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UNITED STATES NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF: DOCKET NO: -- 50-346

DAVIS BESSE INCIDENT

(INTERVIEW & MEETING)

(CLOSED)

Discuss Procedures For: Powering SUFP from the diesel generators; Placing the SUFP in service (manual actions); Actions and time required to get a main feedpump in service following S FARCS. actuation.

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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TUESDAY, JULY 9, 1985

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MEETING BETWEEN THE NRC FACT-FINDING TEAM AND TOLEDO EDISON

TO

DISCUSS PROCEDURES FOR:

* Powering SUFP From The Diesel Generators
* Placing the SUFP In Service (Manual Actions
* Actions and Time Required To Get A Main Feedpump In Service Following SFRCS Actuation

- - -

NRC FACT-FINDING MEMBERS PRESENT:

ERNEST ROSSI
J. T. BEARD
LARRY BELL

TOLEDO EDISON MEMBERS PRESENT:

MS. MacDONALD
MR. O'CONNOR

(1:25 p.m.)

P R O C E E D I N G S

MR. ROSSI: Let's go back on the record, then. What we are going to do is to discuss -- we wanted to get copies of some of the procedures and just talk about it a little bit, and I guess the first one that is on the agenda is the procedure for powering the startup feed pump from the diesel generators.

Do you have the procedures? I am more interested in knowing that there is cne, and that it can be done than actually getting a copy of it, but you may want a copy of it. If one of you guys wants a copy.

MR. BELL: We may need those copies for a record. I will leave that for you to decide, Dr. Rossi. A verbal description from Bill will give us --

MR. ROSSI: I just want to know, you know, that there is one and basically what it has in it.

MR. O'CONNOR: I can go to the library and get a copy of it so I can have it out here, but the abnormal procedure called degraded system buses, which describes in detail how to power up either side from either diesel generator, and it is also in the EP 1202-(1 there is a section or two that power those essential buses which will allow you to start the startup.

MR. ROSSI: Does it have the instructions on

putting the startup feed pump onto --

MR. O'CONNOR: How to power up a particular bus, and then you turn the pump. It isn't specific for the startup feed pump. It just tells you how to power up D-2 bus from D-1 or C-1, and vice versa. The opposite bus.

It isn't specific to the startup feed pump.

MR. ROSSI: Before we send him off to get the procedure, let's be sure we really need it.

MR. BEARD: I was going to suggest that as far as for the record goes, it would probably be sufficient if we could just identify the procedure with its number and title, and stop right there.

MR. ROSSI: Yeah, unless you people have some reason to collect it.

MR. O'CONNOR: Actually, it is in two places. Similar instructions in EP 1202-01, our reactor trip, you know, the big orange book, there is a section in there for quick and dirty power and up the buses, and also in the AB 1203-28, which is degraded system buses.

I think that is the name of it.

That has every possible combination to take No. 1 diesel and power up its side plus the other side, number 2 diesel powering it backwards over to the other side, essential or non-essential buses so that we can cross connect either way in the event that we have two diesels or one diesel,

and we need to power up the other side.

It also has all the appropriate precautions about what you can turn on so as you don't overload the diesels.

In other words, you obviously can't turn on both HPI pumps, and both LPI pumps and all that type of thing, and it has your rack out breakers that you don't want to start -- to prevent them from starting -- but that is all addressed in the procedures.

MR. BELL: Do you need those procedures to refresh your memory?

MR. O'CONNOR: I can probably tell you, if you just want a drawing of how the system is laid out and show you the major breakers to do it, but if you want to go through the exact procedur , I would prefer to get the procedure.

MR. ROSSI: I am more interested in knowing that you have one, and having some understanding of how it would be used by the operators.

Like if you had an event like June 9th, where you had a loss of offsite power also, what would the operator had done in terms of referring to procedures or just having memorized steps to put the startup feed pump onto the diesels?

MR. O'CONNOR: Had we lost offsite power on the evening of June 9th, then when they went into their emergency procedure, 1202-01, one of the first steps in that procedure

is verification of electrical power.

All right? And when you get to that box, you don't proceed until you have power. Obviously, you can't do your other actions until you have power back, so they have to verify that the diesels did start, that they came on to the essential buses first of all, and they are powered up normally.

Then, at the operator's discretion, he is allowed to close the high breakers to power up the non-essential 4160 buses primarily to get his lights back on .

