcivia): Yes. As I say, these particular breakers, which are the man feeder breaker and the main breaker are of the electromagnetic type; they have no thermal elements in them.

The magnetic field which is surrounding the trip elements is producing amperic turns required to actuate a plunger. Now, within this plunger, there are basically two plungers involved. One is what we call the instantaneous and the other, time delay.

During the low current conditions, the time delay plunger is gradually going up as the current is increased; the orifices within the element which prevent the contacting mechanical arm from actually tripping the current, so it is gradually going up under a time delay.

Should the current exceed a certain amount -- and in this case probably between 8000 and 10,000 amps -- the magnetic field is at such value that it will immediately pull up a second plunger in there that actuates the

instantaneous trip.

It is at that point where we get down to that low, low level of .2 of a second or thereabouts.

Q I want to make sure I understood your last answer with respect to the time delay trip. I heard you say that with relatively low fault currents, the plunger would move up slowly.

But I thought what you said was during this time that the current would be increasing.

Is it not the case that when you have sufficient current to start this plunger moving, that even if the current remains constant at that value, the plunger would continue to move?

A (Witness Torcivia): You are talking about transient conditions; is that correct?

Q No, I am not talking about a transient.

Let's say we have sufficient fault current to start the plunger moving on the time delay trip. Assume that that current remains constant at that value, whatever it is.

Is it not the case that the lunger continues to move and that current need not increase any further beyond that?

Is that correct?

A (Witness Torcivia): The current remains

constant. The plunger is now also constant. It has arrived at a certain level as it is going up.

Q If the current remains constant, the plunger will stop at some point before it trips the breaker?

A (Witness Torcivia): That is correct. There is a counteracting force, a diaphragm within the assembly of the trip -- the trip elements. They are counteracting each other. The forces are counteracting each other, and there will be a stabilizing point at which it would no longer go up.

Q According to my notes also -- and correct me if I am wrong -- you testified that with respect to the main bus breaker, which on figure one is labeled "main breaker," that the time delay on the main breaker is 15 seconds.

Is that correct?

A (Witness Torcivia): I believe I said that the time delay would be approximately 15 seconds for the short current value at the terminals of the pressurizer heaters at the short circuit.

Q What is the magnitude of that current?

A (Witness Torcivia): At the pressurizer heaters?

Q You postulated, in answer to Mr. Trowbridge's questions, a fault at the pressurizer heaters. Is that correct?

A (Witness Torcivia): That is correct.

Q What magnitude of current would that fault at the pressurizer heaters generate?

(Witness Torcivia): Approximately 4000 amps.

Q And this fault that you postulated, what type of a fault is it and how many heaters are affected?

A (Witness Torcivia): The fault that is being postulated is a fault at one of the breakers. In other words, the pressure -- one bank of heaters.

Q Mr. Torcivia, I am sorry; could you please use your microphone. I have a very difficult time hearing you.

A (Witness Torcivia): The faults that are being postulated are faults at the pressurizer heater terminals.

Q Is this a line to line fault, a line to ground fault?

A (Witness Torcivia): It is a bolted fault, line to line.

Q It is your testimony that such a fault would only draw 4000 amperes?

A (Witness Torcivia): Approximately 4000 amperes.

Q What limits that current to 4000 amperes?

A (Witness Torcivia): The circuit configurations which include the characteristics of the diesel generator working its way down the impedence of the breaker, the cable impedence, the length of the cable.

All of those characteristics summed up together

are the limiting factors that develop the short circuit current at that point.

(Pause)

Q And the fault you postulated was only on one heater?

A (Witness Torcivia): One bank of heaters.

Q Every heater in that bank has a fault line to line? It is your testimony that that draws 4000 amperes?

A (Witness Torcivia): We would prefer to say three phase bolted fault.

Q On all heaters in that group?

A (Witness Torcivia): In that group; that is correct.

Q And at 4000 amperes, that the main bus breaker would trip in 15 seconds?

A (Witness Torcivia): That is correct; approximately 15 seconds.

Q What other current, other than the 4000 amperes did you assume flowing through the main bus breaker at that time, if any?

A (Witness Torcivia): The main bus breaker would be carrying the full load of the bus.

Q What is the total current through the breaker?

A (Witness Torcivia): I beg your pardon?

Q We have a 4000 ampere fault current caused by the

bolted liner to line fault on every heater in a particular group. This generates 4000 amperes.

I would presume that since other loads are simultaneous being power from, for example, bus 1P, that the current flowing through the main breaker would be somewhat greater than 4000 amperes.

My question is: when you answered the question that the main breaker would trip in 15 seconds, how much current was flowing through the main breaker?

A (Witness Torcivia): During a bolted fault condition of that nature, the induction motor, which is the bulk of our load, would be contributing fault current to that fault. The apparent -- as far as that breaker is concerned, it would indicate that 4000 amps plus some miscellaneous current around there, that may be flowing. But most of the contribution is as a result of that fault, which is a bolted fault, would flow to the fault.

In other words, the 4000 amps includes all contributions from all other sources.

(Pause)

A (Witness Shipper): Maybe I can clarify this position a little bit. At the time of a fault, the motors become generators.

(Pause)

Q Mr. Trowbridge asked you another question, Mr.

Torcivia.

Directing your attention to section 6.1.2.1 of IEEE standard 384-1977, which appears on page 15 of that standard, and then he asked you, was the first criterion in that section met.

And the criterion states: "The breaker time overcurrent trip characteristic for all circuit faults will cause the breaker to interrupt the fault current prior to initiation of a trip of any upstream breaker.

"Periodic testing shall demonstrate that the overall coordination scheme remains within the limits specified in the design criteria. This testing may be performed as a series of overlapping tests."

As I recall the question he asked you, he asked you, does the design of Three Mile Island Unit 1 with respect to the pressurizer heaters meet this criterion.

And your answer was yes.

In giving that answer -- excuse me -- please describe for me the periodic testing that was or will be done at Three Mile Island Unit 1 to demonstrate that the overall coordination scheme remains within the limits specified in the design criteria.

A (Witness Torcivia): We have a set program --

Q I am sorry, Mr. Torcivia. I cannot hear if you do not use the microphone.

A (Witness Torcivia): We have a set program of testing all breakers and relays at the plant. I believe it is approximately every six months. I do not want that figure quoted, but I believe it is.

Anyway, it is a periodic testing. In this case we would be testing each breaker individually and checking it against the characteristics as specified by the engineering department, at least the maintenance department, for the relay testing and maintenance department.

That is the testing that will be done.

Q Could you go into a little more detail, please, as to the actual testing? How do you go about testing the overcurrent trip, say, for example, the main feeder breaker?

A (Witness Torcivia): I assume you are looking for a detailed procedure for testing that would be in the plant?

Q I would like a little more description. I do not say you have to quote from a procedure, but for example, I would like to know how do you simulate the fault current? Which fault current is simulated?

How do you go about measuring the time delays, et cetera?

A (Witness Torcivia): In the testing procedure we do not simulate fault current. We provide to the tester a number of test points to which he has to test the breaker. He has a current type of box which provides him with

sufficient amount of current to run those tests, whether it be 200 amps, 500 amps, 1000 amps, whatever it might be.

He also has a time clock or a cycle counter, depending on how detailed we want the tests. He records all that; submits it to the engineering department for review and approval.

Q Am I correct that in order to justify the restart of Three Mile Island with the circuit breaker arrangement you are relying upon these tests to assure that the breaker coordination can be relied upon to isolate a fault in the pressurizer heater without loss or tripping of the main breaker?

Is that correct?

A (Witness Torcivia): Please repeat that again. How loss of --

Q Are you relying upon these periodic tests as a basis for saying that Three Mile Island Unit 1 is safe enough to restart considering the arrangement by which pressurizer heaters could be powered from the onsite power supply?

A (Witness Torcivia): Yes. We are relying upon the repeatability and the accuracy of the breaker on these tests.

Q So it is important that these tests be done, then, in your view?

A (Witness Torcivia): And they are done.

Q Would you think that they are important enough to be incorporated in the technical specifications to require that they be done?

A (Witness Torcivia): I am just trying to think if they actually are in there. I do not know if I want to --

Q Whether they are or not, do you think they should be?

(Pause)

A (Witness Torcivia): I see nothing wrong with that.

Q I am not asking if there is anything wrong with it. I am asking whether or not it is important enough that these tests be done to make sure that we do not result in degradation of the onsite power supply, that we ought to require that the tests be done.

A (Witness Torcivia): I would say that they certainly are important enough to be done. I am just trying to think of the test procedure which is already set up for which we go so far as to test each individual resistor. Yes, I would incorporate them.

I will see to it that they are if they are not already there.

Q Have you given any thought then as to how often such tests should be done?

A (Witness Torcivia): I have had a great deal of experience with breakers. As a matter of fact, I may have

helped in developing some of them. My personal feeling is, based on my experience, that if they were done once during each refueling cycle, I would feel comfortable.

Q The last sentence of this criterion one in section 6.1.2.1 of IEEE standard 384-1977 states: "This testing may be performed as a series of overlapping tests."

If I understood your previous answer, this is precisely what you are doing: you are testing each breaker independently and you will then, as a result of the tests of the individual breakers, you will then conclude that the breaker coordination is properly set and that therefore you see no need to try and simulate a fault or actually put in a fault to make sure that the breaker coordination works as you expect it to.

Is that correct?

A (Witness Torcivia): That is correct.

(Pause)

Q Did I understand, then, in the answer to the further question about whether criterion two, which reads: "The power source shall supply the necessary fault current for sufficient time to ensure the proper coordination without loss of function of Class 1E loads," that your answer was, yes, the diesel generator has adequate power for functioning of the breaker.

Was that your answer?

A (Witness Torcivia): That is correct.

Q Can you explain to me what that means, that the diesel generator has adequate power for functioning of the breaker?

A (Witness Torcivia): That means that during the period of a fault both the generator and the diesel will be able to supply that amount of power required to operate those breakers without any failure on their part. There may be reduced voltage, but without a slowing down and doing that within the period of time required to operate that equipment.

Q Have you looked at how far the voltage would drop?

A (Witness Torcivia): During the 4000 amps?

Q Yes.

A (Witness Torcivia): The 4000 amp figure represents the equivalent of starting probably -- probably a 700 horsepower motor; in other words, the in-rush from approximately a 700 horsepower engine. That is just grabbing out a figure. That is no problem for a diesel which is actually starting up a 700 horsepower motor, which is something which is done without problem.

As far as the voltage dips go, the voltage dip will be momentary and almost immediately corrected by the regulator.

Q You are saying the voltage on bus 1P will not drop

very low below 480 volts?

A (Witness Torcivia): No. Probably down to maybe on that basis 460, if it is originally established.

Q Can you explain why if the voltage only drops to 460 all the other loads on there start acting as generators rather than loads?

(Pause)

A (Witness Torcivia): Say that again?

Q Mr. Shipper interrupted and helped clarify before; he said during this fault the other motors connected to this bus would be acting as generators in helping to clarify your statement that the total current through the main breaker due to a line to line bolted fault on every pressurizer heater would be only 4000 amps.

My question is: if the diesel generator is capable of supplying the fault current and the voltage on bus 1P does not drop much, not even lower than 460, why do the other loads act as generators rather than loads?

A (Witness Torcivia): They are not acting as generators in the sense of which we are accumstomed to think of and which they provide a voltage together with load. They act as somewhat inductin type generators in which they are feeding back into that load whatever current they are developing because the rotor is slowing down as related to the stator, the stator voltage and the frequency of the

stator.

It is at that point that there is a feedback of current. Now, during that period of time, there is a degradation of voltage, and the reason it is acting as an induction generator is because there is a certain amount of degrading voltage condition developing.

it is not feeding back to the bus a voltage. I do not know if I am making myself clear. It is not that type of a generator we are talking about so that it will not maintain -- it will not contribute to maintaining voltage on the bus.

Q Thank you.

The next question, according to my notes, that Mr. Trowbridge asked you -- and correct me if I am wrong on the question and your answer.

Mr. Trowbridge asked you: is there a circuit breaker available today that can be tripped other than by sensing fault current?

At least, that was the thrust of the question.

And your answer was no.

A (Witness Torcivia): I said not to my knowledge.

Q I have a different question: is there available today a device which would meet the definition of a safety grade isolation device as specified in Regulatory Guide 1.75?

