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Jack Hellemes
PDR 82

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

MEETING BETWEEN THE NRC STAFF AND
TOLEDO-EDISON COMPANY CONCERNING
AFW SYSTEMS

Docket No. 50-346

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Court Reporters
1625 I St., N.W.
Suite 921
Washington, D.C. 20006
(202) 293-3950

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NUCLEAR REGULATORY COMMISSION

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MEETING BETWEEN THE NRC STAFF AND TOLEDO-

EDISON COMPANY CONCERNING AFW SYSTEMS

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Room P-110

Phillips Building

7920 Norfolk Avenue

Bethesda, Maryland

Monday, June 17, 1985

The meeting in the above-entitled matter convened, pursuant to notice, at 10:30 o'clock, a.m., Mr. Harold Denton, presiding.

NRC ATTENDEES:

H. Denton	NRR
B. Sheron	DSI
O. Parr	DSI
W. Houston	DSI
J. Stolz	NRR
F. Rowsome	DST
A. DeAgazio	NRR
D. Eisenhut	NRR

NRC ATTENDEES (continued):

A. Thadani	Safety Technology
D. Wessman	Division of Licensing
A. El-Bassioni	PRAB
B. Newlin	Public Affairs
G. Lainas	NRR
F. Miraglia	NRR

LICENSEE ATTENDEES:

J. Silberg, Esquire

B. Fink

R. Gradomski

B. Peters

T. Myers

S. Jain

M. O'Reilly

ALSO PRESENT:

L. Connor	Doc-Search Associates
R. Borsum	Babcock & Wilcox
J. Nurmi	Engineering Planning & Mgmt
M. Ryan	Nucleonics Week

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PROCEEDINGS

(10:30 a.m.)

MR. DENTON: Good morning. My name is Harold Denton. I want to thank you for coming in on such short notice.

The purpose of this meeting is to develop a chronology of actions that have been taken on the feedwater system at Davis-Besse and the studies which have been done leading to those actions.

I realize I didn't give you much lead time to prepare for this meeting, and all this information was not yet available. But I have had the Staff go through our files on what has transpired between us with the steamline accident, and I wanted to be sure we had a complete chronology developed on that point.

I think there have been some questions asked since the incident at Davis-Besse as to what the status of operations is and when it would be completed and this sort of thing, and I would like to get a clear understanding of what you have done, what studies you've done, and we'll chip in with our knowledge of the process where we can.

Before we begin, I think it might be useful to go around the room and each person identify themselves and their responsibilities for the record.

Why don't we start, Al, with you.

MR. DE AGAZIO: I am Al DeAgazio, Davis-Besse Project Manager in the Division of Licensing.

MR. STOLZ: I'm John Stolz, Branch Chief of the branch to which Davis-Besse is assigned.

MR. ROWSOME: I'm Frank Rowsome, Division of Safety Technology.

MR. EISENHUT: Darrell Eisenhut, Deputy Director of NRR.

MR. DENTON: Harold Denton, Director of NRR.

MR. SHERON: I'm Brian Sheron, Chief of Reactor Systems Branch, DSI.

MR. PARR: Olan Parr, Chief, Auxiliary Systems Branch.

MR. HOUSTON: Wayne Houston, Assistant Director for Reactor Safety and today Acting Division Director, DSI.

MR. THADANI: Ashok Thadani, Chief, Reliability and Assessment Branch.

MR. WESSMAN: I'm Dick Wessman, representing the Branch Chief of the Division of Licensing.

MR. FINK: Bob Fink, MPR Associates, consultant to Toledo Edison.

MR. GRADOMSKI: Rich Gradomski, Engineer.

MR. PETERS: Bob Peters, Licensing Manager.

MR. SILBERG: Jay Silberg, Shaw, Pittman, Potts & Trowbridge, Attorneys.

MR. JAIN: Sushil Jain, I'm with Toledo Edison.

MR. MYERS: Director, Core Safety and Licensing, Toledo Edison.

MS. BRYAN: Margaret Bryan with "Nucleonics Week."

MS. NURMI: Joy Nurmi with Engineering Planning & Management.

MR. NEWLIN: Bob Newlin, Public Affairs, NRC.

MS. O'REILLY: Mary O'Reilly, Toledo Edison.

MR. DENTON: We have two more seats for anyone who would like to move forward.

MR. BORSUM: Babcock & Wilcox.

MS. CONNOR: Lynn Connor, Doc-Search Associates.

MR. MIRAGLIA: Frank Miraglia, Deputy Director of Licensing, NRR.

MR. LAINAS: Gus Lainas, Assistant Director, Operating Reactors, Division of Licensing.

MR. EL-BASSIONI: Adel El-Bassioni. I'm with PRAB.

MR. DENTON: For the benefit of the people who just arrived, what we're doing today is developing a chronology of actions that have been taken at Davis-Besse regarding the feedwater system and the auxiliary feedwater system since the TMI accident. We do not intend to get into any discussions of what happened recently at Davis-Besse but this is to go back to some of the earliest actions that were taken in the summer of '79 and to bring those forward. And I would like to go

forward right up until your plans for late this year regarding completing the operating of the auxiliary feedwater system, including the larger pump associated with the electric drive system for the auxiliary feedwater.

So at this point, Al, unless there are some other preliminaries to get into, I propose that we let Toledo Edison have the floor and give us your understanding of the actions that have transpired.

MR. DeAGAZIO: I think we can probably do that.

MR. MYERS: I am here on behalf of Dick Crouse, who apologizes for not being able to come down here. We have brought several of our key individuals from the engineering and licensing area, who have been involved with the auxiliary feedwater system over the years. It was our intent to exchange information today at your request from Saturday, as much as we could, and if anything was left unvalidated or preliminary, like much of our information is that we developed yesterday and this morning, we would verify that in time to support any further use of that information that we've been involved with that perhaps people have not been aware of over the years.

MR. DENTON: I think what might be useful would be for us to give you a period of time to review the transcript and then provide any additional clarifying material that you think might be appropriate.

MR. MYERS: We appreciate that.

The intention we have this morning was to provide a short description of our auxiliary feedwater system, recognizing several people may be new to it or have not been involved recently in it to bring the system back into focus. I think most of the individuals or many of you here have been involved over the years since TMI with Davis-Besse, but I will give you a short review of its operation and its basic design and then go into both the procedural and the modification activity that we've been involved with since TMI.

Again, much of that has been exchanged with you. Some of that has not specifically been identified to you. The intent today is to come up with a complete list. Hopefully, that would give you both of those packages.