In other words the lighting from the station, most of it comes off the non-essential buses. There is some of it essentially in the control room and the vital areas. But to turn on like the turbine building and all the other areas, he has to power up the non-essential 4160 buses, and that is in the procedure to close AC 110 and AB 110 are the two breaker numbers to power that up.

In that same section, the startup feed pump is powered from the D2 bus, and he would have to, you know, power up D2 in order to start the startup.

So, that is addressed in the procedure.

MR. ROSSI: Go ahead.

MR. BELL: When he closes the breaker from the diesel generator bus back to the non-essential bus, are any relays tripped that he has to reset before he is allowed to

shut that breaker?

MR. O'CONNOR: No. He can close it from the control room.

MR. BELL: Assuming that the problem wasn't a bus fault that took him down -- let's just assume a normal under voltage condition on D-2 that would exist after loss of offsite power.

REPORTER: Excuse me. Could you please let one finish before the other talks.

MR. BELL: I said let's just assume a normal loss of voltage on DC-- on D-2 that would be present after a loss of offsite power.

MR. O'CONNOR: He would not have to manually reset any relays to close that breaker. He could just walk to the panel in the control room and close the breaker.

MR. BELL: I don't know your distribution system that well, but I would assume that you would have things like the condensate pumps and other non-vital pumps, those would remain out of service even if that bus is re-energized?

MR. O'CONNOR: Yes. They automatically load shed when the bus goes dead. In other words, all their breakers trip open except for the lighting breakers, which stay closed,so that when he repowers the bus, lighting turns itself right back on.

All of the other breakers on the bus automatically

load shed.

So that he doesn't have to worry about running around the control room and turning off the condensate pumps even though they wouldn't be running. He doesn't have to open the breakers. They are automatically tripped.

MR. ROSSI: The primary coolant makeup pumps, it is the same sort of situation with those. They are not normally loaded onto the diesels automatically, is that correct?

MR. O'CONNOR: That is not correct.

MR. ROSSI: Oh, they are normally loaded?

MR. O'CONNOR: The operating makeup pump -- in other words, assume No. 1 pump was running before the loss of offsite power, its breaker remains closed when the bus de-energizes so that when the diesel powers back up, it starts the makeup pump and the component cooling pump. That breaker also stays closed.

So, the operator would not have to automatically close the makeup pump breaker.

If the diesel start is delayed, though, in other words, the procedure says that if the diesel didn't automatically come on the bus, then prior to him loading the bus -- in other words, powering it up from the diesel -- he has to close the seal injection valve to ensure that it is wide open when that makeup pump starts, so there are

instructions if the diesel start is delayed, that he closes the seal injection valve before he re-energizes the essential 4160 bus.

Now, the makeup pump does have an inner lock such that if the -- if we get a LOCA condition in the middle of all of this where the pumps start sequencing on, like low pressure injection pumps and all that, there is an inner lock with the low pressure injection pump breaker that if it starts from the S-fas it will trip the makeup pump breaker to prevent diesel overloads with all the other LOCA equipment starting.

You could start the pumps manually and not overload the diesel, because you don't have everything else running, but once you start putting containment air blowers, and hydrogen dillution blowers, and recirc fans and all that on the diesel, it would be overloaded.

So, in a LOCA condition, the makeup pump breaker trips automatically.

MR. ROSSI: Okay. Now, that is the one makeup pump that was -- that would be operating. The other makeup pump --

MR. O'CONNOR: -- you would have to start.

MR. ROSSI: But he can do that, has procedures for doing it.

MR. O'CONNOR: Yes.

MR. BELL: One more question for clarification. I assume that if we had a loss of offsite power on June 9th and the diesel had started at the 490 volt motor control centers would have re-energized as soon as the diesel output breaker closed, is that correct?

MR. O'CONNOR: Only the essentials.

MR. BELL: Those are the ones I am talking about.

MR. O'CONNOR: The essential ones would automatically re-energize, yes. E-1 and F-1 bus. And their breakers stay closed just like the makeup, so that when the diesel starts, they come back on.

MR. BELL: So all the auxiliary feed water valves that are motor operated would have been energized as soon as the diesel generator --

MR. O'CONNOR: The train 1 valves are DC. They had power regardless.

MR. BELL: Yes, sir.

MR. O'CONNOR: And the train 2 valves are AC, and they would get power as soon as the disesel was powered up. Started.

MR. ROSSI: Okay. That is everything I had on putting those two components, or those components onto the diesels. Do you guys have anything more?