A (Witness Torcivia): And that definition, would

you mind detailing which part?

MR. TROWBRIDGE: I think there is potentially an argument of the definition between us of Reg Guide 1.75. Could you supply your definition with your question.

(Pause)

BY MR. POLLARD:

Q In order to do that for you, I must first read you from IEEE standard 384-1974, the definition of "isolation device": "A device in a circuit which prevents malfunctions in one section of a circuit from causing unacceptable influences in other sections of the circuit or other circuits."

And then Regulatory Guie 1.75 says: "Section III, Isolation Device" -- which is where I just read from -- "should be supplemented as follows: interrupting devices actuated only by fault current are not considered to be isolation devices within the context of this document."

My question to you is: is there available today a device that would meet the definition of isolation device without being actuated only by a fault current?

A (Witness Torcivia): The fault current is the one thing that we are measuring, primarily are interested in, the fault current being directly developed and under voltage conditions through which we can actuate an undervoltage device.

Q You are not using the microphone.

A (Witness Torcivia): I do not know of any device which measure current without it directly or indirectly having us measure it.

Q That is not my question.

Is there a device available which would prevent malfunctions upstream rcaused by a fault downstream without the necessity of even measuring or detecting the fault current?

(Pause)

A (Witness Torcivia): I do not know of any.

Q You say you do not know of any?

A (Witness Torcivia): No, sir.

Q Mr. Shipper, do you?

A (Witness Shipper): I know of none.

Q Then do I understand your answer, that to the best of your knowledge, staff has never found acceptable any isolation device in any circuit that meets Reg Guide 1.75?

MR. TROWBRIDGE: Could we have that question again. Could you stick to your definition? Maybe that would be simpler, unless you need to --

(Counsel for UCS Conferring)

MR. POLLARD: Ms. Weiss says I should withdraw the question. I will follow her advice.

BY MR. POLLARD:

Q Have you ever in your professional experience seen the application of what are referred to as isolation transformers?

A (Witness Torcivia): Yes, sir.

Q Is it not possible to design a transformer to protect against faults on the secondary from being reflected to the primary?

A (Witness Torcivia): It is possible to have a high impedence transformer put into the circuitry so as to limit the current to a value which will not affect the diesel -- rather, the upstream bus. I would rather not use the word "diesel."

That can be done.

Q It is also possible to design a saturable transformer?

A (Witness Torcivia): Well, if you mean by that a three legged transformer in which saturation -- you can make external saturation -- it is possible to design it that way if that is what you are talking about.

But a typical high impedence transformer is possible, and there are problems that develop with it. There is nothing for nothing.

Q That seems to be a characteristic of engineering; I agree with you, and certainly instrumentation circuits as opposed to power circuits; an isolation amplifier would be a

type of isolation device wherre a fault on the output of the amplifier would not be reflected to the input.

Is that correct?

A (Witness Torcivia): Yes. As an isolation device between -- yes. As an isolation device.

Q So there certainly are available to day devices which could meet the definition of "isolation device" as set forth in IEEE standard 384-1977 even with the modification set forth by the staff in Reg Guide 1.75?

A (Witness Torcivia): We are coming back to directly or indirectly affected bythe current.

Q You may expand on your answer. Please answer my question first and then you may explain it.

A (Witness Torcivia): Do you mind telling me what device it is that is available?

Q I thought that was just what we had gone through preceding -- I was just trying to summarize, that it is possible to design and there are available devices which can either prevent or limit the reflection of fault current without the need to detect or measure the fault current directly or indirectly.

Isn't that the case?

(Pause)

A (Witness Torcivia): We are coming back to the high impedence transformer isolation devices,controlled

circuitry, and those things. Those devices are available and have been used.

(Pause)

MS. WEISS: Mr. Chairman, I would like to have the document that Mr. Pollard is distributing marked for identification as UCS 28. The document is marked at the top "Interoffice Memorandum GPU Service," the top right. At the top left it is marked "EP&I/80/0010, August 11, 1980, Subject: Emergency Procedure 1202-29, Pressurizer System Failure, to C. Hartman."

It is a one-page memorandum signed by J. Torcivia.

(The document referred to was marked UCS Exhibit No. 28 for identification.)

BY MR. POLLARD: (Resuming)

Q Mr. Torcivia, the introduction to the memo which -- excuse me. First, could you please tell me the capacity of C. Hartman whom you directed your memo to?

A (WITNESS TORCIVIA) He is -- I don't know if you would call him supervisory electrical -- I believe he is the supervisory electrical man at the Island with whom we communicate to have things done in that area.

Q Just for my information, can you tell me the capacity of the two people who received carbon copies?

A (WITNESS TORCIVIA) Who is that? What are their names again, please?

Q I am hesitant to try to pronounce them myself, so perhaps you can help me.

A (WITNESS TORCIVIA) Give me a minute. Steudel, Mr. Studell was the manager of the Engineering Department at that time. He is no longer with us. Mr. Cronberger is the manager of Engineering Systems, the head of our group. We call it Technical Design Services, Technical Services.

Q All three of these people are employees of either GPU or Met Ed?

A (WITNESS TORCIVIA) GPU.

Q In the introductory paragraph you referenced the above procedure, being Emergency Procedure 1202-29. You state that it "has been reviewed in conjunction with testimony which we are to develop relative to the pressurizer heaters. As a result of this review, we have the following comments, and to satisfy the basis of our testimony, a request for some changes."

My question is what basis under your testimony did you think these changes were necessary to in order to satisfy?

A (WITNESS TORCIVIA) We wanted to make sure that the load, when the pressurizer heaters came in at a later date, after a number of our other data was developed, and we wanted to make sure at this point that the load which we were adding on as a result of the pressurizer heaters did not exceed the total generator allowable load of 3000 KW.

Q And you end your letter by saying "Let us know if

these proposed changes will be included in the procedure."

Have you received a response?

A (WITNESS TORCIVIA) They are going to be included. That is a polite way of saying "do it."

Q I see. You have control over these gentlemen. Is that the case?

A (WITNESS TORCIVIA) They are being included right now, and they will be reviewed by us.

Q Would you please refer to Emergency Procedure 1202-19, which is UCS Exhibit 19.

A (WITNESS TORCIVIA) Yes.

Q I assume because of the date on our exhibit, which is August 27 of 1980, compared to the date on your document which is August 11, 1980, that at the time you prepared your letter, you were referring at that time to Revision 11 of Emergency procedure 1202-29. Am I correct?

A (WITNESS TORCIVIA) That is correct.

Q With respect to your first suggested change on Item 8 on page 12, I note that that apparently has not been incorporated, whereas your second suggestion about the 150 amps instead of 130 amps apparently has been. I am referring particularly in Revision 12, pages 12 and -- page 12. Both things are on there. On page 12 the note reads "Only one group of heaters may be powered from an ES bus at a time," and at the bottom, it is Step G, it refers to the

less than 150 amps.

I am wondering why one change at least partially has been incorporated and the other has not.

Can you explain that?

A (WITNESS TORCIVIA) I was aware that that change hadn't been made, and we intend to get it made.

Q So with respect to Items 1 and 2 in your letter, it is your testimony that prior to restart, Emergency Procedure 1202-29 willk be revised as you indicate in both Items 1 and 2?

A (WITNESS TORCIVIA) That is correct.

Q With respect to Item 3, does the current verson of 1202-29, which is Revision 12, does it appear to be in accordance with the latest modification of the plant with respect to the Kirk Key Interlocks?

A (WITNESS TORCIVIA) Yes.

Q Have you reviewed Amendment 22 to the Restart Report with particular emphasis on this Kirk Key Interlock system?

A (WITNESS TORCIVIA) I haven't compared the two, if that is the question. I will be honest, I have not had time to compare the two. That is on Restart 2178, as compared to the two. I have not yet compared those two.

Q I don't really want to ask you to do too much during breaks, but I would like to know before you leave the

witness stand whether the description of the heaters and this interlock system as it now appears in the Restart Report through Amendment 22, and whether the description in Revision 12 of Emergency Procedure 1202-29 both reflect the latest modification or the latest proposed design for Three Mile Island Unit 1.

Do you think that is a request that is capable of being fulfilled?

A (WITNESS TORCIVIA) I think we could by comparing it right now.

Q We don't need to do it right this minute. I don't want to give you something that is so impossible to do you can't do it.

Now, with respect to your August 11 memo, let's focus first on Item 2, which is at least partially incorporated in Step 8G on page 12 of Revision 12 of Emergency Procedure 1202-29. What information is available to the Three Mile Island Unit 1 operators to determine the load on the diesel generators?

A (WITNESS TORCIVIA) Are you referring to that 150 amps?

Q No. First I am referring to your statement that they should add a note that says "Verify that the diesel KW is below 2874," and then you continue to say that the total continuous diesel load must be kept at or below 3000 KW, and

my question is what information or instruments does the operator have available to him to determine what the KW load is on each diesel?

A (WITNESS TORCIVIA) What KW load is on each diesel?

Q Yes, sir.

A (WITNESS TORCIVIA) It has a watt meter.

Q He has one watt meter for each diesel generator in the control room?

A (WITNESS TORCIVIA) One watt meter for each diesel.

Q In the main control room.

A (WITNESS TORCIVIA) In the main control room.

Q What is the range of that meter?

A (WITNESS TORCIVIA) I don't know. Offhand I don't remember.

Q Would you agree with me it must at least be 3000 KW?

A (WITNESS TORCIVIA) That's right.

Q Presumably somewhat higher?

A (WITNESS TORCIVIA) Usually 25 percent higher.

Q What is the accuracy of the meter?

A (WITNESS TORCIVIA) Those are control room type meters, 1 percent, approximately 1 percent.

Q One percent of full scale?

A (WITNESS TORCIVIA) That's about right.

Q Assuming for the time being that the maximum range

is 3000 KW, its accuracy would be plus or minus 30 KW?

A (WITNESS TORCIVIA) Yes.

Q What is the resolution of the meter? In other words, how closely can a human being read the meter?

A (WITNESS TORCIVIA) Those are graded -- I would say he can read that within probably 5 KW.

Q Five KW.

A (WITNESS TORCIVIA) I would say that if the full scale is that way.

Q You mean -- let me see if I understand this. We have a meter that at least goes up to 3000 KW, and you proposed an instruction that he must keep the load at 3000, at or below 3000 KW. It is your testimony that he can tell the difference from this meter between 3000 KW and 3006 KW?

A (WITNESS TORCIVIA) No, in reading a meter, that type of an instrument, they are graded in proportion. Probably this is 1, 500, 1000, 1500, 2000, 2500. Now, each of those, at that first band, which is at zero to 500, will be broken down into probably 50 portions of 10 KW each. A a result of that, the manner in which he looks and reads, I think it is reasonable to say he may read within an accuracy of 3 to 5 KW. To tell you otherwise would be --

Q So it is your testimony that the operator using this meter can distinguish between 3000 KW and 3006 KW.

A (WITNESS TORCIVIA) Depending on the angle he is

at in reading it, within two, three or four, five KW. There will be a certain amount of visual inaccuracy there.

Q You have physically looked at this meter, is that correct?

A (WITNESS TORCIVIA) I beg your pardon?

Q You physically have examined this meter on some occasion?

A (WITNESS TORCIVIA) No, sir.

Q You haven't looked at the meter?

A (WITNESS TORCIVIA) No, no, sir, not that particular meter. You asked me for my experience. I am talking from my experience of instruments of that nature.

Q I do not recall asking you about your experience. I started off asking you what information is available to the Three Mile Island Unit 1 operators. I am trying to focus on -- the purpose of this line of questioning, Mr. Torcivia, is you are recommending that the emergency procedures have a note in them which you have suggested to be the exact wording, "Verify that the diesel KW is below 2874 before energing pressurizer heaters. The total continuous diesel load must be kept at or below 3000 KW ."

You and Mr. Shipper have also testified that the 2000 hour rating of these machines is 3000 KW.

What I am trying to determine is, although your instruction may be technically accurate, I have some

question about whether or not the operators have the instrumentation by which they can accurately follow your instructions.

As I understand your testimony at this point, you have not physically looked at this meter.

A (WITNESS TORCIVIA) No, no.

Q Let's turn to the section about the 150 versus the 130 amperes. What information to the Three Mile Island Unit 1 operators have to determine the current to which you are referring?

A (WITNESS TORCIVIA) An ammeter.