As I said, we have some of our people here, but some of our key people are also back supporting the fact-finding team. So if we need to validate any information or if there are burning questions, we can probably still do that today by phone. But to at least give you an overview of what those changes have been, we should be able to supply that here.

We are working again back at Toledo to actually identify actual installation and modification dates for you to give you an accurate chronology of exactly when these modifications were in place. We can give you estimates today, to the best of our knowledge and what we were able to come up

with yesterday. But we will be validating, and you should recognize this is preliminary information, so we can append the transcript, possibly, with any changes that we would find in the interim to validate that information for you.

I would like to introduce now Mr. Jain, who will be describing in general the system function. I had expected a smaller meeting, so unfortunately our overhead doesn't seem to focus large enough.

We have a system layout drawing that we will pass around that will help in the discussion.

MR. DENTON: Do you have sufficient copies? If not, we would make some.

MR. MYERS: I think we do, hopefully.

This is a simplified drawing and is not the actual, exact detail that's in the field. Any differences will be pointed out as we go through, but I think it will offer a basis for discussion.

MR. JAIN: Davis-Besse right now has two independent, redundant trains of auxiliary feedwater systems. The mode of power provided right now is a steam turbine, and each train, which drives one full hundred percent capacity aux feedwater pump, normally is taking suction from the condensate storage tank. The Seismic I supplies and the safety grade supplies the service water system, for which we have an automatic switchover from the condensate to the service water

in the event of a LOCA condition from the condensate storage tank.

On the discharge side, we have each aux feed pump discharging to its respective steam generator with provisions for crossties, so that each aux feed pump can feed either steam generator at a given time. We have similar crossties on the steam inlet side on the aux feed pump turbine. Normally the No. 1 steam generator would be providing steam to the No. 1 aux feed pump turbine, and the No. 2 steam generator would be doing that for the No. 2 aux feed pump turbine. We have similar crossovers where any steam generator can provide steam to either aux feed pump turbine.

The initiating system for the aux feedwater system is what we call a steam and feedwater rupture control system. The SFRCS, as we call it, is actuated on four different parameters ranging from steam at low-level for loss-of-feedwater condition, a loss at the coolant pumps to promote natural circulation, and then a steamline break, which is a low steam pressure condition.

The alignment of valves on the discharge of the pumps, as well as the steam inlet to the turbines, is dependent upon which steam generator is good, meaning which has good pressure. If a steam generator has a break, that is considered to be a bad generator, and auxiliary feedwater is isolated from that generator, and so is the steam coming from

that steam generator.

The system that we have right now is essentially all safety-grade components, both on the steam inlet as well as on the discharge side, with all the motor-operated valves supplied from either the diesel, in the case of loss of offsite power, or from the DC power supply from one train of the aux feedwater system.

That is the basic overview of the system, very briefly.

MR. DENTON: What is the function of the system labeled "steam generator wet layup generation and recirculation pumps?"

MR. JAIN: This drawing includes two systems. The basic intent here is to look at the aux feed pumps. The recirc pumps are used when you have flooded the steam generator during a shutdown condition, and you have the steam generators in a wet layup condition, and then you want to insert to maintain chemistry, and you have steam generators flooded up to the top nozzle.

MR. DENTON: So that's merely a recirculation system?

MR. JAIN: Correct. That is merely relevant to what we're talking about today.

MR. DENTON: Let's stop and see if the Staff has any questions about this system.

MR. STOLZ: Were you also going to discuss the startup pump and its relationship to supporting the aux feed system that you show here?

MR. MYERS: Verbally describe that.

MR. EISENHUT: Before you do, though, if we could maybe on the aux feed system, with what you were just describing, the normal mode, then, on any event such as a low steam generator level would be that both aux feed pumps get a signal to turn on?

MR. JAIN: Correct.

MR. EISENHUT: And they actually get a signal to turn on, and are there any valves that have to open? Where would the normal water supply be coming from in such an event? Could you just describe the scenario of what would have to happen to turn on the auxiliary feedwater?

MR. JAIN: For a steam generator low-level condition, there is one valve that has to open to supply steam to the aux feed pump turbine, and those are shown on the left top of this drawing. But for just a low-level condition, the respective valve from the No. 1 generator would open the No. 1 aux feed pump turbine. With respect to the valve for the No. 2 generator, it would open the No. 2 aux feed pump turbine.

MR. EISENHUT: Could you tell me which those are on this diagram?

MR. JAIN: 106 and 107 is for the No. 2 aux feed pump turbine.

On the discharge side, I will tell you what the configuration is today, because we have changed it over the last few years. In the configuration today, there will be one discharge valve that would have to open on a low-level signal, and that would be 3870 and 3872 for the other generator.

MR. EISENHUT: So given an event of a low-level or dry generator, for whatever reason, upon the loss of -- or low-level upon the loss of the main feed system, those four valves would open, and that would normally turn on the aux feed system, and it would deliver flow to the steam generator?

MR. JAIN: Correct. The normal water supply in this case would be the condensate storage tank.

MR. ROWSOME: Would not AF-360 also have to open?

MR. JAIN: This is an older drawing. AF-360 and 388, which were also on the discharge of the pump, they used to be speed control valves. It used to open on an rpm of 2800. We have since deleted that interlock in order to improve the reliability. It's one of the changes I'll be talking about later as to what has transpired.

MR. ROWSOME: Okay. They're normally open, then?

MR. JAIN: Yes.

MR. DENTON: Could you start your description of the changes, beginning about the time of the TMI accident?

MR. MYERS: Excuse me. We had one other question that John wanted, having to do with the current use of the startup feed pump and how that would be utilized. We can do that before we get into that.

MR. JAIN: The startup feed pump, as it is configured right now, delivers water to the main feedwater nozzles into the steam generators. It takes suction or it could also take suction from the condensate storage tank. That's the normal alignment for the startup feed pump. We could go into detail as to what actions are required for it to be put in service, given a complete loss of feedwater -- main and auxiliary feedwater.

MR. DENTON: What is its normal function?

MR. JAIN: The startup feed pump is basically there

to support low-power operation and for feedwater cleanup for the steam generator chemistry again.

MR. DENTON: And the capacity of that system again?

MR. JAIN: It's 300 gpm. It's not enough to remove decay heat by itself.

MR. LAINAS: Was that about half the capacity?

MR. JAIN: Yes.

MR. MYERS: Any other questions as far as the basic operation currently?

MR. THADANI: That startup pump, what is the mode of power for the pump and the associated valves?