Okay. The startup feedwater pump, placing it in

service by opening the valves that had to be opened and putting the fuses into the breaker control circuit, there- is a procedure also for that?

MR. O'CONNOR: Yes, yes.

MR. ROSSI: And is that in 12 --

MR. O'CONNOR: It is in two places. EP 1202-01 gives instructions for putting the start up feed pump on. The startup feed pump operating procedure also gives the same instructions.

That is SP 110 -- I think it is 1106-24, but I am not positive of the exact number. The startup feed pump operating procedure, though, wo·ld give the specific instructions, in addition to the emergency procedure.

MR. ROSSI: Now during the event when Steve Fiesel, I guess, did that, he was relying on his knowledge of the procedures and his training for doing it and not a check off list or anything?

MR. O'CONNOR: Yes. He did not have a procedure with him. It is only four valves, and the valves are known by everyone.

Can I go back to the diesel and startup pump for a minute?

MR. ROSSI: Sure.

MR. O'CONNOR: We ran an acceptance test, or a special test last June to prove that we can do this and

actual start the startup pump from the diesel.

So there was a TP, touch procedure, that we ran. We ran over some discussions with engineering over feed water problems during the refueling, and they had requested us to actually line up and start the startup pump from a diesel, so we did do that.

I can get the test procedure number if you need it, but we did a test to show that we could do that.

MR. ROSSI: I don't see any reason to get the procedure.

MR. BELL: Would you see if my list of valves is correct to replace this startup feed pump in service. Suction valve.

MR. O'CONNOR: Yes.

MR. BELL: Then the discharge valve?

MR. O'CONNOR: Yes.

MR. BELL: Just because of locations, he would probably then rack in the pump -- excuse me -- install the control keys for the circuit breaker, and then he would go down to the pump and open up the cooling water inlet and cooling water outlet?

MR. O'CONNOR: Cooling water inlet and outlet are outside the pump. None of the valves are inside the pump.

MR. BELL: I had a tour, but it has been a

couple of weeks now. I forgot.

So you would have to open those four valves plus install the control power fuses for the circuit breaker.

MR. O'CONNOR: Yes, sir.

MR. BELL: And the control power fuses are only removed because the suction valve to that pump is closed?

MR. O'CONNOR: Yes, sir.

MR. BELL: And that is a self-imposed safety precaution that is common with Toledo Edison practice?

MR. O'CONNOR: Yes, sir.

MR. ROSSI: Those fuses were in the cabinet at the time of the event, or --

MR. O'CONNOR: Inside the cabinet. When you open the cabinet doors, there is a little hook that is specifically installed to hang the fuses on when you are removing the fuses. They are part of a fuse clip, that you pull it out, there is a little baker light clip with a few fuses in it.

It has a ring for hanging them, and you just hang them on the door inside so that they are always there.

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MR. ROSSI: And that's where they were at the time of the event?

MR. O'CONNOR: Yes.

MR. ROSSI: Okay. The next one was to get a few more details on the makeup flow, flow control valve during the event as to what happened.

Now, one makeup pump would have been running at the time of the event?

MR. O'CONNOR: At the time of the trip.

MR. ROSSI: Yeah, at the time of the trip. And it's our understanding that a second one was placed in operation.

MR. O'CONNOR: Yes, as part of the supplementary actions of the reactor trip procedure to start the makeup tank.

MR. ROSSI: Okay. Now, there is also a makeup flow control valve that is operated by a pressurizer level?

MR. O'CONNOR: Yes, sir. MU-32 is the valve number.

MR. ROSSI: MU-32. And there is let down valve which I guess he closed --

MR. O'CONNOR: Yes.

MR. ROSSI: -- as part of his normal procedure.

MR. O'CONNOR: Yes.

MR. ROSSI: So he closed let down and then he had both makeup pumps running. The makeup flow control valve would of essentially been closed I assume because they had --

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during the time they had a high pressurizer level.

MR. O'CONNOR: Initially the valve would have opened because the pressurizer level goes down when the reactor trips and the initial cool down from 582 to 555. When the plant started heating back up, once the plant got above 582 again, now pressurizer has been restored to 200 inches, at that point it would start closing the makeup control valve, you know, once you exceeded the 200 inches in pressurizer.

So, from 582 to 592, that ten degrees band, it would have closed itself.