Q Specifically with respect to Figure 1 of your testimony, can you identify for me where the current is occurring that this meter reads?

A (WITNESS TORCIVIA) There is a current transformer between the bus there, the so-called 1P bus, and the main breaker feeder, the arch of the main breaker feeder.

Q Let me see if I understood your answer.

Referring to Figure 1, there is a bus labeled 1P. Directly below the bus there is a circuit breaker labeled main feeder breaker.

A (WITNESS TORCIVIA) I want to correct that statement. It may be above or below. I don't recall. I happened to mark it above. It is in that line, in that feeder breaker current transformer.

Q Let me try it a different way.

It is your testimony that in the circuit from bus 1P through the main feeder breaker, and if the Kirk Key Interlock disconnect device were installed down through there, down through the distribution breaker panel into the heaters, there is an ammeter to measure the current on that circuit.

A (WITNESS TORCIVIA) I'm sorry.

Would you say that again, Mr. Pollard?

Q My comment was I don't like to keep interrupting you, but I just cannot hear you if you don't use the microphone.

A (WITNESS TORCIVIA) I will do my best. All right.

Let me correct that statement. The current transformer, we are talking about the current, we are reading, we are reading the total current to bus 1P, that 150 amps. That is coming from the 4160 side.

Q The current we are reading, then, is the 480 volt current essentially flowing through the breaker which is labeled main breaker?

A (WITNESS TORCIVIA) That is correct.

Q So the ammeter is reading the total loads on bus 1P.

A (WITNESS TORCIVIA) That is correct.

I'm sorry, I misled you for a minute.

Q Can you tell me the basis for your recommendation of changing from 130 amps to 150 amps?

A (WITNESS TORCIVIA) I am not exactly sure where the 150 amps comes from. Our interest in that area was to maintain the 1200 amps on the bus itself, the 1P bus which is there. It is being fed from that transformer, and our interest was to maintain and see that we maintain approximnately 1200 amps on that 1P bus, limit ourselves to approximately 1200 amps on that bus, and on the basis of the 150 amps on the 40 volt side, it would give us approximately close to 1200 amps on the secondary side. In other words, if you translate from the 4160 side to the 480 volt side, your current would increase .5, .6 times.

Q Let me back up to make sure I understand. The meter which is reading the 150 amperes is measuring the current on the 4160 volt input to the transformer shown above bus 1-P

A (WITNESS TORCIVIA) That is correct.

Q You wanted to limit the current through the main breaker to 12 amperes

A (WITNESS TORCIVIA) Yes.

Q What was the basis --

A (WITNESS TORCIVIA) Pardon me, Mr. Pollard. I'm just trying to think if that was 1500, 1600 -- I believe 1-P, bus 1-P is 1600 amps.

I apologize again. I was thinking of another bus. That is a 1600 amp bus there. We want to limit that to 1600 amps. We have another case where we want to limit it to 1200 amps and for some reason or other that came to mind.

Q When you say it is a 1600-amp bus, you are referring to bus 1-P and 1-S, each of those

A (WITNESS TORCIVIA) That is correct, yes.

Q Do I understand, then, finally, that the basis for your recommending that the note in the procedure be changed to 150 amperes is that, with 150 amperes on the 4160 volt side of the transformer, that this would correspond to 1600 amperes on the 480 volt side of the transformer?

A (WITNESS TORCIVIA) That's correct.

Q And this precaution that you have recommended in item 2 to limit that current to 150 amperes, is that before or after the heaters have been connected to the bus?

A (WITNESS TORCIVIA) The 150 amps again would be after the heaters have been installed. I thought I had it here, quote: "If the current exceeds 150 amps, the following loads may be removed," which is to limit that load to 150 amps under any and all conditions.

Q I have to agree with you that that is a correct interpretation of Emergency Procedure 1202-29 as it now exists. I am asking you to search back in your memory as to whether or not that is what you intended when you made this recommendation back on August 11th, when Revision 12 didn't exist?

A (WITNESS TORCIVIA) I definitely did intend it, for other reasons. We were making some load studies in that area and we wanted to keep that bus within limitations for other reasons.

Q Your intention as to whether or not at any time, either before or after the heaters are connected, whether the current could exceed 150 amperes, because as the procedure now reads it leaves you with the impression that for some period of time the current may actually be higher than 150 amperes, and that if so the operator should take

action to reduce the load on that bus.

That would be a different situation than if the procedure said, make sure that the loads on the bus are such that after you had the pressurizer heaters the current would still be below 150 amperes.

A (WITNESS TORCIVIA) Yes, I think that would help clarify it. I cannot help but agree with you, to clarify to that extent.

Q My question is, which did you intend? Did you intend that the current never go above 150 amperes or did you intend that it is all right if it did go above 150 amperes as long as the operator, at some time subsequent to that, removed loads?

A (WITNESS TORCIVIA) No, the intent was that if there should be short swings during starting conditions or anything of that nature and it goes 150 amps, do nothing; If it goes up to 150 amps as a stabilized condition, immediately take action to lower.

Q Would you agree with me, then, that the current version of 1202-29 does not accomplish that objective of yours?

A (WITNESS TORCIVIA) I think in the minds of the operators it has. It has never brought that up. I cannot help but agree that it would help clarify it if that were expanded upon.

Q Of course, the step occurs after he has already energized the heaters. There is no warning prior to energizing the heaters that there should be some value of current on this meter.

A (WITNESS TORCIVIA) I think something could be done in that area.

DR. JORDAN: Would you help out a poor Board member who is having trouble with some of the numbers? Supposing we had 150 amperes flowing in that 4,160 volt bus. What diesel power does that represent?

WITNESS SHIPPER: Approximately 1333 KVA.

DR. JORDAN: I thought we were talking about diesels of 3,000?

WITNESS SHIPPER: This is only one load on the diesel. This is a subfeed off the four KV.

DR. JORDAN: There are other transformers like this?

WITNESS SHIPPER: Yes, there is another transformer like this, and there are additional motors, large horsepower motors, on that 4 KV bus, the 4160 volt bus.

DR. JORDAN: I see. I think that perhaps carries us all away, then.

Instead of my trying to figure it out for myself, approximately how many -- before the heaters are connected, approximately how much current is flowing through the main

breaker at 480 volts?

(Witnesses conferring.)

WITNESS SHIPPER: Reflected to the 4 KV side, pressurizer heaters will draw somewhere in the vicinity of approximately 18 amps. If you subtract 18 amps or 20 amps from the 150, you could be at 130 amperes load and successfully load the pressurizer heaters without exceeding that 150 ampere limit.

BY MR. POLLARD: (Resuming)

Q Mr. Shipper, I don't want to interrupt, but I don't think the answer was to the question that was asked. The figures you just gave Mr. Jordan, are those on the 460 side or the 480 side?

A (WITNESS SHIPPER) The 460.

DR. JORDAN: I wanted the other side.

WITNESS SHIPPER: On the other side?

DR. JORDAN: That is the side that the breaker is set on and you gave me the breaker figures. That's why I wanted to know.

WITNESS SHIPPER: I gave you the side where the M meter would be read.

DR. JORDAN: I now want to know the other side, because that is where the breaker is set.

(Pause.)

WITNESS SHIPPER: On the low side, you would have

a rating somewhere around 150 amps.

DR. JORDAN: So there is only 150 amps flowing through this breaker that is set to break at 4,000 amps in 15 seconds; is that right?

WITNESS SHIPPER: That's correct.

BY MR. POLLARD: (Resuming)

Q The record at this point is no doubt getting very complicated. I would just like to ask a further few questions. The currents you are now giving, are these phase currents?

A (WITNESS SHIPPER) Three-phase currents.

Q In making the conversion back and forth across the transformer, are you assuming that that is either a YY or a delta-delta transformer?

(Witnesses conferring.)

A (WITNESS TORCIVIA) The configuration of transformer, whether primary or secondary Y or delta, will result in the same value in terms of the calculations, which would be 1.73 times the voltage times whatever it is. So the configuration of the transformer in our particular instance will not --

Q It won't matter, you say, which transformer it is for the figures you have been giving?

A (WITNESS SHIPPER) Three-phase current.

DR. JORDAN: This is a three-phase current.

A (WITNESS TORCIVIA) That is correct.

BY MR. POLLARD: (Resuming)

Q Please don't misunderstand me. You and I are talking, and I want to make sure. There are other people in the room who may not know what we're talking about.

MS. WEISS: Is there anybody else in the room who does know what you're talking about?

DR. JORDAN: I understand the delta Y and the delta Y connections and the three-phase connections.

MR. POLLARD: I didn't include you in that,; Dr. Jordan.

DR. JORDAN: The disconnect device, therefore, is not a single wire. It is three phases, all three phases.

WITNESS TORCIVIA: That is correct. It is shown here as a single unit. There are three of them. This unit is mechanically -- all three of them have to go in and all three come out.

DR. JORDAN: The main breaker is a three-phase breaker?

WITNESS TORCIVIA: Absolutely, mechanically tied together.

DR. JORDAN: The current, then, the current in each phase in which it breaks?

WITNESS TORCIVIA: That is correct.

WITNESS SHIPPER: That is correct.

DR. JORDAN: Thanks.

DR. LITTLE: Before we get too far from the question that I want to ask, I am a little bit puzzled by the item that says, verify that the diesel KW is below 2874. I want to go back to the question of where the 2874 came from and whether or not this implies that the operator, whoever is reading it, can read the watt meter to four significant figures.

WITNESS TORCIVIA: I fully appreciate your dilemma.

(Laughter.)

WITNESS TORCIVIA: Yes, we engineers have an unfortunate situation that we take for granted in calculating that can go on and on with numbers. The 2874 was developed on the simple basis of subtracting 126 from 3,000. There was no question about it, the operator will not be able to read 1874, but he might read 2870 or 2875 or 2878.

DR. LITTLE: That's correct. I have taught engineers for many years. That is why I was so puzzled. It was an engineer who taught me not to use four significant figures when I was looking at a watt meter.

WITNESS TORCIVIA: We would have no problem, frankly, of reducing that for a matter of margin, as we have been saying, bringing it down to a few amps to provide for that margin, that is correct.

I will say this relative to the instruments. Where these positive figures are involved, such as 500 or 1,000 and so forth, they are thicker black lines and the operator will read that. I would be abusing everybody's intelligence if I said it was 28 between a black and a white line that he is reading it. He is guessing at 2872, 2875. But if it is a black line like 3,000, he will be fairly accurate within the accuracy of the instrument.

DR. LITTLE: You say you can be confident in the first three figures, but not the fourth. You are saying he can be confident with the first three of the figures, but not the fourth?

WITNESS TORCIVIA: That is correct. That is absolutely correct.

MR. POLLARD: The witness also testified he expected the accuracy of the meter to be no better than one percent full scale.

DR. LITTLE: That is the other thing I was considering.

WITNESS TORCIVIA: Sometimes they say I talk to much. But a digital instrument would, of course, improve that considerably in that area.

MR. POLLARD: It would certainly improve the resolution. I am not sure it would improve the accuracy.

(Laughter.)

WITNESS TORCIVIA: They have troubles too, huh.

MR. TROWBRIDGE: Mr. Chairman, would this be a good time for a break to see if we can get an answer to the question?

MR. POLLARD: I have one further short question and then I would agree with Mr. Trowbridge.

CHAIRMAN SMITH: All right.

BY MR. POLLARD: (Resuming)

Q Finally, referring to this meter, which I think we have now identified what current it is measuring, I assume that also here there is one meter for each bus in the main control room at Three Mile Island Unit 1?

A (WITNESS TORCIVIA) Yes, sir.

Q Have you physically inspected that meter?

A (WITNESS TORCIVIA) No, sir.

Please let me say this. When you say inspect, do you mean did I actually go there directly and look at it? No. I have been in the control room. I have passed it by and said, this is (Indicating). But to actually inspect it, no.

Q Do you know what the range of the meter is?

A (WITNESS TORCIVIA) I beg your pardon?

Q Do you know what the range of the meter is?

A (WITNESS TORCIVIA) I don't recall.

Q Do you know what its accuracy is?

A (WITNESS TORCIVIA) It is a typical control instrument, approximately one percent accuracy also.

Q Do you know what its resolution is?

A (WITNESS TORCIVIA) Probably 200 amp meter. If you mean by resolution the gradings --

Q What I mean by resolution all the time is how accurately can a human being read the meter, how much effort?