MR. JAIN: It's supplied from a nonessential 4160 bus, but we have provisions for it to be backfit from an essential 4160 bus.

MR. MYERS: Those are also discussed. That activity is also discussed in the changes we've provided over the years.

Anything else?

Okay, we have -- Mr. Jain will also continue, then, if you want to talk about the equipment and associated procedural changes. Again, some of these -- the exact times when they're implemented, we're in the process of validating. We've kind of placed them in a general flow, early to late, but we would jockey their positions, based on the actual times we would hopefully get back to you today or tomorrow or in the

transcript here.

MR. JAIN: Originally the Davis-Besse auxiliary feedwater system motor-operated valves were all AC power operated. We made changes so that the No. 1 train over the auxiliary feedwater system has valves which are all DC power operated, so one train of valves is entirely independent of AC power. This change, we think, was done sometime in 1980 in order to reduce the probability of human errors on manual valve mispositioning in the flow path of both the aux feedwater system as well as the startup feedwater system. So we have put padlocks on the local handwheels. We have also put padlocks on local handwheels, as well as the pushbutton stations for vital motor-operated valves in the field. So nobody in the field could inadvertently misposition those valves.

There is an administrative procedure in place which is a control on the positioning of both the manual valves, as well as the motor-operated valves.

We have made provisions for the startup feedwater control valve and the feedwater block valve to be controlled from the control room by the operator. These are the two valves that get isolated on a steam and feedwater rupture control system, which is the initiating system for the auxiliary feedwater system. So for a loss-of-feedwater condition, these valves will get isolated. However, they will

have to be reopened to provide startup feedwater to the steam generators for a complete loss-of-feedwater condition.

We have provided the capability, so that the SFRCS signal to these valves can be blocked from the control room, and these valves can be reopened in order to expeditiously provide feedwater to the steam generator and the startup feed pump.

MR. EISENHUT: Can you point out where they are on this?

MR. JAIN: I'm afraid this startup feed pump is not on this drawing.

MR. EISENHUT: But the valves -- also, they're not on here, obviously. Okay, thank you.

MR. JAIN: Okay. After the TMI accident, we were to demonstrate that the aux feed pump turbine could be driven on a dry steam generator. We actually conducted a test where we ran the steam generators dry and started the aux feed pump turbine with a dry steam generator. The test was successful.

The SFRCS --

MR. DENTON: Let's stop there. Can you describe a bit more about the test? Is that because when it's dry, it's not really dry?

MR. JAIN: It's dry in the sense that it has bottled up steam in it with all the isolation on the feedwater as well as the steam side.

MR. DENTON: When you ran the test, do you recall what the pressure was?

MR. JAIN: I don't recall personally. We would have to look at the test results.

MR. EISENHUT: But the reason you ran the test was the concern that the pumps would not have any inlet flows -- sufficient inlet flows so that they would overstrip and overspeed?

MR. JAIN: The reason to do that test was to demonstrate that you had enough power, if you will, in the steam generator that could initially roll the turbine, and once the turbine was rolled, you had enough water going into the steam generator to start the cycle, the production of steam, and then running the turbine again.

MR. EISENHUT: But yet enough to actually start the turbine flow?

MR. MYERS: There was a question -- the question we're trying to answer was, in all the lines and everything, once the system was bottled up, would we lose the motor force prior to getting water backflashing to raise pressure to recover the motor force.

MR. THADANI: Can you tell me two things? Number one, how long did you run the test for?

Number two, is there any implication in terms of controls? Steam inlet valves, for example, and so on. The

speed of the pump -- the speed of the turbine, what happens?

MR. JAIN: I'm afraid I cannot answer that right now. I don't have firsthand knowledge of that.

MR. MYERS: The test engineer is not here. We can get that information in the detailed test. As a matter of fact, I believe that was even submitted. We can dig those details up.

MR. DENTON: Do you recall if this is one that we asked you to perform, or you performed it on your own initiative?

MR. MYERS: I'm pretty sure the details were provided. I don't know whether it was one that was asked for or was part of our program anyway. I'd have to -- we changed Project Managers and a lot of people since then. I'm not sure that we can dig that up, too.

MR. DENTON: I think we've had a turnover of personnel also in the intervening five or six years, and it's difficult for us to reconstruct all the details.

Let me ask just about dryout. When you use the term "dryout," what do you really mean with regard to the water level in the steam generator? What does B&W normally mean when they talk about dryout conditions? Is that no liquid remaining or --

MR. JAIN: Well, the procedure that the operators are told to use is -- again, you have to realize what's

happening to the level instrumentation, because the level instrumentation doesn't read the actual level. It gives you the indicated level, based on the conditions it was calibrated to and so on.

The procedure they have been given is eight inches in the steam generator indicated, eight inches indicated -- it could be anything actual, depending on what the steam generator pressure is.

MR. DENTON: I was asking in connection with that test you performed, whether there was water still in the bottom of the steam generator, or whether it was --

MR. JAIN: I think the assumption was that there was no water, but we will have to dig further into that.

MR. EISENHUT: A correlated followup question, if you could look at it at the same time. The B&W eight inches left in the bottom of the vessel, is that the definition of a "dry generator?" What's the instrument error?

I think eight inches is B&W --

MR. MYERS: It's a determination by the ATOG guidelines, which utilizes an either/or level, eight inches or below, or pressure below, and I believe that's 960 pounds. Whether there is water or not, you should assume that that generator is dry.

MR. DENTON: Why don't you go ahead, then, with your chronology?

MR. JAIN: The steam and feedwater rupture control system, as well as the auxiliary feedwater system, utilizes several pressure switches, either for actuation or for protection of the pump or the steamlines. Initially, for a few years after we started up, we had recurring problems with the pressure switches. They were failing at a very fast rate because of corrosion problems in the diaphragm.

We have since gone to a modified design for the pressure switches, and since then, the failure rates of these pressure switches have gone down considerably, which essentially improves the reliability, because it eliminates the potential failure mechanism for valves going inadvertently closed or so on.

As part of the NUREG-0737 requirements, we installed a control-grade flow indicator in each train of the auxiliary feedwater system, and we also installed a safety-grade flow indicator on each train. These indicators have since been tech spec'ed.

MR. MYERS: Those were part of the 0737 requirements. Specifically the control-grade, I believe, was part of the original startup after TMI, and 0737 required a safety-grade upgrade.

MR. STOLZ: Ted, as you go along, can you indicate the dates when these were implemented?

MR. MYERS: We're going to try to do that wherever

we can; however, the concern is that the best dates that we have right now are off the top of a couple of engineers' heads. We will get those dates specifically down, so we can have a chronology. Where we have them, we'll provide them.