MR. ROSSI: Okay. And there was not an attempt at any time in the event to open it or preparations for feed and bleed?

MR. O'CONNOR: No. Had we gone to feed and bleed operations, the next step would have been to open the high point vents, to open the PORV, open the makeup control valve and put the makeup pumps on. That is spelled out in the procedure.

But he did not open it at the time. All he would have done was take the pressurizer solid had he begun feeding.

MR. BEARD: Excuse me, Bill. You went too fast for me. Had he gone to PORV cooling, he would have opened the PORV --

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MR. O'CONNOR: Yes.

MR. BEARD: You would have opened the high point vent?

MR. O'CONNOR: Yes.

MR. BEARD: And what was it?

MR. O'CONNOR: Makeup control valve.

MR. BEARD: All right. Now, what does he have to do to open that? Does that involve some reset or take it from auto to manual?

MR. O'CONNOR: Take it to manual and let it open.

MR. BEARD: So, all he would have to do is really take it out of automatic into manual and reopen.

And the procedures describe that step?

(Mr. O'Connor nodded in the affirmative.)

MR. ROSSI: Do you have anymore on those?

MR. BELL: Yes.

MR. ROSSI: Go ahead.

MR. BELL: Is there a proportional interval control on this MU-32?

MR. O'CONNOR: Yes.

MR. BELL: So it would modulate closed a little --

MR. O'CONNOR: Depending on the size of the error.

MR. BEARD: I guess earlier, Ernie, we had this question about this makeup control level. And we also had a question about the piggyback thing. And I don't know whether

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Bill is the right one to ask more on that subject or not.

MR. ROSSI: Yeah, I think if you ask him if he is not the right one, he will tell us.

MR. BEARD: Yeah. He is not bashful. Bill, earlier we were talking about the emergency procedures used during the event. And we were concentrating on this area of the makeup valve with regard to makeup flow, PORV cooling.

And what we were trying to understand was if I remember the emergency procedure correctly that part of the procedure that talks about opening the makeup flow valve is part of one of the specific rules, and it's in fact a sub-part. I believe it's 2.4 of that specific rule.

Okay. Then as a separate specific rule, if I remember correctly, it talked about piggyback operation. So, what we were trying to learn more about was, would an operator typically be expected to tie all these loose pieces together at just this kind of a situation or is there some flexibility that maybe one would and one wouldn't?

What would be a reasonable thing to -- in other words, if you were in the Control Room and said: Okay, guys, we are going to core cooling, and the fellow on the primary side does his thing and the other people do their thing, what would you expect from the average individual?

MR. O'CONNOR: I guess the answer to your question, if the decision was made to go to core cooling then the Shift

#8-5-SueWalsh Supervisor or the Assistant Shift Supervisor in the Control Room would have directed the actions of the reactor operator in telling him to open the high point vents, open the PORV, open the makeup cooling valve, make sure both makeup pumps are running and he would actually go through those steps of Section 6 of, you know, the overheating section.

The specific rules that you are talking about are the makeup HPI throttling rules. In other words, if we are in a LOCA and we are on makeup cooling or HPI cooling you are not allowed to throttle makeup or HPI until those conditions are met. And they are not just for overheating conditions. In other words, the specific rule also is this primarily for a LOCA condition where that is your cooling medium.

And you are not allowed to throttle until you have other cooling in place, whether it be low pressure injection running at greater than a thousand gallons a minute and pressurizer level reestablished, or you are not going to break the vessel in pressure temperature limits.

So those rules, those specific rules, are established for many other things other than overcooling. The makeup specific rules are addressed such that if we have one of those little LOCAs that does repressurize us that we don't throttle makeup; in other words, it falls under the same rules as high pressure injection throttling.

You have to treat the makeup pump just like a

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high pressure injection pump for the sake of throttling criteria. So the specific rule is not just for overheating specifically.

MR. BEARD: Okay. Well, I'm not too much interested in the throttling aspect. I'm trying to focus on the -- taking the makeup valve out of automatic, putting it into manual and then manually open it so that your makeup flow will actually flow in.

MR. O'CONNOR: Uh-huh.

MR. BEARD: And my memory was that was a part of the specific rule dealing with the throttling and not part of Section 6.

And, therefore, I have to question where they tie it all together.

MR. O'CONNOR: I'm not sure I can answer what you mean by tie it all together. It's their training. They know that they have to open the makeup valve and the only way to open the makeup valve is to push it into manual and let it open.