A (WITNESS TORCIVIA) That is a tough one. The human element.

Q Then you don't know?

A (WITNESS TORCIVIA) It varies with the angle you are standing at.

Q On both meters, the one that is measuring the diesel generator KW and on this meter which is measuring the current being supplied to bus 1-P or bus 1-S, do you think it is important that these meters, since they are going to be relied upon by the operator, be periodically tested and callibrated?

A (WITNESS TORCIVIA) It is important and they are done, too. They are tested.

Q They are tested?

A (WITNESS TORCIVIA) Oh, yes.

Q Do you think these meters and their accuracy are sufficiently important that these tests ought to be mandated by inclusion in the technical specifications for Three Mile

Island Unit 1?

A (WITNESS TORCIVIA) I would have no objections to mandating it, yes, I do.

Q I am not interested -- well, I am interested, but that wasn't my question. Do you think they are sufficiently important that they should be required tests, to make sure that these meters, which the operator will be relying upon to prevent overloading either the diesel or this bus, are accurate? Yes or no?

A (WITNESS TORCIVIA) Yes. The reason I am hesitating a bit, every instrument and relay in the control room is important. To point your finger at that particular one is -- well, it is really not necessary. They are all important. They all should be maintained, and they are.

Q I know, Mr. Torcivia. It is just, in my view, there is a difference between the tests that Metropolitan Edison Company does as a matter of good practice versus the tests that are required to be done by technical specifications. I understand that you do do a lot of tests in the plant that aren't required.

MR. POLLARD: I think we can take our break now.

CHAIRMAN SMITH: Ms. Weiss, during the recess the Board will try to address your request. But could you remind us. Tell us exactly what calculations you want, why you want them, do you still want them, and when did you

become first aware that you needed them?

MR. POLLARD: Perhaps I can do the first part. The calculations that I was referring to, and I think the witness understood me to be referring to, are the calculations he referred to where he was adding up or summing the loads that would be powered from the diesel generators.

And in making those calculations, he not only had to identify the load, he assigned service factors, he assigned power factors. And it is those calculations incorporating this information which I am interested in.

CHAIRMAN SMITH: What are you going to do with them?

MS. WEISS: Look them over and see if in our viewpoint they represent reasonable calculations. If they don't, we will ask -- we may ask to have these witnesses questioned about them or we may have Mr. Pollard testify about them.

CHAIRMAN SMITH: When did it first occur to you that there were calculations made that you needed in your cross-examination?

MR. POLLARD: Either today or last evening, when these witnesses began their oral rebuttal testimony or the cross-examination. I have forgotten which.

CHAIRMAN SMITH: In retrospect, when do you

believe it should have occurred to you that the man would have made calculations in adding and summing loads?

MR. POLLARD: I don't think it ever should have occurred to me that this was going to be the basis for judging the reliability of diesel generators as a result of having added loads. I don't think I could ever have expected that to be the technical basis for the Licensee's position.

CHAIRMAN SMITH: Now I am confused about whether the testimony was -- whether he used these calculations for reliability or capacity.

MR. POLLARD: That's the other problem. I am not on the stand yet. It is my opinion you cannot separate the question of capacity from reliability.

CHAIRMAN SMITH: Any other comments before we rule?

(Recess.)

CHAIRMAN SMITH: On the record.

MR. CUTCHIN: Mr. Chairman, yesterday in his questioning Mr. Pollard had referred to statements on tech spec requirements on the PORV that appeared at the bottom of the staff safety evaluation on page C2-15. The question was: How would the witnesses know what was required of them if the staff didn't tell them?

I have determined that on July 2, in a letter to all pressurized water reactor licensees, the staff did indeed inform Met Ed as well as other operating licensees by sending them copies of the model technical specifications, the requirements in the form of technical specifications that are imposed on pressurizer relief and block valves and indication of valve position. The licensee responded to that guidance in Amendment 21, and those particular specifications are now under review by the staff.

CHAIRMAN SMITH: Now we are prepared to rule, or, better stated, we are not prepared to rule on your motion, and address what our considerations are. We don't have to go back to whether this is discovery or whether it was timely discovery. When Mr. Pollard represents to the Board that it did not occur to him to expect to have calculations as a part of the testimony, we accept that entirely from our observations of Mr. Pollard throughout this proceeding, and his diligence in preparation and his hard work.

So we accept that representation. However, that cannot always be controlling, because the issue should more appropriately be in exercise of reasonable diligence would a person, an adversary, expect such calculations existing in support of the testimony. And we certainly believe that when the issue is that they have to calculate rather the capacity of the diesel generator system, it would accommodate the heaters, that some type of calculation, however simple, would have to be made.

And then we go another step. And that is in our prehearing order of May 22, we, on the footnote on page 9, refer to our discussion at the prehearing conference, transcript 1892 and 1893, where we told the parties that if they wish to place their adversary on a high degree of preparation on notice that they are expected to be highly prepared on a particular area, that they can in some fashion, perhaps by providing a part of their cross-examination plan, in some fashion, forewarn them that they should come to the hearing prepared to be examined on certain aspects.

So we believe that with reasonable preparation and diligence, UCS could have anticipated that there would have been underlying calculations in support of the conclusion that the emergency -- that the diesel generating system could support the pressurizer water heaters.

On the other hand, we think that when Mr. Torcivia comes to the hearing to testify that -- as he did on page 4 -- that the rated capacity of the diesel has been verified as being capable of handling the heaters, in addition to the safety-related loads, that he should have been reasonably expected to have been examined on that, too, following the practice of other witnessese, bringing at least a more relevant aspect of the underlying support for their testimony with them.

Although we cannot assign exact precise weights to these various considerations, we think it is on equilibrium.

Now, as to the testimony, the Board is thinking -- and we won't decide until after Dr. Jordan and Dr. Little ask some questions -- that there are parts of the testimony that we think should be better explained. At least there are important parts that we are still confused about.

We are thinking that we might even request that Mr. Torcivia come back at a later date to explain these confusing aspects, if it doesn't turn out that they can be explained this afternoon. It may very well be whether we enforce the request to produce the calculations will depend upon how Dr. Jordan's questioning goes this afternoon. As it is, we think it is equilibrium. We are going to decide whether we believe it is necessary to produce it for a full

and reliable record.

Now, if anybody would like to correct any observations we made, or challenge our logic of our process of arriving at that conclusion, you are really free to do it. And we welcome, we invite you to do it.

MS. WEISS: What I am doing right now is looking through the deposition we took of at least one of these witnesses on this subject, to see the questions that we asked and whether one of the questions should have elicited the answer that there were some calculations either done or being done.

I don't want to make that argument in advance, in case Dr. Jordan decides that he would like to see them anyway but --

CHAIRMAN SMITH: This is an important part of our determination. We just think it should have been obvious to anybody approaching this testimony that they are going to have to count before they know that the diesel system can accommodate the extra load.

MR. POLLARD: That's true, Mr. Chairman, but there is a difference in how you count, whether you look at the nameplate rating and add them up, what service factors you assign, and so on.

CHAIRMAN SMITH: I think we have explained the considerations.

Mr. Trowbridge?

MR. TROWBRIDGE: Mr. Chairman, I don't want to argue further. We will wait for the Board's disposition of this. But it is my understanding that while thorough calculations were made, it is a very standard procedure in judging the capacity of a diesel generator to go through just the kind of calculations made here. It's not peculiar to Three Mile Island or Mr. Torcivia.

CHAIRMAN SMITH: That may be the case. And although that is information that I think the record should reflect, as we stand here now, there is a lot we don't know about it.

DR. JORDAN: Let me explain why I happen to be interested, perhaps not in the detail that Mr. Pollard is interested in. I was curious as to how you come up with 2874. Well, I knew you came up with that by subtracting 126 from 3000. You had to. But how it came out to be 3000 as the total load interested me, particularly in view of the fact that the previous license was something like 2500.

But more, as to what safety-related loads are there that must be taken off during a period of loss of off-site power. It means that, therefore, before you can connect these pressurizers, that something has to be disconnected, apparently. And I was surprised at that, in view of the numbers.

So that I would like to see what engineered safety features therefore are connected and approximately what loads they carry. And as I say, I don't need to have accurate figures. It doesn't have to come out to 1 percent. I would be interested in seeing just what loads are left on the emergency safety transfer bus after there is a loss of off-site power.

MR. TROWBRIDGE: I don't want to have them start answering that question. I want to have Mr. Pollard finish his cross, but I would ask him if they could address the subject. And the answer, I think, is "Yes." And if there is time, Dr. Jordan, I would invite you to pursue that line of questioning.

DR. JORDAN: He suggested they wait until after the other questions come in. And I would be very happy to do that, yes.

MR. TROWBRIDGE: That was just a suggestion.

DR. JORDAN: To wait until we finish with the other questions.

MR. TROWBRIDGE: I don't know how close Mr. Pollard is to closing his cross examination. We have the answer now to our trip signals. He may have more cross examination based on that alone.

CHAIRMAN SMITH: Then our other questions that I might have asked, for example, I will use the -- I don't

remember the exact figures -- but I will indulge in the freedom to use only three places. How did we get from 2530 something megawatts up to 2874? How did that arrive? How did we get there? What is the significance of exceeding 3000 megawatts by 1 percent?

All of those may have very, very good answers, but the record doesn't reflect it. And it is something that a layman might be wondering about as they review the record.

Is it a coincidence, or was there a misunderstanding, that we heard you testify at the beginning that you added load and arrived at 2874 and then later on you subtracted load? That needs explanation. Maybe we misread; maybe we didn't hear correctly. All of it does indicate that the Board needs a better explanation, and this has been a long day; maybe we just didn't listen carefully enough.

MR. TROWBRIDGE: The record needs straightening out on this point. I think it will not be that difficult.

MR. POLLARD: In your explanation just then, you were using the phrase "megawatts." Did you mean "kilowatts"?

CHAIRMAN SMITH: Yes, I meant kilowatts. That much I know.

(Laughter.)

MR. ADLER: I want to point out that some of these

questions Mr. Dornsife intends to hit in his cross examination. That might help the Board before you need to delve further into it.

(Board conferring.)

BY MR. POLLARD:

Q Are we now able to proceed on the three separate and independent signals?

A (WITNESS SHIPPER) Yes.

Q Can you please tell me which three separate and independent signals you are referring to in item 1 on page 4 of your testimony?

A (WITNESS SHIPPER) 1600-pound pressure from the reactor coolant system, a 400-pound or 500-pound pressure from the reactor coolant system, and a 4-p.s.i. building pressure signal.

Q The 400-pound signal from the reactor coolant system, can you describe to me where that comes from and what the purpose of that signal is?

A (WITNESS SHIPPER) As far as the ES actuation, I am not at all familiar or prepared to discuss the inputs or its actuation. This is out of my field.

Q Is your microphone on?

A (WITNESS SHIPPER) Yes.

If you wish to discuss the actuation signal or the actuation sequence, safeguard actuation, we can get the designer.

Q In other words, you are unable even to tell me what that signal is used for, even in a general way, as to what safety systems it turns on or what safety functions it initiates, even in a general way?

A (WITNESS SHIPPER) I do not know the details of it.

Q I am not asking for the details. For example, you are aware that the 1600-pound signal is the signal which initiates emergency core cooling; right?

A (WITNESS SHIPPER) I am aware that the matrices do trip the pressurizer heaters upon actuation. I have never gone into the details of it.

Q It is your understanding that the signal does in somme way perform an automatic safety feature actuation?

A (WITNESS SHIPPER) Yes.

Q We had asked a similar question during the deposition on the 26th of March. I am focusing particularly

on page 67 of that transcript. And prior to that answer, you had been giving the answers, and then after this you resumed giving the answers. And it actually was a Mr. Willems, W-i-l-l-e-m-s, who gave the answer. And Mr. Willems also works for Gilbert; is that correct?

A (WITNESS SHIPPER) That's correct.

MR. POLLARD: Mr. Chairman, I think this is an important question that we ought to have an answer to on the record as to what the purpose of this 400-pound reactor coolant presure signal is and what automatic safety feature actuation it performs, because in the witnesses' testimony they are portraying the signals as a method of satisfying the requirements set forth in Regulatory Guide 1.75. And if we don't even know what the signals are used for, I don't see how we can judge whether or not the signal can at all be counted, even.