The control-grade was prior to restart after TMI, and the safety-grade was sometime in 1982, I think it was, 1982.

MR. JAIN: We have also modified the control room annunciator in order for the operator to be better able to diagnose what has caused an aux feedwater pump or train inoperability, given that the pump has been called upon to actuate during an accident or a transient.

Using that revised annunciator window and the computer printout, we can tell what exactly has gone wrong with the aux feedwater train and take remedial action to correct it.

MR. LAINUS: These are additional annunciators?

MR. JAIN: This was an additional annunciator, for which we revised the logic, so it's for him to tell exactly what went wrong.

As I mentioned earlier while describing the system, we deleted the speed switch interlock from the auxiliary feedwater pump discharge valves and left these valves locally open with the local handwheel and the pushbutton stations locked to minimize the number of valves that had to open on

the discharge side.

In terms of the analyses we have done after TMI, the startup and makeup pump PORV analysis, which talked about using the startup feed pump, if you lost both trains of auxiliary feedwater, there was also a B&W reliability analysis done as part of NUREG-0737 requirements, which was done on the auxiliary feedwater system, and then in December '81 we submitted a detailed PRA analysis of the Davis-Besse aux feedwater system and the several improvements that could be made to it to improve the reliability overall.

MR. DENTON: Is that the one that was done by EDS?

MR. JAIN: Correct.

MR. DENTON: Was there also a Bechtel study? Was there a Bechtel study of the aux feedwater system reliability, in addition to the EDS report?

MR. JAIN: I don't think there ever was a Bechtel reliability. There was a B&W aux feedwater reliability analysis done and submitted to the NRC.

MR. DENTON: Just to be sure I understand, you have mentioned so far three reports: the original report done in response to bulletins and orders, and then what was the second report that you mentioned, the one done by B&W?

MR. JAIN: Right.

MR. DENTON: That was the reliability analysis of the auxiliary feedwater system. And then the third report was

the reliability analysis of the auxiliary feedwater system also, but done by EDS?

MR. JAIN: Correct. To a different scope and to a different detail.

MR. EISENHUT: Let's see, in fact, the last one that EDS did was really the report submitted under NUREG-0737 of the PRA study?

MR. JAIN: No. We never claimed that. The B&W analysis was part of the NUREG-0737 requirements. The EDS was submitted basically to assess what we in the company could do to improve the overall reliability of the aux feedwater system, what options.

MR. EISENHUT: Was it the study that concludes that a third train of aux feedwater is not required?

MR. JAIN: Correct.

MR. MYERS: The conclusion was that there was equal improvement in reliabilities that could be made in utilizing an installed pump and other procedural activities as the third pump, part of that third capacity full pump.

MR. JAIN: There have been some procedural changes -- excuse me. I'm sorry. We have also undertaken a comprehensive government -- governor improvement program, and Rick Gradomski is going to talk about that.

MR. DENTON: We could also probably use an overall government improvement program, too.

[Laughter]

MR. GRADOMSKI: I am Rick Gradomski from Toledo Edison. In speaking to the governors that are installed on the Terry Turbine/Byron Jackson pump auxiliary feedwater pump turbine system, the Woodward governors that were originally installed on this system were Woodward PGPL pneumatic type governors that were modified with the addition of a Bodie motor attached to the hand control knob to accept electric pulse signals from the steam generator level control.

There are two major points to this program other than the fact that we continue to try to adjust and make repairs as necessary to the modified PGPL system.

MR. DENTON: When did this system go into operation?

MR. GRADOMSKI: This was September 1977 or July 1977 when we started it up.

MR. MYERS: It was the original operational system.

MR. GRADOMSKI: From roughly startup until May of 1982 we continued to work and resolve problems with the PGPL system until it became apparent to us in roughly late 1981,

early 1982 that some serious work and evaluation had to be done on this in order to improve the reliability of this system in general.

In May of 1982 the Woodward Governor Company began conducting an evaluation of the Woodward governors supplied by the Terry Turbine Company and modified by the Terry Turbine Company for Davis Besse.

In approximately September of 1983, we had completed a major modification to eliminate speed setting problems associated with adaptation of the electric motor drive to the manual hand control knob. At that point in time there was a 1983 refueling outage, and we made changes to both the installed governors and the spare governor that we had, so all three of them were now modified as a result of the exhaustive testing program that both Woodward and Toledo Edison had conducted in order to solve a lot of the recurring mechanical problems that we were seeing.

In October of 1983, we began a program for the qualification and installation of a replacement governor. The fixes that we had instituted in September of 1983 were at best considered short term. We knew that at this point in time we couldn't continue to operate with the system as it was. We felt confident that the changes we had made had drastically improved the reliability of the governors and that had been proved out in testing, that the recurring problems that we had

seen had, in fact, been solved.

Since that time, I don't recall any of the recurring problems with either jamming on the high and low speed stops nor the problems of the slip clutch recurring since that point in time.

MR. MYERS: I think in response to one of the early bulletins and orders, we went back through the failures and described those that had happened over the period of time. Many of those were associated with valve operation as well as governor speed settings. This is the main thrust, that the failures had been in that area. We didn't mention that. I just wanted to bring that in.

So go ahead.

MR. GRADOMSKI: All right.

Again, in October 1983, we began a program for qualification and installation to improve the reliability of the aux feedwater pump speed control. As a result of that, in November 1984 during our last refueling outage, we installed a Woodward model PGG governor on auxiliary feedwater pump No. 2, and we plan to install at the 1986 refueling outage, depending upon the continued evaluation of the performance of the new model PGG governor, we intend to install a new model PGG governor on the No. 1 auxiliary feedwater pump.

MR. PETERS: I'm Bob Peters. I'm going to discuss the procedure generation and modification that we went through

to support the use of the electric-driven startup feed pump. Prior to our restart from the TMI accident approximately May 1979, we generated a procedure that allowed the operators to utilize the electric-driven startup feed pump to feed one steam generator at a time. Although we are not sure of the exact dates, early on we provided the capability of powering the electric-driven startup feed pump from one emergency diesel generator, and subsequently we modified the plant to allow the startup feed pump to be powered from either emergency diesel generator.

As Mr. Jaim mentioned earlier, in September of 1980, we modified the procedure again to reflect the plant modification that allowed the reset of the SFRCS trip on the main feedwater block valves from the main control room. This allowed the control room operator to regain control of the main feedwater block valve to utilize the startup feed pump feed the selected steam generator.