MR. BELL: Without all three of us relying on the memory, why don't we just get 1202 and look at Section 6, and I think we can answer the question. Maybe it would be easier than everybody trying to recall it from memory.

Because the operator is allowed to use that. It's not an immediate action; he can have that open anyhow.

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(Pause.)

MR. ROSSI: I think we are ready to go back on the record now. So, Bill has the procedures and we were trying to find out specifically what the PORV cooling procedures require with respect to the makeup flow control valve. And then I think one of the next questions, at least that I'm going to have, is what is specifically required and what would be done in PORV cooling with respect to piggybacking the HPI and LPI pumps.

MR. O'CONNOR: Okay. It's Section 6 for lack of heat transfer enter sub-cool or saturated where it tells you, establish makeup HPI cooling. The first step says: Actuate and control makeup HPI per specific Rule 1 and 2.

Specific Rule 1 is actions for loss of adequate subcooling margin. Specific Rule 2 is makeup HPI flow initiation, throttling and termination.

This would direct the operator to get his makeup or HPI pumps running and open the flow control valve which would say start the second makeup pump, fully open MU-32 makeup control valve, shift the makeup pump suction to the BWST and so on.

MR. BEARD: Okay. So, the opening of the flow control valve if the ICS were to close is part of Specific Rule 1 --

MR. O'CONNOR: Yes.

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MR. BEARD: -- under the inadequate and subcooling margins.

MR. O'CONNOR: Yes.

MR. BEARD: And they understand they have to follow that?

MR. O'CONNOR: Yes.

MR. BEARD: Okay.

MR. BELL: But the ICS doesn't control the makeup flow control --

MR. O'CONNOR: Yes, the N&I.

MR. BELL: The N&I, that's right. It's a separate non-nuclear instrumentation.

MR. BEARD: It's one of the unique ones, like the PORV.

MR. ROSSI: Okay. Now, what about operation of HPI and piggyback? Is that part of PORV cooling or would that not be part of it?

MR. O'CONNOR: It is not mandated to go to piggyback. The operator may go to piggyback operation.

The only time we restrict him in piggyback operation is in the case of a large break LOCA where we don't allow them to go to piggyback because the safety analysis does -- would not protect them in piggyback.

In all other cases, the operator may opt to use piggyback operation to maintain his pressurizer level or his

#8-9-SueWalsh RCS pressure. And that is Specific Rule 24.

MR. ROSSI: Okay. So the makeup flow control valve is very specifically mandated by PORV cooling.

MR. O'CONNOR: Yes.

MR. ROSSI: And the piggyback operation isn't specifically mandated but it would be an option --

MR. O'CONNOR: Yes, sir.

MR. ROSSI: -- if he chose to use it. Do you have anymore on that?

MR. BELL: I don't.

MR. BEARD: I guess the long and the short of it is that when you go to PORV cooling, you would expect both makeup pumps be running, makeup valve open --

MR. O'CONNOR: Yes, sir.

MR. BEARD: -- piggyback is optional.

MR. O'CONNOR: Yes, sir.

MR. BEARD: But HPI, both trains would be running.

MR. O'CONNOR: Yes, sir.

MR. BEARD: And on the bleed side, one of the things I had forgotten about is not only is the PORV -- now, the PORV, is that told to be blocked open?

MR. O'CONNOR: It says open the PORV. And the only way that you can keep it open is to take the switch all the way around. Otherwise, you will have to hold it. If you go to the locked open position it will stay open.

MR. BEARD: Well, what I'm trying to understand, Bill, simply is how does the operator know he has to hold it open?

MR. O'CONNOR: It says to open it which means make sure it's open.

MR. BEARD: Okay.

MR. O'CONNOR: Their training --

MR. BEARD: Okay.

MR. O'CONNOR: -- tells them that the valve has to stay open.

MR. BEARD: Okay. No problem.

MR. O'CONNOR: This switch was replaced after the TMI accident. The original PORV control switch, you could not hold it open but you had to hold it continuously.

MR. BEARD: Okay.

MR. O'CONNOR: So, this switch was added for that reason.

MR. BEARD: Okay. And then on the high point vent --

MR. O'CONNOR: Yes.

MR. BEARD: -- where would that steam or water go?

MR. O'CONNOR: [illegible]ight in the containment.

MR. BEARD: [illegible] trying to visualize the flow path, but it's basically exhausted to containment?