1.75 requires, among other things, that you use an isolation device that is not acutated by either fault current or an indirect effect of the fault current. It also goes on to suggest that an appropriate signal would be a signal which is used to initiate engineered safety features. I am paraphrasing, because I am not reading from it.

These are the signals listed in their testimony. I am personally unfamiliar, despite my knowledge of P&W

design, of an engineered safety feature actuation signal coming from reactor coolant system pressure at 400 pounds.

DR. JORDAN: I must say it comes as a surprise to me. I am puzzled by the 400 pounds. I guess I would like to have it cleared up, if it is not for this, for general interest. As far as I am concerned, it doesn't have to be today.

MR. POLLARD: That's correct.

DR. JORDAN: Or tomorrow or any time soon. But for Mr. Pollard, if he needs it, it may be different.

MR. TROWBRIDGE: It will be cleared up, Dr. Jordan.

DR. JORDAN: All right.

MR. POLLARD: I will proceed on the assumption that there is a such a signal, that it is similar to the other engineered safety feature actuation signals that come from 1600 pounds reactor coolant system pressure and 4 pounds at reactor building pressure.

DR. JORDAN: I would presume so, and they said any one of those three signals would trip the ESFAS.

BY MR. POLLARD:

Q That is your testimony?

A (WITNESS SHIPPER) To the best of my knowledge.

Q With respect to the use of these three, what you call "separate and independent signals," tripping of the

main feeder breakers, as illustrated on figure 1 of your testimony, is it not correct -- let me back off.

Let's talk about the 1600-pound signal. Do you know how many devices there are which measure reactor coolant system pressure and supply that signal to the engineered safety feature instrumentation to the engineered safety feature actuation logic in Three Mile Island Unit 1?

A (WITNESS SHIPPER) No.

Q Can you please make the assumption that there are three? And is it not the case in a B&W design that the actuation logic is developed in two separate systems; that is, two separate trains?

A (WITNESS SHIPPER) Yes.

Q You do know that?

A (WITNESS SHIPPER) Yes.

Q And that logic, are you aware that it is two out of three for most parameters?

A (WITNESS SHIPPER) Yes.

Q And the output from this coincident logic is then assigned on a train basis to actuate components; is that not correct? It is correct?

A (WITNESS SHIPPER) That is correct.

Q Now, when you say there are three separate and independent signals, are you saying that the 600-pound signal and the 400-pound signal --

DR. JORDAN: 1600 pound?

BY MR. POLLARD:

Q The 1600-pound signal and the 400-pound signal from the reactor coolant system pressure and the 4-pound signal from the reactor building pressure go directly into the control circuits for the main feeder breakers; or is it the fact that any one of those signals would produce what is called an "engineered safety feature actuation signal," and that is the signal that goes to the breaker?

A (WITNESS SHIPPER) I think your statement is somewhat incorrect when you said "one signal."

Q My statement --

A (WITNESS SHIPPER) You need the two out of three into the actuation system and out of the actuation system comes the trip signal to the pressurizer heater breaker.

Q Let me try and phrase the question a little bit, hopefully, simpler. Referring to this paragraph 1 on page 4 of your testimony, how many signals go to the breaker? Is it three or one?

A (WITNESS SHIPPER) There is a matrix out of the ES actuation cabinet which goes to the breaker to trip the circuit breaker.

Q I agree with you; that is, as far as the breaker is concerned, it receives an ES signal.

And that is the same circuit and the same signal

regardless of whether it is generated by 1600 pounds in the reactor coolant system or 4 pounds in the building; is that correct?

A (WITNESS SHIPPER) I think that is correct.

Q Wouldn't you agree that your testimony is more accurate, that there is one signal to trip the breakers, which could be activated by any one of three different possible input parameters?

A (WITNESS SHIPPER) I think that is a way of stating it. I also think that the way we have stated it is correct.

Q I don't want to argue over semantics. I just want to make sure I understand the circuitry.

Back again to our example of the 1600-pound signal. Is it not correct, as you indicated, that this is done on a per-train basis, that, for example, the signal for train A would start high-pressure injection pump A and the signal from the other division would start high-pressure injection pump C, and the high-pressure injection pump B could receive a signal from either division?

A (WITNESS SHIPPER) That is correct.

Q Now, transferring that kind of design philosophy to the main feeder breakers illustrated on figure 1 of [illegible] testimony, take the main feeder breaker on bus 1-P, will that be tripped by an engineered safety feature actuation

signal from just one set of logic, or would it be tripped on an ES actuation signal from either set of logics?

A (WITNESS SHIPPER) The main feeder breaker is the main feeder breaker feeding the pressurizer heaters.

Q I am referring to the breaker on figure 1 of your testimony, which is labeled "main feeder breaker."

A (WITNESS SHIPPER) That main feeder breaker receives its trip logic from its channel.

Q That's correct. So that if one channel of logic failed, the trip signal would go only to one breaker, one of the main feeder breakers, and it would be that breaker associated with the channel of logic that did not fail?

A (WITNESS SHIPPER) Would you repeat that question? I am not sure I caught the context.

Q Let me slow down. Let's identify -- and let's make the assumption that there are two logics at Three Mile Island Unit 1. Let's call one "A" and one "B." Let's assume that logic A trips the main feeder breaker on bus 1-P, and logic B sends the ES signal to trip the main feeder breaker on bus 1-F.

Am I correct that if the heaters were being run off of bus 1-P and an accident occurred but there was a failure in the logic on channel A, that the main feeder breaker from bus 1-P would not trip?

A (WITNESS SHIPPER) I would assume now -- and

please correct me -- I think you missed something in your scenario here. Maybe we ought to get that on the record. The pressurizer heaters would only be put on in case of loss of off-site power.

Q Well, I am sorry, I have to disagree with that, because of the provisions of emergency procedure 1202-29. In this procedure, as other witnesses testified, even if the plant is at 100 percent power, and I can't imagine the plant being at 100 percent power and having a loss of off-site power -- let me back up and give you the scenario again and show you why I don't think it matters.

Forget about, for the time being, off-site power, that we had a failure of the heater power supply bus, let's say, instead of complete loss of off-site power; and therefore, we have now rearranged Three Mile Island Unit 1 so that pressurizer heater group 8 is now being powered from bus 1-P.

A (WITNESS SHIPPER) You have to go a little more in the scenario. You actually need two failures. There is basically a second power supply bus, which is not shown. The reason that is not shown is because those heaters were not touched. There are 13 groups of heaters.

Q Let's start over again. Let's see if we can work through one scenario and not get too complicated. Let me just assume that, for whatever reason, pressurizer heater

group 8 is being powered from bus 1-P. Now an accident occurs which generates an engineered safety feature actuation signal in at least one logic train.

My question is, simply: If logic train A is the train which is used to trip the main feeder breaker on bus 1-P and that logic train undergoes a failure, is it not correct that the main feeder breaker on bus 1-P will not trip?

MR. TOURTELOTTE: Can we have a clarification? Is Mr. Pollard's question assuming two failures rather than a single failure on the same system?

MR. POLLARD: I don't know why there could be need -- the only failure I postulated was the failure of the logic channel in train A, in which I made the assumption that that was the train of logic through which the ES signal is supplied to the main feeder breaker on bus 1-P.

WITNESS SHIPPER: As a very quick answer --

MR. TOURTELOTTE: Mr. Chairman, I am wondering if -- doesn't it require a failure of one system to get that heater on that bus in the first place, and then isn't Mr. Pollard then postulating a second failure?

CHAIRMAN SMITH: Wasn't that in the nature of --

MR. POLLARD: Let me back up and see if I can explain.

MR. TOURTELOTTE: One of the reasons that I

mightobject to the way that the hypothetical is posed is the words bothered me in Mr. Pollard's hypothetical, "Let's assume, for whatever reason, that this occurs."

It seems to me that there may be a possibility that we are assuming a failure in order to get the configuration that he wants in order to assume a second failure, which is -- I am not sure, but it seems like it is inconsistent. I am going to the question that Mr. Pollard just got through postulating.

MR. POLLARD: I think I can explain. Part of the problem is Mr. Tourtelotte has arrived in the middle of the questioning on this contention. So let me see if I can back up and, hopefully, help him understand where we have been before he arrived.

MR. TOURTELOTTE: That is not really the problem. The problem is only in the question. I understand where you are, and I understand where you have been. I think I have made it very clear what the problem is I have, and that is that the question first assumes that there is a failure to get the hookup that Mr. Pollard wants to have, and then he asks about a second failure. It seems to me that is assuming two failures in the same system.

CHAIRMAN SMITH: That is why I referred to Mr. Shipper's point, and Mr. Pollard said we will assume that failure and get to this one.

MS. WEISS: The objections have now been stated three times, and Mr. Pollard hasn't had a chance to respond to it once. I think he is going to explain that that is not a necessary part -- two failures are not a necessary part of his assumption.

DR. JORDAN: I need to be caught up a little bit, if you don't mind, Mr. Pollard. That is, what are the circumstances, first of all, in which the Kirk Key disconnect devices will be brought up to the control room and inserted? I guess it is my understanding that the only circumstance in which the disconnect devices would be inserted into the Class 1-E system was in case of an off-site power failure.

Now, have I gotten the wrong impression? Apparently, you do have a different impression, that there are other circumstances in which the disconnects would be brought up and the heater buses would be connected.

MR. POLLARD: That's correct. There are two different circumstances. Perhaps I can try and explain both.

DR. JORDAN: That would be helpful to me. And would you please listen and help me try to get straightened out now?

MR. POLLARD: The first case --

DR. JORDAN: By the way, Mr. Dornsife, you are

listening, too, and if you see where one of us has made a mistake and you understand the situation -- for example, did you understand the 400 pound -- I looked at you to see if you did.

MR. DORNSIFE: No, sir, I didn't. I know Unit 2 had an ESFAS signal on a high building pressure of like 20 pounds, and the 4-pound signal was only for building isolation.

DR. JORDAN: The 4-pound signal we understand.

MR. DORNSIFE: The 4 pound on Unit 2 --

DR. JORDAN: 400 pounds.

MR. DORNSIFE: Let me explain Unit 2. The 1600-pound signal was for high-pressure injection; that is true. There was also high-pressure injection, or ESFAS, signal that let off the safeguard, the emergency core-cooling system for a 25-pound building pressure signal. But the 4-pound signal for building pressure was only for containment isolation.

MR. POLLARD: I am not sure that helps at all.

DR. JORDAN: I don't think it does.

MR. POLLARD: That is entirely different from my own knowledge of B&W design, what Mr. Dornsife just said.

DR. JORDAN: Let's not worry about that for the moment.

CHAIRMAN SMITH: Begin with Mr. Tourtelotte's

comment, question.

MR. POLLARD: I have my explanations all in mind. What I would like to do is first address Dr. Jordan's, which really wasn't relevant to the question I was asking. And then I will get to Mr. Tourtelotte.

CHAIRMAN SMITH: Please do.

MR. POLLARD: Reviewing section E of emergency procedure 1202-29, which is inoperative pressurizer heaters, if you consider the procedure as a whole, the procedure itself envisions the possible circumstance where at least one group of pressurizer heaters, either eight or nine, would be powered from bus 1-P and 1-S, even if there has not been a loss of off-site power. Under those circumstances, of course, the power for the heaters would be coming from off-site, but it still would be coming from bus 1-P.

Let me slow down. Bus -- referring to figure 1, buses 1-D, 1-E, 1-P, and 1-S during normal operation are not dead buses. They have power to them. If we lose --

DR. JORDAN: They are powered by the off-site power system?

MR. POLLARD: That's correct. If you review the entire emergency procedure -- and one witness has already answered a direct question, "Does the procedure apply while you are at 100 percent power," there was a straight answer, "Yes." I think that is confirmed by reading the procedure.

You can envison some possible failure involving the pressurizer heaters which brings forth the need to power the pressurizer heaters from bus 1-P, even though we have not yet lost off-site power.

DR. JORDAN: You are saying that the procedure calls for that?

MR. POLLARD: Yes, sir. Now, with respect to Mr. Tourtelotte, looking at this piece of testimony from the Licensee, they are relying upon what they call three "separate and independent" signals from engineered safety feature actuation, to separate the heaters from bus 1-P and bux 1-S or 1-F, if an accident were to occur such that the normal accident loads needed during a loss-of-coolant accident could be powered.