Then in July of 1981, we again modified the procedure to reflect the modification to the plant to allow use of the startup feedwater valve -- I'm sorry. Regain control of the startup feedwater valve from the control room. That, again, would be to reset the steam rupture control system trip from the control room.

And then finally in January of this year, January 1985, this procedure was incorporated into our abnormal

transient operating guidelines, the symptom-based operating procedures that we have utilized that were developed as a result of the TMI accident. And that's it.

MR. MYERS: That brings you up to current changes. There are several additional changes that are being planned that are down in the areas of lower contributors but are still in our plans in addition to the mode of the startup feed pump.

Sushul, would you like to cover those?

MR. DENTON: I would like for you to be sure and cover the status of the latest amendment. I guess it was Amendment 83 that requires installation of a new startup feedwater pump prior to starting cycle No. 6.

MR. JAIN: As a result of the PRA study that we submitted in 1981, we had identified there that one of the most dominant contributors to the aux feedwater unreliability was the failure of the motor-operated valves. To that end we designed and engineered several changes so as to reduce the number of valves that have to open on demand for the aux feedwater system.

We are planning to leave the discharge valve on this drawing 3870 and 72, leaving them normally open and locked open, so that there wouldn't be any valve in the discharge of the pump which will need to be opened to provide water to the steam generator.

The other change that we are planning to make is the

change to the logic of the steam and feedwater rupture control system, as I had mentioned earlier. On low level or loss of feedwater condition, the respective steam generator provides steam to the corresponding aux feed pump turbine through its normal path, MS-106 or 107 in this path.

The logic is to be changed such that when steam generator can provide steam to both aux feed compartments -- in other words, two valves will open, providing two paths, two redundant paths for a given aux feed pump turbine, so if one path or one valve fails to open, the other path can still provide steam to the aux feed pump turbine.

So essentially, eacn aux feed pump turbine has got two paths of steam for it to be run.

We are proceeding on designing changes to improve the operation of the steam inlet valves. The steam inlet valves have several interlocks. One interlock is the one that closes these valves if you had a break in the steam inlet line to the turbine itself. We have proposed a tech spec change to the NRC to delete that interlock so that the closure of the valve is eliminated and thereby eliminating a potential failure by that valve.

These valves are also interlocked with the decay heat drop line valves, and the interlock has been there because once you go to the decay heat mode, you trip all your reactor coolant pumps, and tripping all four reactor coolant

pumps starts the auxiliary feedwater system at Davis Besse, so the interlock was provided to prevent inadvertent start when you are going to the decay heat mode.

We are proceeding to delete that interlock and taking manual action to de-energize the valve, which we already have been doing for the last six or seven years anyway to remove power from those valves so they don't come on open to start the aux feed pump turbine.

These two modifications essentially reduce all the control systems or the interlock failures that could potentially contribute for these valves to fail to come up.

As part of the control room design review, we have identified several changes to the steam generator system, as well as the SFRCS. We are going to be providing a redundant steam geneerator level and pressure indication in the control room so the operator has better knowledge of the steam generator status as far as what the level is and what the pressure is as far as its usability for aux feedwater system.

We are also going to be relocating some of the SFRCS manual trip switches to enhance human engineering.

The normal suction supply from the condensate storage tank has a valve that is normally open to provide suction to the aux feed pump turbine, and that goes closed on a low suction pressure to transfer to service water, which is a seismic suction for the pump.

One potential failure mechanism would be that the valve in the suction from the CST could spuriously go closed, thereby robbing the aux feed pump of water for a few seconds before it is called upon to actuate, and then it transfers to service water. We are proposing to delete or remove power from that valve so that particular failure mechanism is again eliminated.

And finally, we are putting in a new startup feed pump which is of a higher capacity, which has a capability of feeding water into the steam generator, both in the main feedwater nozzles as well as the aux feedwater nozzles. We were planning to implement that in the next refueling outage.

MR. DENTON: What would the capacity of that pump be?

MR. JAIN: As I recall, 600 gpm, but we could provide the exact number.

MR. DENTON: So that would be an estimate of the equivalent capacity

MR. JAIN: It is equivalent to 100 percent capacity decay heat removal aux feedwater pump.

MR. DENTON: Have you had any studies done of reliability of this system since that one that you mentioned done by EDS?

MR. JAIN: What we have is we have internalized most of the risk assessment work. We have fault trees and other

models made up for the system, but we are unable to support at the present time any numbers in order to compare what the numbers were when we submitted the EDS PRA study.

MR. DENTON: Could you summarize what the EDS study stated?

MR. JAIN: The premise of the EDS study was to evaluate what we should be doing as far as spending our money on installing either a third aux feed pump or otherwise improving the existing aux feedwater system to include the reliability, and the analysis-based configuration in that report was the one that was aimed at addressing each of the most dominant contributors to the unreliability and making changes to the system to eliminate those dominant contributors.

There was a third change analyzed in the report, which analyzed a third aux feed pump, if you will, and the analysis showed that you have a bigger improvement in reliability for the analysis-based configuration for a lesser expenditure, and you had lesser improvement in reliability for the third aux feed pump with a much greater expenditure.

MR. MYERS: I think the third -- the moving of the startup feed pump was initiated and actually has several other functions in addition to providing 100 percent auxiliary feedwater backup to our concept. It eliminates some of our operational concerns about limited startup flow. It gives us

improved operability in the normal function of the system, and also helps separate some of our fire hazards as under the Appendix R activities for control circuits and shutdown panels and that sort of thing.

So there are quite a few issues that moving the startup feed pump into a different area and increasing its size actually addresses.

MR. DENTON: If your configuration on the auxiliary feed pump system is different than other B&W plants, as I recall, do you happen to remember what the decision process was leading to that decision?

MR. MYERS: Maybe there is some here that can help. In reconstructing -- and that's as good as I can do, trying to put it together -- I think if we remember timeframe-wise, Davis Besse was late in the licensing period to where safety-grade auxiliary feedwater systems were being discussed as requirements, and Davis Besse perhaps was the first to actually enter design a required safety-grade system, safety-grade initial operation and control of the B&W units, the 177 B&W units.

At that time the -- I'm not sure exactly how this particular configuration came out, but it was driven a lot on this feedwater rupture control system, and the dedicated discharge -- you notice that is fairly unique -- pump to generator rather than two pumps to header arrangement. One

pump .o one generator, and if you need cross-connectors, you dedicate cross-connect, so that original thought process in the instrumentation and in the original system seems to have been generated in those days of converting from a normal control grade for older plant's aux feedwater system into a fully safety-grade aux feedwater seismic qualified control-started system.