MR. O'CONNOR: Yes. Off the top of the hot legs we have two solenoid valves in series with just a little tail

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pipe.

MR. BEARD: Yeah.

MR. O'CONNOR: And that exhausts right into the containment. At the high point vents there is a -- I believe it's a three-quarter or one inch line. i don't remember the exact size, off both hot legs.

We also open the pressurizer vent path. So, in addition to the PORV we open the high point vents and the pressurizer vent. So, we essentially have four holes.

MR. BEARD: So, the exhaust as far as the pressurizer goes though is more than just the PORV's capacity, it's also the high point vent on the pressurizer.

MR. O'CONNOR: And the pressurizer vent. We open four valves.

MR. BEARD: The pressurizer vent?

MR. O'CONNOR: Yes.

MR. ROSSI: The high point vents are where?

MR. O'CONNOR: Physically?

MR. ROSSI: Yeah.

MR. O'CONNOR: Right on top of the hot legs.

MR. ROSSI: Okay. The high point vents are on top of the hot legs.

MR. BEARD: All right. So, you open the PORV --

MR. O'CONNOR: Yes.

MR.BEARD: And then you open three high point vents,

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one on top of each loop and one on the pressurizer?

MR. O'CONNOR: Yes.

MR. BEARD: That's what I mean. We just tangled up on the words.

MR. O'CONNOR: Yes. So, there is actually four outlet flow paths.

MR. BEARD: Right.

MR. O'CONNOR: That's just to give us more capacity going out to insure that we can put enough volume through it to insure adequate cooling.

MR. BEARD: I think that the people that are doing analysis for this event have raised questions about the flow capacity of the PORV. So, this is very relevant information.

MR. O'CONNOR: Uh-huh.

MR. ROSSI: Okay. The next -- these are all loose ends that we are -- go ahead.

MR. BELL: Do the makeup pumps receive an automatic start signal if engineering safety features is initiated?

MR. O'CONNOR: No.

MR. ROSSI: The next question is to ask about the main feedwater pumps and what, if anything, could have been done on June 9th to return them to service, how long would that take?

MR. O'CONNOR: To return the main feedwater pumps to service after that event would have been a timely affair,

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because with the main steam isolation valves closed that shuts off the main steam to auxiliary steam reducing station which shuts off the bland steam to the steam seals on the turbines.

The condensor vacuum then goes away and in order to restart the main feed pumps we have to start up the boiler, reestablish steam seals, start up the air injectors and the steam hoggers and draw vacuum into the condensor again.

MR. ROSSI: So, you can't run the main feedwater pumps without again establishing vacuum?

MR. O'CONNOR: We cannot run the main feed pumps without vacuum.

MR. ROSSI: How long would you think that would have taken?

MR. O'CONNOR: We could have gotten back into the point where we could run a main feed pump in probably forty-five minutes to an hour. That would not be normal full vacuum of the condensor but I don't need normal full vacuum to run the main feed pumps. I only need twelve and a half inches.

So, to get to that point we probably could have made it in, my guess, forty-five minutes to an hour.

MR. BEARD: Bill, when you say forty-five minutes to an hour, are you saying that on a routine plant situation that operation normally would take forty-five minutes to an hour or during an emergency the expedited version of that

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time would be forty-five minutes?

MR. O'CONNOR: Routinely we would draw the condensor down to a couple of inches before we roll anything. I'm saying I could draw it down to just the twelve and a half inches that I need to reset the feed pumps and roll.

And, you know, maybe in even a little less time than the forty-five minutes.

MR. BEARD: Okay.

MR. O'CONNOR: But to get to that point it takes about that long just to get vacuum to that point.

MR. ROSSI: Would you have had to open the main steam line isolation valves to do that, or would you have gone to bypass valves?

MR. O'CONNOR: I could have run the boiler onto the main feed pump.

MR. ROSSI: The auxiliary boiler?

MR. O'CONNOR: Yes, sir.

MR. ROSSI: Okay. So, your forty-five minutes to an hour assumes the use of the auxiliary boiler?

MR. O'CONNOR: Yes, sir.

MR. ROSSI: What was the status of it?

MR. O'CONNOR: It was running within five or six minutes of the reactor trip.

MR. ROSSI: Was it running before the reactor trip, too?

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MR. O'CONNOR: No, sir.

MR. ROSSI: Okay. So, it can be started up very quickly?