The question which occasioned Mr. Tourtelotte's objection simply began with the premise that the heaters were being powered from bus 1-P. I am not sure in my mind that it matters what the conditions are at that time, because the only point I am trying to get at -- and we are almost there; I think perhaps it is already on the record and I was just trying to make it absolutely clear -- the way that the B&W plants are designed normally, as well as this witness has confirmed, you have two logic trains, and you use those output signals, the engineered safety feature actuation signals, on a train basis.

That is, one logic circuit will supply the ES signal which will trip the main feeder breaker on bus 1-P, and the other logic circuits will supply the ES signal which will trip the main feeder breaker on bus 1-S.

DR. JORDAN: I see. I hadn't gathered that from his testimony.

MR. POLLARD: You can't get it from his testimony. What you get it from is from an earlier question, the answer to an earlier question I asked.

I am trying to make it crystal clear that if the heaters were being powered from the bus 1-P or 1-S -- and their testimony does say it can only be one group at a time -- I simply asked a very simple question: If group B was being powered from bus 1-P and the logic circuits which supply the ES signal which is fed into the main feeder break off bus 1-P failed, that if a loss-of-coolant accident occurred, is it correct that the main feeder breaker on bus 1-P would not trip?

I am assuming, of course, that the other logic system works and it supplies an ES signal to the main feeder breaker off bus 1-S. But that is presumably already open anyway.

MR. TROWBRIDGE: Mr. Chairman, could we have from Mr. Pollard an identification of the sections of emergency procedure 1202-29 to which he refers, in which he asserts

under some circumstances for the connection of the pressurizer heaters to on-site buses without a loss of off-site power?

Essentially, we have had testimony from Mr. Pollard at this point. For all I know, he may be correct, but we have the procedures and would very much like to know how he arrives at that conclusion.

CHAIRMAN SMITH: I want to insert that we are talking about UCS Exhibit 19.

MS. WEISS: May I suggest the reason why you have had what amounts to testimony is because of an objection which was raised which required a substantial amount of explanation. If there is any reason to dispute the fact that the heaters can be connected to the emergency buses without a loss of off-site power, I think it is incumbent upon the Licensee.

CHAIRMAN SMITH: As a matter of simple courtesy, if you know a place in that exhibit which justifies the statement, point it out. If you don't, then explain it. If you do, point it out.

Ms. Weiss, I hope you did not intend that to be heard by the Board.

MR. POLLARD: First of all, let me preface my answer. I can answer Mr. Trowbridge's question that I put to one of his witnesses -- excuse me -- one of the

Licensee's witnesses, a direct question. In this section E of UCS Exhibit 19, a procedure that could be used at 100 percent power.

Now, I may be wrong, but I recall the answer to my question to be an unqualified "Yes."

MR. TROWBRIDGE: Which witness are you talking about?

MR. POLLARD: I am talking about section E --

MR. TROWBRIDGE: Which witness are you talking about?

MR. POLLARD: I wish I could remember, Mr. Trowbridge. I am sorry I don't.

MR. TROWBRIDGE: Was it one of these two witnesses?

MR. POLLARD: No, sir.

MR. TROWBRIDGE: I would like the transcript record to support that statement.

MS. WEISS: Let me suggest that the courtesy ought to go in the other direction. This is your plant, and if the witnesses have any reason to dispute that statement, I think they ought to be called upon to dispute it.

MR. TROWBRIDGE: Anybody who makes an affirmative statement has the burden, in my view, of sustaining it. He claims to have asked an unidentified witness a question to which he also claims to have an answer. The obligation is

clearly on Mr. Pollard to identify who he is talking about and when he is talking.

MS. WEISS: Let's just ask these witnesses.

BY MS. WEISS:

Q Do you have any reason to dispute the assertion --

MR. TROWBRIDGE: Objection. This is Mr. Pollard's cross examination. Mr. Pollard has made a statement which we are entitled to some backup for before he proceeds to examination based on it.

MS. WEISS: Then we will ask these witnesses if they can answer the question.

CHAIRMAN SMITH: What is the pending question? The pending question is still the one that Mr. Tourtelotte made the clarifying question which is predicated upon assumption that you have off-site power.

MR. POLLARD: No, Mr. Chairman.

CHAIRMAN SMITH: Then why does it matter?

MR. POLLARD: The only reason I brought it up -- and I was quite clear before I started my explanation -- that first I was going to address Dr. Jordan's comment, which I don't think was incorporated in the objection made by Mr. Tourtelotte.

Now, if it will help to move this proceeding off the point where we seem to be stuck on, I will try and answer the question Mr. Trowbridge has put to me, either now

or when I again take the witness stand; whatever you choose.

CHAIRMAN SMITH: Mr. Trowbridge, what is your -- exactly what do you want from the Board right now?

MR. TROWBRIDGE: I guess I have entered a second objection to the question, because it starts with the premise --

CHAIRMAN SMITH: The Board's question?

MR. TROWBRIDGE: -- which, for the moment, I can't accept. However, there do seem to be a couple of ways we might get off the ground. Perhaps Mr. Pollard can explain how this emergency procedure provides for the connection without loss of off-site power, without reference to a statement of some witness? Or perhaps he can just point to the portion and it will, on its face, support his statement.

CHAIRMAN SMITH: I assume --

MR. TROWBRIDGE: We are baffled by the statement.

CHAIRMAN SMITH: You are?

MR. TROWBRIDGE: Yes.

MR. ADLER: Did I understand UCS' problem to be that they could not identify the section, that they could not find it?

MS. WEISS: No, that's not our problem. We haven't been able to answer that yet, and Mr. Pollard is

about to answer.

CHAIRMAN SMITH: That was the first thing you were called upon to do. I thought your response to that request indicated that you could not do that.

MS. WEISS: No; we can do that.

CHAIRMAN SMITH: Then do it.

MS. WEISS: If given an opportunity.

CHAIRMAN SMITH: Then do it. Excuse me. I raised my voice.

MS. WEISS: We're getting objections on top of objections.

CHAIRMAN SMITH: Then let's do it.

MR. POLLARD: Referring to UCS 19, section E, inoperative pressurizer heaters. Let me point first particularly to step 3 on page 11, which states: "For deenergized heaters, determine cause; and if a minimum of one heater group is not operable, continue load reduction to shutdown and cooldown."

I interpret that step to mean that if there is at least one heater group operable, there is no need to shut down and cool down.

Continuing on, step 5, there is a reference to "During the shutdown from 15 percent power or if the reactor trips." I infer from that step that we must have been at a power level higher than 15 percent.

Referring now to step 8 on page 12, where it talks about connecting either group 8 or group 9 to bus 1-P or bus 1-S, it says nothing about diesel generators; it only says where we are getting the power from. Once again, if we were successful in powering at least one group of heaters from those buses, it would not be necessary to shut down and cool down.

With those specific references to the procedure and having read and studied the whole section 8 of this procedure, I could imagine either power supply failures at particular buses, failures in circuitry which trips all pressurizer heaters at low pressurizer levels of less than 80 inches, which is referenced on page 12 with a caution, that circumstances could arise where the heaters powered from the normal power supply were not working, that they might successfully power either group 8 or group 9 from bus 1-P and 1-F.

And I see no reason to assume that at that time we necessarily have had a loss of off-site power.

DR. JORDAN: I hear the arguments, and, so far as I can tell, they are reasonable. But I would like Mr. Trowbridge to ask his witnesses if they agree with that analysis or if they disagree.

MR. TROWBRIDGE: Could you spare me a few minutes to see if I am educable in that length of time or not?

MS. WEISS: Whether or not Mr. Trowbridge is educable or not doesn't affect the fact that the witnesses may know the answer to that question. I don't see why --

CHAIRMAN SMITH: We have to come to the point -- it is going to be arbitrary where we begin to resolve one thing at a time and unravel the confusion. Let's select it right now, where we stand. Dr. Jordan's question to Mr. Trowbridge.

MS. WEISS: I thought the question was to the witnesses.

CHAIRMAN SMITH: To Mr. Trowbridge.

DR. JORDAN: I guess the question was one that I guess I was asking Mr. Trowbridge to relay to the witnesses; namely, have the witnesses understood Mr. Pollard's explanation as to why he believes that the pressurizer heaters are connected to those buses even when the off-site power is not there.

MR. TROWBRIDGE: I would be glad to have the witnesses answer that question right now.

DR. JORDAN: If you want to do that right now, fine.

WITNESS TORCIVIA: I would like to spend a few minutes on an explanatory phase. The implications of the question probably needs a prior explanation. The assumption here is that we have had off-site power is there and the

primary transformers are fine except we lost the internal main buses, 4160 buses, which eventually are feeding the pressurizer heaters from the balance of plant buses.

Such a condition would mean -- and we have two of these buses; each are redundant. That means if we lose one, we have the other available to us. The condition has developed here -- at least the scenario has developed here -- indicates that we have had a serious problem on both of those two buses, which, in turn, means that immediately the diesels have gone on.

They have not been actuated because of a fault, but they have gone on because we have loss of off-site power. Whatever loads the diesel required would have been picked up by the diesel, but not as a result of an ES signal, merely as a result of off-site power -- of the loss of off-site power.

The need for the pressurizer heaters would result if, in theory, we continued to operate with the diesels on, because now theoretically we have lost these two buses, not necessarily off-site power, but we have lost the two main buses that feed the balance of plant. The plant itself does not continue to operate from the diesels.

So it would be extending our thinking pretty far to say that we could continue to operate the plant. We would have to shut down. We would have no alternative. So

now, in place of the diesels, the diesels will be carrying only those essential loads necessary for the shutdown of the plant.

Now, at that point, those essential loads at the possible extreme would be in the vicinity of, say, 2500 KW, as was indicated by the gentleman from the NRC, under the worst conditions. Should that happen where we have the 2500 KW and those are loads that go on in blocks automatically, any future loads that we want to put on -- which is that question which is up in the air concerning the 2500 KW and the 3000 KW -- those are manually put-on loads. The essential loads go on automatically in blocks.

Those are not manually put on loads. The essential loads go on automatically in blocks. Now, at the 2500 kW, the operator has a choice of continuing to relieve the plant of any of these manual loads, either put them on or relieve the plant of any of the manual loads listed on page 13.

He does not have to put anything on. We might lose a few motors. We may burn up a few others things, but that is immaterial. The safety of the plant has been assured.

At that point we could pu on the 126 kW heater after going through that process of connecting up the units, and so forth, if we had to, which is a high emergency, because we are in the process of shutting down. We have no alternative.

Coming back to Mr. Pollard's question, he has made an assumption that the circuitry which is feeding the main feeder breaker has failed, and therefore will not trip out should an ES occur. Now, that ES must occur during the period of time in which we are shutting down, oin the way down, and that ES signal comes on at that point.

Now, let us assume that that signal does fail right there. Number one, we have put on automatic loads which went on to approximately 2500, 2700, whatever they may be, in that vicinity. We have added on the 126 kW, which

brings us to about 2800, 2900, theoretically; we actually still have a little room to put on some manual loads.

Now, the operator has instructions to keep that load to 3000 kW, so should he by any chance have put on for some reason or other some manual loads, he should take them off and still maintain that 3000 kW.

The question here in my mind is: suppose the fantastic idea of the signal being lost in the process of losing the two main buses and putting on the unit, suppose we do lose that signal which will not permit the breaker to trip, the feeder breaker to trip out.

We still would be with a diesel that is not overloaded, and if by any chance there were a few loads on, manually put on, the operator is supposed to take them off. So we do have that situation there, if I make myself clear.

(Board Conferring)

DR. JORDAN: Does that help, Mr. Pollard?

MR. POLLARD: It does not help me. I think the witness, instead of being asked the question, thought up his own question and answered it.

If we are going to unravel things one at a time, first let's unravel Mr. Trowbridge's original question to me as to whether or not this emergency procedure envisions using bus 1S or 1P to power the pressurizer heaters without a loss of offsite power.

Now, this witness just went through a whole explanation about where he assumed the loss power.

WITNESS TORVICIA: No, I did not.

DR. JORDAN: I did not get that. I gathered he said yes, there is the situation that you envision that could happen during a short period; that they might indeed want to put heaters on.

WITNESS TORCIVIA: May I add something else?

MR. POLLARD: Let me ask you a question and see if it is the same question you just answered.

BY MR. POLLARD:

Q Section E of emergency procedure 1202-29, considering that --

A (Witness Torcivia): What page? Section E? What page is that on?

Q It starts on page 9 and runs through page --

A (Witness Torcivia): What page are you referring to now?