MR. DENTON: Is that normally under the jurisdiction of the vendor or the architect engineer?

MR. MYERS: Architect engineer. The basic requirements for steam generator cooling are provided by the vendor, however, the particular design is architect engineer specific, and safety-grade systems being new, probably was fairly unique, I would imagine, during that timeframe. I'm not sure if maybe someone here can help illuminate, who was in a position at the time who could help. This was the '74 through '76 timeframe.

MR. DENTON: Well, I had heard -- at least I had a memory, a recall that you had a study done, a Bechtel study done, but you are saying you don't think Bechtel was ever involved.

MR. MYERS: In the original design?

MR. DENTON: I'm not sure. I thought there was Bechtel involvement.

MR. MYERS: Absolutely. I'm sure there was Bechtel

in the original design of the system, and Consolidated Controls was our vendor for the steam and feedwater rupture control system. So in the original design, that definitely was the case.

MR. JAIN: The effort that you may be thinking about would be maybe a study that we had Bechtel do trying to define different options for a third aux feed pump, and they did a cost-analysis as to which alternative was going to cost how much, and that's the one we were quoting when we met here four or five years ago with the NRC would cost $6 million or $7 million. That's the only involvement that I can think of in those timeframes.

MR. DENTON: That's probably the one I remember.

MR. ROWSOME: I can clarify the record a little bit. There was a system reliability analysis done at Bechtel by me. I was at Bechtel at the time.

[Laughter.]

-- in the 1974-75 period. It was not at the request of Toledo Edison. It was submitted to the project design team and I presume passed on to you all. But it was not at your request.

It did not result, to my knowledge, in any design changes.

MR. MYERS: Do you recall in this timeframe of the original design, where you were off project?

MR. ROWSOME: I was off project. It was supported under overhead as an exercise in developing Bechtel's capability in using fault tree analysis and system reliability techniques, and it was not requested by the project.

MR. MYERS: So you weren't really disowning the actual design?

MR. ROWSOME: No, it wasn't part of the design effort.

MR. MYERS: Good timeframe, though.

MR. DENTON: Well, does that complete your presentation?

MR. MYERS: That completes our presentation. But, if there are any questions, again as I said, we are in the process now, still now, trying to actually get dates for chronologies here.

Any discussion or questions concerning either the studies or --

MR. DENTON: What I wanted was to be sure that we had as complete a record of the studies and the physical changes to the plant that we could amass.

Are there other studies you have now underway in the system, or is there anything more you are doing with it, or do you see the completion of the effort just described as providing a satisfactory feedwater system absent some further problems?

MR. MYERS: Let me cover the philosophy which wasn't, obviously, in the discussion of the individual items.

In our early review of the system it was felt that having the installed system being somewhat unique and somewhat inflexible to change, particularly without having a common header on the discharge like many of the newer designs, would have to allow options of dropping pumps onto the header and that sort of thing, that we work on the major contributors to unreliability of the installed septic rate aux feedwater system. Because, as we saw them, they were quite identifiable and quite attackable. The governor valve systems and elimination of potential for new signals coming into isolate.

In addition we would provide procedurally a backup to the condition of loss of all main feed and auxiliary feed, and provide that to the operator, and also continually improve that for reliability. So, just bringing an additional power supply capability to it, and then from either side of the

not pursued the evaluation of that type of additional backup to date. We felt much more reliable feed pump pressurewise and availability and power supply-wise --

MR. DENTON: Well, then, a normal unplanned trip -- what role does the main feed pump play?

MR. MYERS: In just a normal plant trip without a steam and feedwater rupture control signal?

MR. DENTON: Whatever would normally happen, assuming no equipment failures.

MR. JAIN: Steam and feedwater control system, the ICS will take -- the integrated control system will take the plant to a steam generator low level condition where the main feed pumps will be used to maintain level at 35 inches in the steam generators and removing decay heat thereby.

Once the pressure in the steam lines has gone down significantly, you can either go on the auxiliary boiler to run your main feed pump turbines or you can go to the decay heat mode. That's the long cooldown process without the

MR. DENTON: What's the auxiliary boiler?

MR. JAIN: It's an oil-fired boiler that we use for station heating, for example, when the plant is not running, or we also use it for initial warming up of the plant's chilled steam for the turbine. It is shut down during normal operation.

MR. DENTON: If you had a loss of all feedwater, is

that the system that you try to bring into operation?

MR. JAIN: We normally don't --

MR. MYERS: I believe that the start-up time on the auxiliary boiler is quite significant and I'm not sure if we actually consider it able to be brought on 24 hours a day. It's able to be started, but I believe it takes a while to get that system going, and it would actually be -- I don't want to say a detraction from the main recovery mode, but it would be much less reliable and swift to recover feedwater than the start-up pumps or recovering the aux turbines.

MR. DENTON: Do you happen to remember the conclusion of the reliability of the aux feed system that EDS reached?

MR. JAIN: As to what we should be doing?

MR. DENTON: No, how reliable, say, the system was likely to be, either in this state or upgraded.

MR. JAIN: As far as the numbers?

MR. DENTON: Yes.

MR. JAIN: I don't remember it, but the report has the numbers in there. I don't remember it right now.

MR. MYERS: That was submitted.

MR. DENTON: I'll look at that later. Let's see if there are any other questions from the staff or other parties. And if not, I propose we take a caucus for the staff and mull over what we have heard and see if we have some more

questions. But before we break, we'll see if anyone has any further questions.

Is there any other information you want to tell us about the system that you've got or actually plan to take?

MR. WESSMAN: One quick question. Maybe it's outside the scope of what you-all wanted, but can you summarize some of the changes that are going on with the main feed system?

I understand you have had some difficulty with governors on main feed pump turbines.

MR. MYERS: We can probably give you 30 seconds. We converted the complete main feedwater pump control system in this last outage. It's a General Electric system modification. We have had some problems, as a matter of fact, prior to last Sunday's event. We even did special instrumentation of this system specifically to try to nail down if any control failures occurred, and that's hopefully when we get into -- with the fact-finding team, into the machinery, that instrumentration is going to give us quite a bit of input. But it's a complete change-out. Our main feedwater pump control guru is right now working with our team, the fact-finding team, back there. We can respond to you more in the future, or if you have specific questions, we can probably get specific answers today for you on that. But the staff here -- that information is not available.

MR. DENTON: Okay. Why don't we break until say a quarter after 12:00. That will give us time to see if there is other information or questions we might have on what you have told us.

[Recess.]