MR. O'CONNOR: That is one of the actions in the post-trip procedure, to get the boiler running, to get steam seals on as soon as you can.

MR. BEARD: Do you know if it was performing reasonably normally during the event, or whether they had difficulties with it?

MR. O'CONNOR: They had some difficulty with it in that -- I don't remember whether it was the feed flow controller or the steam flow controller. One of the two inputs to the feed valve, they had to run the feed valve in manual. But that's not any big deal

But other than that, the boiler was operating.

MR. ROSSI: Okay. But before the trip it was not in operation?

MR. O'CONNOR: It was in its normal stand-by condition which the boiler is hot but it has anywhere between 50 and 200 pounds pressure, and what we do is fire up the boiler in the morning and take it up to 235 pounds, its normal pressure, shut the boiler down, then over the day it just tends to drift down to 50 or 60 pounds, then we fire it back up again.

So, we keep the boiler hot, ready to go. And to get

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from 50 pounds to 235 pounds is only a matter of a couple of minutes. Once you have got a fire in the boiler you just run the oil valve and air controllers open and you will re-pressurize it in just a matter of minutes.

MR. BELL: May I see if I've got these steps listed correctly? First, you fire your auxiliary boiler, then you establish sealing steam to the main turbine and the feed pump turbines, then you start your mechanical hoggers --

MR. O'CONNOR: And steam hogger and air injectors.

MR. BELL: And steam hogger and air injectors and then when the vacuum gets down to twelve --

MR. O'CONNOR: Twelve and a half inches is what I --

MR. BELL: Absolute?

MR. O'CONNOR: Yes.

MR. BELL: Okay. Eighteen inches of vacuum.

MR. O'CONNOR: It was hard for me to get out of that mode, too.

(Laughter.)

Then, that's where the feed pump trip clears on vacuum.

MR.BELL: Then, you would have to roll a turbine and that's going to take you --

MR. O'CONNOR: No time at all. Reset, roll. The GE turbine doesn't require warm-up. They can roll it right to

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full speed. Now, in a dire emergency I could have reset that feed pump before the twelve and a half inches. There is a vacuum override on that feed pump so that I could have reset it with even less vacuum than the twelve and a half and run it to the condensor.

Obviously it's not as efficient as when you have full vacuum, but the feed pump could have been rolled before even clearing the trip.

MR. ROSSI: How fast could you have done that? I mean, if you had done that how fast could they have gotten the main feed pump back if you had --

MR. O'CONNOR: It's hard to guess. I would say maybe a half an hour.

END #8
Simons flws

Sim 9-1

MR. ROSSI: But even a half an hour you think to do that?

MR. O'CONNOR: Yes.

MR. BELL: But, again, this is something that is not directed in the procedures. This is something that you know because of your training and experience at Davis-Besse.

MR. O'CONNOR: Yes.

MR. BEARD: And other places.

MR. O'CONNOR: Yes.

MR. BEARD: Bill, there has been some discussion about the possibility of reopening the main steam valves and using some of that steam to get the main feed pumps running. Could you talk a little bit about that approach to getting the main feed pumps back and maybe compare the two?

MR. O'CONNOR: In parallel with starting up the boiler and getting vacuum back in the condenser, the main steam isolation valve bypasses would be opened and start warming up the steam lines. You have to get less than a 250 pound differential pressure across the MSIVs to open them by procedures. So the operators would have been also in parallel to starting up the boiler, you know, had they needed it, and gone to warming up the steam lines to be able to run the feed pumps also.

I would have said they would have reached the two points at about the same time, and it takes usually about

Sim9-2

a half an hour or so to warm up the downstream side of the steam lines to get them pressurized up to allow the MSIV to open, in other words, to get that DP within the specification.

MR. BEARD: So you have to be concerned about the DP across the isolation valve and you have to be concerned about warming and pressurizing the pipes so you don't straighten it out.

MR. O'CONNOR: Yes.

MR. BEARD: And what about exhaust on the steam? Do you have to have any vacuum source associated with that?

MR. O'CONNOR: You cannot start warming up the steam line until you have some vacuum in the condenser because the traps that come off of the steam line stub header drains go to the condenser. So if you would try and warm it up before you had some vacuum, you know, it would just cause severe water hammer.

MR. BEARD: So since these parallel paths sort of overlap and intermingle with each other, don't they, in terms of re-establishing vacuum?

MR. O'CONNOR: Yes. You have to have vacuum, in other words, to allow the traps, you have to dump their water back to the condenser.