Q It runs through the bottom of page 13.

Do you see any thing in the procedure which precludes powering the pressurizer heaters from bus 1P or bus 1S even though we may not have lost offsite power?

A (Witness Torcivia): I believe I made that quite clear. I said that we are willing to assume that the offsite power is still there,but we have a fault of some

nature on the two 4160 buses which the balance of plant equipment.

Now, that is a conceivable thing, probably out of the extraordinary, but it is conceivable. So we have the offsite power.

Q Which two buses are you referring to in your last sentence?

A (Witness Torcivia): The balance of plant buses.

Q Are they shown on figure one?

A (Witness Torcivia): No, they are not shown on figure one.

Q Thank you.

A (Witness Torcivia): Those are balance of plant buses.

Q Your answer was satisfactory to me if it was satisfactory to you. I am saying you need not continue unless you really wish to.

A (Witness Torcivia): I am perfectly happy.

MR. POLLARD: Mr. Chairman, what is the next thing to unravel?

MR. TROWBRIDGE: The question Mr. Pollard asked, does this procedure preclude -- that is not the statement Mr. Pollard made. He indicateds section E provides for the connection of pressurizer heaters in some situation where offsite power is still available.

Now, that may be that that is a correct statement, that he has not yet --

MR. POLLARD: Let's ask the witnesses that question, then.

BY MR. POLLARD:

Q Does section F of emergency procedure 1202-29 provide for powering either heater group 8 or 9 from either bus 1-P or 1-F, even though there may not have been a loss of off-site power? "Yes" or "No," please.

A (WITNESS TORCIVIA) It does not intentionally provide -- I did not intend to have it provided for at the time I reviewed it -- but it does provide for it when it says specifically if the pressurizer heater bus has failed from whatever cause. It says on page 12: "If the pressurizer heater bus has failed, the pressurizer heaters can be powered from 1-P or 1-F bus." I never questioned that.

DR. JORDAN: You got your answer.

MR. POLLARD: Does Mr. Trowbridge -- now what is the next step?

CHAIRMAN SMITH: Mr. Trowbridge?

MR. TROWBRIDGE: I think we have gotten the answer: Under highly unusual circumstances, there could be a connection under that provision of the emergency plan.

CHAIRMAN SMITH: Now would you begin the question that was pending before we got into this discussion. State it anew. Specify in your assumptions.

MR. POLLARD: This is the question to which Mr. Tourtelotte objected.

CHAIRMAN SMITH: That's where I think we are, unless you think we are not there.

BY MR. POLLARD:

Q Mr. Shipper, assuming that pressurizer heater group 8 is being powered from bus 1-P and at this point a loss-of-coolant accident occurs and the logic circuit which provides the ES signal to trip the main feeder breaker on bus 1-P fails, is it correct that the main feeder breaker would not be tripped?

A (WITNESS SHIPPER) I would think that is correct. I would also like to have that identified as "the single failure."

Q With respect to item 2 on page 4 of your testimony where you are talking about the low emergency bus voltage trip, which continues on page 5, am I correct that once again you are referring to a trip of the main feeder breaker from either bus 1-P or 1-F?

A (WITNESS SHIPPER) That is correct.

Q What is the set point of that trip?

A (WITNESS TORCIVIA) Of what trip? The under-voltage relay?

Q The under-voltage trip.

A (WITNESS TORCIVIA) We have not precisely established the set point of the under-voltage trip at this point, primarily because we expect to establish first the

trip of the motors -- not the trip of the motors -- but the point at which the motor, the trip rating of the under-voltage relays which -- I am sorry, let me go back a bit.

These three under-voltage relays that we are talking about now are directly associated with the pressurizer heaters. Beyond that point, there are more under-voltage relays which are intended to protect the motors and equipment beyond that. We have not established precisely the value of the under-voltage relays, although I believe they will end up at approximately 92 percent of the nominal voltage of the bus.

Until we determine the final setting of the upstage relays, we are still leaving that question open. They are intended to be set in such a way that they will trip out the pressurizer heater before we in any way will endanger the operation of the bus or any of the motors connected to it.

Q These three under-voltage devices are something that are being added to Three Mile Island Unit 1 specifically as part of the modification needed to power the pressurizer heaters from the diesel generators; is that correct?

A (WITNESS SHIPPER) That is correct.

A (WITNESS TORCIVIA) That is correct.

Q Did I understand you to say that the set point of these new under-voltage devices you expect to be in the neighborhood of 92 percent of nominal voltage?

A (WITNESS TORCIVIA) I would expect it in that area as an off-the-cuff answer. The exact value will be established at a later date.

Q Would you agree that 92 percent of rated voltage is roughly 441.6 volts?

A (WITNESS TORCIVIA) If that's what you say.

A (WITNESS SHIPPER) Roughly.

Q At this point, I am not sure, so maybe you better check it.

A (WITNESS SHIPPER) I just did.

Q Did I understand --

DR. JORDAN: How many volts was that? (-TAB-)

WITNESS SHIPPER: 441.6, roughly.

DR. JORDAN: All right.

BY MR. POLLARD:

Q I understood your testimony earlier that during your postulted bolted line-to-line fault on all of the pressurizer heaters in a particular group, that the voltage on bus 1-P, for example, would only drop to about 160 volts.

A (WITNESS TORCIVIA) Say that again?

Q Earlier today you had postulated a fault in the

pressurizer heaters. You came up with 4000 of amps fault current. And I asked you about the voltage on bus 1-P, and I recall you told me roughly 460 volts.

A (WITNESS TORCIVIA) My guess would be in that area. That would be a very fast dip and up again.

Q A dip from 480 down to 460 and back up?

A (WITNESS TORCIVIA) That's right. In that neighborhood.

Q If the under-voltage relay set point was 441 volts, it would not be useful in terms of interrupting the fault current?

A (WITNESS TORCIVIA) They would not be required, because at that point, the breakers will have tripped them out, those pressurizer heaters. Again, we come back to the coordination as set up for these breakers is such that the -- if there is any fault on those heaters, they will have tripped out.

DR. JORDAN: By over-current?

WITNESS TORCIVIA: By over-current.

DR. JORDAN: So the under-voltage is not a backup for the over-current?

WITNESS TORCIVIA: No.

DR. JORDAN: I hadn't understood that.

WITNESS TORCIVIA: Not in that sense. I think we want to be careful there. The under-voltage relays, per se,

are reading the voltage off the bus. Now, as such, those relays do not know where the fault is that is pushing that voltage down. It may be on the pressurizer heaters or it may be any other place on the bus.

Now, as a result of that, what we said was that we don't know where the fault is. What we will do is put those relays in there. If the voltage dips and approaches the 92 percent level or thereabouts, we will at least trip those out, just in case they are the ones at fault and were not tripped out by any other means.

I do not want to leave the impression that those relays are unnecessarily a backup for the pressurizer heaters.

DR. JORDAN: I understand. I had not understood that.

Go ahead, Mr. Pollard.

BY MR. POLLARD:

Q Let me make sure I understand. You are saying that the under-voltage relays, the three that are being newly installed to trip the main feeder breakers on under-voltage are in no way a backup to the trip from fault current?

A (WITNESS TORCIVIA) Again, we are making a statement there.

Q I am not trying to introduce anything new. I am

trying to understand your last exchange.

A (WITNESS TORCIVIA) It is not to be interpreted as a complete backup.

Q With that testimony, then, do I understand you to mean that your testimony on page 4 is incorrect where you state, "Diverse means of tripping the pressurizer heater loads from the safety-related buses are provided to assure that the capacity, capability, and reliability of the safety bus to supply power to safety loads is not degraded. These diverse trips are" -- and then you list an item to the under-voltage trip and in items 3 and 4 --

A (WITNESS TORCIVIA) What page again?

Q Page 4 of your testimony.

A (WITNESS TORCIVIA) All right.

Q You start off by saying you are going to list some diverse means of tripping the pressurizer heater loads, and then you list in item 2 the under-voltage trip and you list in items 3 and 4 the over-current trips.

A (WITNESS TORCIVIA) Do you mind if we read that?

Q Feel free.

A (WITNESS TORCIVIA) What we have said, the low emergency bus voltage trip, emergency bus voltage is an indicator of the capability of the emergency bus to supply power to the safety loads. Three under-voltage relays are provided, any one of which will trip the pressurizer heater

load from the emergency bus when the voltage level -- we didn't say where the voltage level was determined, but when the voltage level -- that that capability is jeopardized.

As I previously stated, those under-voltage relays are relieving that bus of that pressurizer, just in case it happens to be that pressurizer heater which is in trouble. It does not necessarily mean that that pressurizer heater is in trouble.

It may be something else.

Q There are existing and there were before this modification, as I understood you to say, other undervoltage relays on bus 1P and 1S.

A (WITNESS TORCIVIA) That is correct.

Q What is the set point of those relays?

A (WITNESS TORCIVIA) In the vicinity, around 90 percent, in that area. Again, that is up in the air.

Q What were they before this modification? What was the set point before this modification?

A (WITNESS TORCIVIA) It had nothing to do with this modification.

Q I understand that. That's why I'm asking what was the set point of those undervoltage relays which previously existed on bus 1P and 1S.

A (WITNESS TORCIVIA) Previous to this modification, the relays themselves consisted of a first level of operations. We since then added a second level to comply with some of the -- I forget which case it was -- one of the conditions in which an undervoltage condition existed in one of the plants, and we provided a second level of operation. The set points at that time were, for the first level were. I believe they were --

A (WITNESS SHIPPER) Are you familiar with induction disk undervoltage relays?

Q Are you questioning me now? You go ahead and say whatever you wish and then I will question you on what you said.

CHAIRMAN SMITH: Just a minute, Mr. Pollard.

Gentlemen, whenever -- gentlemen, please. It is becoming increasingly difficult to maintain decorum and organization, and I don't want to single out any particular problem, but we are just getting very argumentative and we are beginning to fail from simple courtesy. I think we had better go back to basics, and I am going to watch it very carefully, and I am going to follow through.

BY MR. POLLARD: (Resuming)

Q Let me try again the question which started this.

Prior to beginning the modifications to add the capability to supply the pressurizer heaters from bus 1P or 1S, you had some undervoltage relays on bus 1P and 1S, and I understand that as a result of some modifications, you may have had one level and two levels.

My question simply is what were the set points of the existing undervoltage relays?

A (WITNESS SHIPPER) My recollection on the set points in those was approximately 73 percent, with a time dial at 2.3 seconds.

A (WITNESS TORCIVIA) For the benefit --

DR. JORDAN: I didn't hear the answer.

WITNESS SHIPPER: Approximately 73 percent with a time dial of 2.3 seconds. That is why I asked the question if he is familiar with induction disks.

DR. JORDAN: And you wanted to add something to that, Mr. Torcivia?

WITNESS TORCIVIA: I merely wanted to add for the benefit of everyone concerned that those original relays were of the electromagnetic type -- electrodisk type, which were primarily an aluminum disk that rotates around a magnetic field with time. The voltage changed, then the disk got faster and slower. We considered that somewhat inaccurate and poor repeatability. We therefore changed those relays to solid state. We also did that for another reason. Our voltage studies indicated that we wanted more accurate control of our voltage dips. Therefore, or settings at this point are up in the air because we haven't yet completed our studies as to exactly where we want those points. I have a pretty good idea where they are going to end up, but the relays themselves have been changed to solid state. That's why it is hard to answer that question.

DR. JORDAN: But for my in ation in straightening out any confusion that I may well have, that is not the relays that you were talking about under Item 2, page 4?

WITNESS TORCIVIA: Those are completely different.

BY MR. POLLARD: (Resuming)

Q The set point around 73 percent of nominal voltage, you think by the time you finish your evaluation that set point might be raised to the vicinity of 90 percent, is that correct?

A (WITNESS TORCIVIA) Again let me correct that impression. At that time we had one set of relays, and those relays were set at a position in which there would be a drastic reduction in voltage of approximately 70 percent. With our new relays, we have now two sets. One set takes care of an upper limit which is where we are keeping an alarm indication, and the second set to trip out. The second set, which will be comparable to the electromagnetic relays which we have taken out will be set at approximately the same area, about 70 to 75 percent, and they take in a major dip in voltage.

Q So the second level which will be set in the vicinity of 90 percent only provides an alarm function, is that correct?

A (WITNESS TORCIVIA) At this time.