MR. DENTON: Let's resume the meeting. We don't have any additional questions to ask. What you told us this morning has been very useful to help us reconstruct events and actions that you have taken.

What we will do is coordinate with our team at the site to be sure that any follow-up questions that we ask of you are coordinated with them. I think some of the types of questions that come naturally to mind are whether the EDS study that was done for you sometime ago used what I would call generic failure rates as opposed to plant-specific failure rates, and whether if you were using plant-specific performance data over the past couple of years or you had gotten a different result, and the question of whether it is safe to resume operation with the type of failure rates that we are experiencing is the type of question that leaps to mind.

But I don't have any specific requests to make for additional information of you at this time. What I will do is coordinate with Mr. Rossi and others to be sure that we're not having two different arms of the NRC asking for information, so I'll just mention these items as one that I think followed from the discussion we had; namely, you had a reliability study done. It looks like the system was getting upgraded, you thought it was being upgraded, you worked on the valves and control systems and those kind of things. And then we had

both systems that didn't work, and that naturally leads to the question of why the difference between what you had expected from a previous PRA analysis and real life, and that's a scenario that we will be looking into back here and with Mr. Rossi.

MR. MYERS: Harold, I would like to make one comment that I think you can feed back to your staff now, and if the report doesn't stress it we should note that in the EDS PRA that was done, plant-specific failure rates were used, as a matter of fact, and because of that we did see specific differences between generic and industry, and that started some of our follow-on work with Limotorque operators and some other consultants to actually -- in that comparison of our own failure rates individually to industry's. And we took some action there.

So I believe that maybe doesn't stand out in the report but it should be in there somewhere, the specifics.

MR. DENTON: Do you have a feel for whether your plant-specific experience up to a few weeks ago would give the same estimate that was used in the EDS report, whether patterns of changes in the reliability of --

MR. MYERS: I think the patterns that changed we saw were improvements. Like I said, the main contributors were quite well defined and, in our corrective actions, were noticeably turned, both in valve operation and in governor

performance, which were the main contributors to system unavailability.

In those particular areas I think we can say that in going back and revisiting the data now, I'm sure we will see past performance had reflected that. Of course, the exact cause of the two turbines being unavailable is a major focus of our investigation, and with the factfinding team activity at the site, both of us are anxious to get in there and validate our findings. And I think hopefully, that will shed a lot of light back on the analysis to reflect whether it was something that should have been foreseen or something outside the procedures of PRA.

MR. DENTON: That is something we'll have to await for respective efforts to be completed.

All right. If there are no more questions or comments, I appreciate your coming in on such short notice. Thank you.

[Whereupon, at 12:20 p.m., the meeting was adjourned.]

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of

Name of Proceeding: Meeting Between the NRC Staff and Toledo-Edison Company Concerning AFW Systems

Docket No.:

Place: Bethesda, Maryland

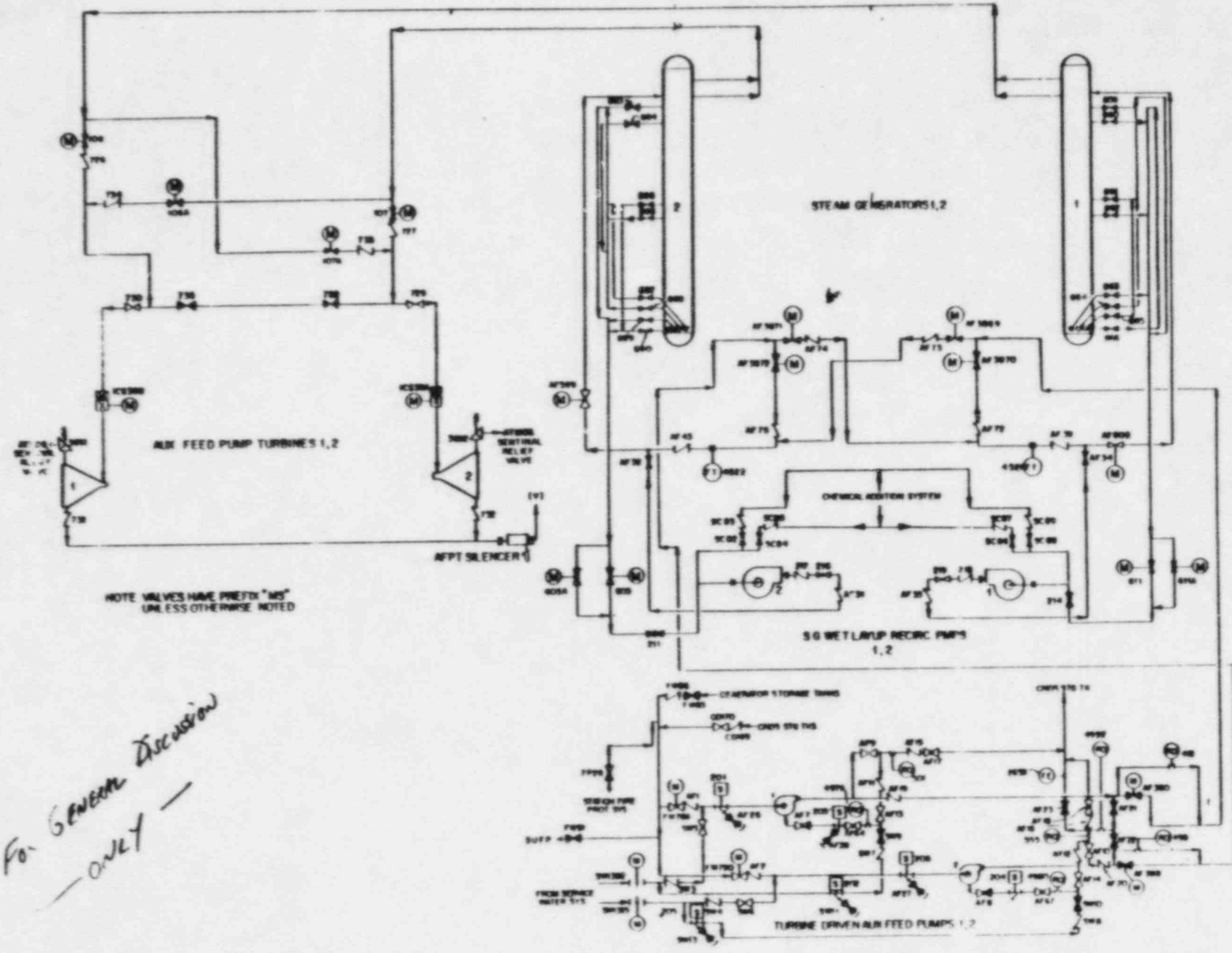
Date: Monday, June 17, 1985

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

(Signature) Ann Riley

(Typed Name of Reporter) Ann Riley

Ann Riley & Associates, Ltd.