Q At this time.

Will that be the case at restart?

A (WITNESS TORCIVIA) Yes.

Q So that in terms of shedding loads from bus 1P or 1S, the 90 percent level will provide no shedding function,

and we will still be relying upon this level at around 73 percewnt.

A (WITNESS TORCIVIA) I don't know if shedding of loads comes in the picture or not.

Q Let me ask that question. When the undervoltage relays on bus 1P and 1S, those which are set at nominally 73 percent, what function or what action do they perform when they trip?

A (WITNESS SHIPPER) I think the relays you are referring to there at those set points are the induction disk relays that are presently installed. I think Mr. Torcivia indicated -- and let me turn the mike over to him to explain that.

A (WITNESS TORCIVIA) The relays which are coming up that we are talking about, the other set of relays, have nothing to do with this bus here. They are on the 4160 bus, which under normal conditions are operated from the offsite power. Those will give an indication on loss of offsite power, and then we transfer to the diesels.

Now, the relays on the diesels are the ones that are referring to number two, paragraph number two.

Q Let me run through what I think we now understand, or what you are now testifying to. Let me see if I am wrong.

There are three new undervoltage relays being added as a result of the modification to power the

pressurizer heaters from bus 1P and 1S, and those relays will be set at roughly 92 percent of nominal, and their function will be to trip the main feeder breaker if the voltage decreases to that level.

A (WITNESS TORCIVIA) That's right.

Q And then we have some undervoltage relays also on bus 1P and 1S which serve an alarm function, and those are set at roughly 90 percent of nominal.

A (WITNESS TORCIVIA) No.

Q Where am I wrong in my last statement?

A (WITNESS TORCIVIA) The relays you are referring to and that I was referring to are on the 4160 bus, on the diesel bus itself.

Q Bus 1D and 1E?

A (WITNESS TORCIVIA) Yes.

Q We have three undervoltage relays on that bus set to actuate at approximately 90 percent of nominal, and those provide an alarm function.

A (WITNESS TORCIVIA) Yes.

Q There are three more relays on bus 1D and 1E set at 73 percent of nominal.

A (WITNESS TORCIVIA) Loss of off-site power.

Q If the voltage decreases to 73 percent of nominal on bus 1D or 1E, what happens?

A (WITNESS TORCIVIA) We transfer over to the

diesel, the diesel takes over.

Q I understand that. If it specifically trips the incoming breaker from off-site power, does it trip any loads off of bus 1D or 1E?

A (WITNESS TORCIVIA) Not unless there is an ES signal.

Q I am just speaking of the undervoltage device. What does it do other than trip the incoming breaker from offsite power?

A (WITNESS TORCIVIA) Say that again.

Q The undervoltage relays on bus 1D and 1E which are set at 73 percent of nominal, what function do those undervoltage relays perform other than tripping the incoming breaker to bus 1D or 1E?

A (WITNESS TORCIVIA) They relieve all loads, and the diesel takes over the emergency load.

We have now lost off-site power.

Q When you say they relieve all loads, are you saying that they trip all load breakers on bus 1D and 1E?

A (WITNESS TORCIVIA) That's correct, 1D and 1E.

Q Including the breakers supplying bus 1P and 1S?

A (WITNESS SHIPPER) That is not correct. On undervoltage the feeder breakers are never tripped. The incoming feeder lines, feeder breakers on the undervoltage actuation, the only equipment actuated is the driven

equipment, or the only equipment tripped is the driven equipment.

Q Is there any equipment powered from bus 1P, a load? Is there any load powered from 1P or 1S that would be tripped on undervoltage?

A (WITNESS SHIPPER) Yes.

Q Would you please tell me what those loads are, and which undervoltage relays trip them.

A (WITNESS SHIPPER) The way the scheme is presently installed -- and I can't speak for what the new installation is, but the way the scheme is presently installed, all the motors are tripped, which includes --

Q You need not give me the specific loads.

Are they engineered safety feature loads?

A (WITNESS SHIPPER) Yes.

Q Now, which undervoltage relays trip those engineered safety feature loads?

A (WITNESS SHIPPER) At the present time, the undervoltage relays that are monitoring the bus voltage on bus 1P or 1S.

A (WITNESS TORCIVIA) Would you repeat that question again?

Q The question was are there any engineered safety feature loads on bus 1P and 1S that would be tripped on undervoltage? I think I got the answer to that was yes, is

lthat correct?

A (WITNESS SHIPPER) Yes.

Q My subsequent question was which undervoltage relays trip those engineered safety feature loads powered from bus 1P awnd 1S?

A (WITNESS TORCIVIA) Which undervoltage relays trip those at the present time? Those are the ones on the 4160, bus 1D and 1E.

Q Mr. Shipper just said they were on bus 1P and 1S. He is shaking his head no in answer to your last question.

A (WITNESS TORCIVIA) We are in a state of transition.

Q Just to clear things up, I am only interested in the configuration of the plant at the time of restart.

A (WITNESS SHIPPER) I will not answer any questions, because Mr. Torcivia is in charge of those.

Q At the time of restart, are there any engineered safety feature loads powered from bus 1P and 1S that would be tripped on undervoltage?

A (WITNESS TORCIVIA) No, sir.

Q Then this is a change in the design, is that correct? Prior to the modification to add the pressurizer heaters, there were some engineered safety feature loads on bus 1P and 1S that would have been tripped by undervoltage.

A (WITNESS TORCIVIA) Under an ES condition or

without an ES condition?

Q I didn't know that it mattered, so I have to ask you under both conditions.

A (WITNESS TORCIVIA) Just to clarify the answer, prior to the change which is being made and will be instituted for restart, there were undervoltages relays on buses 1P and 1S. Those relays have been left in there, and they are electromagnetic disk type, and they are left in there for alarm purposes, and they will indicate an over or under voltage on the bus. It will not do any other function. The other, the relays that will be taken over on the circuitry are the ones on bus 1D and 1E. They will indicate the voltage condition at bus. They are the ones that will trip out the breakers, and under normal conditions, the breakers that are already closed will continue to be closed if there is -- it is equivalent toi a transfer. It trips out from one to the other. On an ES condition those breakers will be tripped out and the plant block loaded, and the diesel block loaded.

Q Is it the ES signal that trips the loads, or the undervoltage signal?

A (WITNESS TORCIVIA) Yes.

Q The ES signal directly trips the load breakers rather than the undervoltage signal tripping the load breakers.

A (WITNESS TORCIVIA) If there is an ES and there is -- I see what you are talking about -- if there is an ES and there is power on the buses, then of course the breakers are not affected by the ES signal except the block load, yes.

Q So it is the undervoltage signal that trips the breakers.

A (WITNESS TORCIVIA) Yes -- wait, no. Wait.

(The witnesses conferred.)

WITNESS TORCIVIA: Paul is pointing out to me -- perhaps you should say it.

WITNESS SHIPPER: I don't want to get -- I am confused enough.

WITNESS TORCIVIA: In making the change, in taking off the undervoltage relays from the 1P bus and transferring to the 4160 bus, there was nothing changed in the tripping scheme as it originally was.

Do you agree with that? That's the way I remember.

WITNESS SHIPPER: I think I know what you did, but I didn't study that.

WITNESS TORCIVIA: Nothing was changed in that area, that is correct. We just took the relays and put them on the top.

Does that clarify?

BY MR. POLLARD: (Resuming

Q I hope so. I always have to just ask one more

question to make sure. In other words, there have been no changes in the tripping scheme, simply physically move some relays from bus 1P to 1D, and now it senses voltage on bus 1D.

A (WITNESS TORCIVIA) Yes.

Q And if they sense undervoltage, they will still trip some engineered safety feature load for load breakers for loads powered from bus 1P.

A (WITNESS TORCIVIA) I don't recall what breakers they trip.

A (WITNESS SHIPPER) I think that is correct.

A (WITNESS TORCIVIA) The tripping scheme is the same. I don't recall which loads they trip out to. Essentially you are correct, we did not change the tripping scheme.

Q The set point for shedding the loads is, as I understand it, roughly 73 percent of nominal.

A (WITNESS TORCIVIA) We considered that loss of voltage, yes, on the balance -- on the buses.

Q I think I have just one more line of questioning, and then I will just have to check my notes, but I think we may be done.

In January of 1980, specifically January 31 of 1980, there was an ACRS Subcommittee meeting on Three Mile Island Unit 1. Part of the subject matter discussed was

pressurizer heaters. I am going to just read portions from it, and then I will give you the transcript so that you can examine it as well.

MR. TROWBRIDGE: Mr. Chairman, I take it this is a follow-up on the testimony of Mr. Keaten and the ACRS questions which were -- is that correct?

MR. POLLARD: It is certainly relying upon the same document, Mr. Trowbridge, but what I intend to do is ask questions about these witnesses' testimony, specifically Figure 1 and the illustration on Figure 1 of the location of the distribution breaker panels being outside containment.

MR. TROWBRIDGE: Thank you, Mr., Pollard.

BY MR. POLLARD: (Resuming)

Q Mr. Slear states, "Let me describe what we are proceeding with the containment boundary is essentially here on this drawing. As you can see, there are small circuit breakers insidew the containment, much like your house circuit breakers. These are being removed so that they are outside of any adverse environments."

MR. TOURTELLOTTE: The point I would raise is that in ordinary circumstances, when a cross examiner is relying upon a document to cross examine from, there can be a series of objections on the basis of whether it is in the proper context or not. The documents are generally provided the other parties so the other parties can understand the full

context of what the document is about, and also can follow along. I don't have the document that Mr. Pollard is referring to. I would like to have that document if he is going to pursue a line of questions along this subject matter.

(Board conferring.)

(Counsel for UCS conferring.)

MR. POLLARD: I will try not to use the document.

BY MR. POLLARD: (Resuming)

Q Did the distribution panel breakers -- excuse me, did the distribution breaker panels shown in Figure 1 of your testimony, were those previously inside containment?

A (WITNESS SHIPPER) Yes, they were.

Q Now, what replaces those circuit breakers inside containment at this point in time?

A (WITNESS SHIPPER) What replaces those circuit breakers?

Q Yes.

A (WITNESS SHIPPER) Nothing. It is a straight cable run.

Q In other words, when you removed the circuit breaker, you had to do something to join the cables together, am I correct?

A (WITNESS SHIPPER) We are installing new cables between the penetration and the terminal box.

Q Where were the breakers located before in the pressurizer heater circuit?

A (WITNESS SHIPPER) Where were they located before?

Q Let me slow down.

We have a cable coming in through a containment penetration, and eventually power gets to the pressurizer heaters. Originally the circuit breakers were inside containment. There is a terminal box inside containment, is that correct?

A (WITNESS SHIPPER) Yes.

Q Where in the circuit between the containment penetration and the pressurizer heaters were these breakers located prior to being moved? Were they between the containment penetration and the terminal box?

A (WITNESS SHIPPER) Yes, from the terminal box. The circuit came from the heater through the secondary shield wall into the distribution panel, out of the distribution panel through the containment penetration to the power distribution motor control center.

Q Does the terminal box still exist inside containment?

A (WITNESS SHIPPER) Yes.

Q Where the circuits have been removed, did you install a butt splice?

A (WITNESS SHIPPER) When the circuits are removed,

there will be a butt splice and heat shrink tubing.

Q Do I uniersiand you correctly that these circuit breakers have already been moved? It is not that you are planning to do that, it has actually already been accomplished at Three Mile Island Unit 1?

A (WITNESS SHIPPER) They are in the process of being -- they are in the process of being installed. They are new panels that are being installed. The existing panel I think will remain iside containment.

Q And is Figure 1 accurate with respect to the number of distribution breakers for each group of heaters?

A (WITNESS SHIPPER) Yes.

MR. POLLARD: We have one remaining series of questions which is quite lengthy. It is the last question listed on our cross examination plan. I would propose not to try to start that this evening.

CHAIRMAN SMITH: All right.

If there are no objections, then we will adjourn until 8:30.

(Whereupon, at 5:10 o'clock p.m., the hearing in the above-entitled matter recessed, to reconvene at 8:30 o'clock a.m., Wednesday, December 24, 1980.)

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: December 23, 1980

Docket Number: 50-289 (Restart)

Place of Proceeding: Harrisburg, Pennsylvania

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

Barbara L. Whitlock

Official Reporter (Typed)

Barbara L. Whitlock

Official Reporter (Signature)