For General Discussion — Only —

AUXILIARY FEEDWATER SYSTEM	
FIGURE 1	[redacted]

plant, as we saw the opportunity to actually move the startup feed pump to not only increase the size, but also increase the capability to deliver directly into the feedwater nozzles, which is highly desirable on the B&W generic design. We certainly did not let that opportunity go by at all.

The intention is to continue to improve the as-installed system while we are providing an upgrade also in the startup date of system supports.

MR. DENTON: Will this new system you are describing actually replace the previous system?

Or, will you keep it in addition to the system you are talking about, talking about the upgraded pump and motor?

MR. MYERS: The upgraded pump and motor will be normally use to replace the startup feed pump. It is in place now.

MR. DENTON: It will go in the same place in the plant?

MR. MYERS: Oh, no. No. We are moving it to an entirely different location in the plant. The size and piping limitations are one of the reasons for moving it. The piping energy line break considerations, and also fire considerations for moving it out of fire areas to give us additional support so it will be moved into a different portion of the plant, the turbine area where there is more room, a capability for a different pump activity and cross

connects for water supply and discharge lines.

MR. EISENHUT: When is Cycle 6 scheduled?

MR. MYERS: It was scheduled for spring of 1986. The long lead time components, as I believe Dick Crouse had mentioned to you, they are already on order.

Again, we are trying to get the details of when they were put on order to provide to you. But that design process is well underway and procurement is underway for that.

MR. EISENHUT: How much time is programmed on your schedule in Cycle 6 to actually do the installation, do you know? Is it a three month job, six month job?

MR. MYERS: I'll have to find that out. Actually I can give you the philosophy also of the location. It is relatively free of activity currently. I don't want to say it is a dead spot in the plant where the square footage is doing nothing. But, a lot of the work was planned to do pre-outtage so that we would not impact in working around the area with more important pumps while we are operating, but we would be able to do a lot of that construction independent of our operation. It would not hamper that.

I can certainly find out what the construction module says now for actual outage time. That is a dedicated plot in our planning.

MR. DENTON: Any other questions?

MR. THADANI: Do you have procedures today,

recognizing the low capacity of the start-up feed pump, in the event of extended loss of main and aux feed? Can the operators perform combinations of actions, the start-up feed pump as well as the other mechanisms for removing decay heat? Do you have procedures in place --

First of all, is it feasible?

Second, if it is feasible, do you have procedures today in place to be able to remove decay heat by a multiple source of actions? The start-up feed pumps, maybe open up the PORV, try to get the pressure down, that kind of stuff?

MR. MYERS: Yes. The procedure that Bob Peters mentioned earlier, the one that we originally developed, was called an abnormal procedure, total loss of main and auxiliary feedwater, and specifically did give instructions to utilize and make up the high head capability of the makeup system utilizing the pilot operated relief valve and the start-up feed pump to provide full decay heat capability, and that's our procedural action and has been in place since that procedure was initially approved.

Since then, this last cycle, we converted to the ATOG, the symptom-oriented guidelines and incorporated that whole thing into our current program, current procedures program and that, along with, of course, the recovery of auxiliary feedwater, is stressed in the procedure and actually was the procedure we followed, the process we followed, last

summer and it is a result within, I believe, two minutes of when we lined up the feed pump and the auxiliary pumps were recovered also.

So, yes, that is proceduralized and is an integral part of our ATOG program

MR. THADANI: In reference to some analysis that was done by you and supported this procedure, I assume?

MR. MYERS: We have done analysis to support it. I don't know what the ATOG references are. We can find those out. They are probably in Volume 1 of the book, of the ATOG guidelines for Davis-Besse. We can dig out exactly what -- the actual emergency procedure in the plant probably does not have that as "this references such and such a" --

MR. THADANI: No, I understand that, but the procedures were developed on the basis of whatever analyses were done.

[Mr. Myers nodding.]

MR. ROWSOME: Two technical questions on what Mr. Jain told us. I didn't quite follow what you said about dropping the auto start on the trip of the reactor coolant pumps. How is that being implemented?

MR. JAIN: These valves get an open signal from the steam and feedwater rupture control system when we have lost all four reactor coolant pumps.

Now we are proposing to and we have been doing this

ever since we started up, is when we go into the decay heat mode, we take the power off of the steam inlet valve so the interlock really never has been used, per se.

So we are deleting that interlock so that you are in mode 1 operation, nothing can go wrong in the interlock to cause the valve to go closed, you know, a spurious failure.

MR. ROWSOME: Instead of manually depowering the valves, you are going to change the logic so that they are automatically cut out of the logic when you are in mode 5?

MR. JAIN: We will be depowering it still, but we don't need the interlock any more. I guess we never needed the interlock, but it was put in there for that purpose, so that you don't start the aux feed pump turbine.

Maybe I am not very clear.

MR. ROWSOME: I don't quite follow, but I am reassured. We will find out in due time.

You are saying that you would lock open the discharge valves 3870 and 3872?

MR. JAIN: Yes.

MR. ROWSOME: I think that gives you trouble with isolating a main steamline break, does it not? Do you depend on manual action to isolate the affected steam generator?

MR. JAIN: This is a motor operated valve and locking it open in the field, the hand wheel and the local push button station doesn't disable the control from steam and

feedwater rupture control system.

MR. ROWSOME: Oh, it's just the local control and hand wheel. All right.

MR. JAIN: So most of your SFRCS actuations are on the low level.

MR. ROWSOME: So it will still be normally closed, it will just be that the --

MR. MYERS: An operator in the plant could not misposition the valve because it's locked. He would have to have -- there's a rigorous control for him to change the position of that valve.

MR. ROWSOME: But it remains normally closed?

MR. JAIN: Open. We are proposing it to be open.

MR. EISENHUT: Open, and the logic would close it.

MR. ROWSOME: And you are counting on check valves to constitute the pressure boundary?

MR. JAIN: Right.

MR. DENTON: Let me ask about the main feed pumps. Once the main steam line isolation valve closes, are you able to bring them back to service again following a reactor trip? What prohibits those from being used as "auxiliary" feedwater?

MR. MYERS: The steam supply essentially would not be available to run them because there are large steam needs. I understand, like in Combustion Engineering plants, they talk about condensate booster pumps and things like that. We have