MR. BEARD: Okay. But I think you would end up at basically the same point with two essentially parallel paths.

Sim9-3

MR. O'CONNOR: Yes.

MR. ROSSI: If you were to use the vacuum override on the main feed pump to get it back in service, you indicated that even that would take a half an hour. What would be the limiting thing in terms of time if that were done?

MR. O'CONNOR: You would still have to have enough vacuum to exhaust the feed pump to a vacuum, and I am not positive what that actual number is or whether I could have gotten enough capacity out of that feed pump turbine with vacuum being very, very low. To get the capacity or efficiency I need to pump enough water with the boilder. In other words, the boiler is only rated at 175,000 pounds per hour and with the back pressure on that turbine high enough, I might not have been able to get enough out of the main feed pump to even pump any water until I got, you know, a decent vacuum. And, like I say, I have never done it.

MR. ROSSI: And you have no procedure.

MR. O'CONNOR: And I have no procedure for that. We are required to have a name plate vacuum by the outbreak procedure.

MR. BELL: Even had you been able to open the main steam isolation valves, do you think you would have enough decay heat and pump heat to run that main feed pump for any significant period of time?

MR. O'CONNOR: Not if we had not put any water in

Sim 9-4

it there wasn't enough.

MR. BELL: You mean there was not enough steam in the steam generators even if you could have equalized across the MSIVs.

MR. O'CONNOR: There would have had to have been some water in there and enough to get it going.

MR. BELL: That is right.

MR. BEARD: Do you think there would be enough to even start it? You know, the question has come up of could you restart an aux feed from a bottled up condition in a dried out steam generator. And the answer to that, as I understand it, was there probably a gracious plenty for an aux feed pump, but is there anywhere near enough for the main feed?

MR. O'CONNOR: My personal opinion is that in a dried out condition I rather doubt that there would be enough there to get a main feed pump up to speed, but that is just an opinion, you know, not having ever tried it.

MR. ROSSI: What about the condensate pumps, could they have been used in any way to pump through the main feed pumps?

MR. O'CONNOR: We do not have a line up to take our condensate pumps through our main feed pumps. Some plants have a direct discharge of their pumps into the main feed pumps. Ours go to aerator.

MR. ROSSI: And there is no way to bypass the

Sim 9-5

aerator?

MR. O'CONNOR: No, sir.

MR. BELL: I am through on the main feed pumps. What is your next category, or is that the completion of the category?

Oh, I wanted to ask another just general question if we are through with the items on the agenda while Bill is here. He is a valuable resource.

MR. ROSSI: Go ahead.

MR. BELL: Bill, I am curious of your knowledge and experience on the MSIVs in terms of the automatic safety signals that they get.

Do you remember, neglecting the safety features actuation system, neglect that one for a moment and talk only about the SFRCS and what combination of signals it takes to close one of those valves. Do you happen to remember?

MR. O'CONNOR: I will draw a little picture.

MR. BELL: I understand there is something like three solenoids and it is a little complicated.

MR. O'CONNOR: There are five. If you want, I can go and get an official drawing.

MR. BELL: No, no. We have got some of the technical people looking at the details and I am really asking you from an operational experience.

(Mr. O'Connor proceeds to draw.)

Sim 9-6

MR. O'CONNOR: There are five solenoid valves associated with the main steam isolation valves. They are labeled A, B, C, D and E.

Let's talk about the main steam isolation valve on line one, and that way we can talk about which specific channels go to which.

The A and the B solenoids come from the SFRCS channel one and SFRCS channel 3.

MR. BELL: All right. So the A selenoid is the channel one SFRCS No. 1, and the B selenoid is SFRCS No. 3?

MR. O'CONNOR: Yes. The A is also S-FASS one and the B is S-FASS 3. Two contacts will pick up the relay for the A selenoid, and two will also get the B.

The C, D and E, and I don't remember whether the C and D are lumped together, or the D and E, but ---

MR. BEARD: I think maybe C and D are together.

MR. ROSSI: Yes, we were told that this morning.

MR. O'CONNOR: This would be SFRCS channel two and this would be ---

MR. BEARD: The two that are left together would be channel two.

MR. O'CONNOR: Yes. And SFRCS channel four for this one.

Now you have to look at the selenoids go to air operated valaves. In other words, these solenoids actually

Sim 9-7

line up air to air operated valves, and by porting the air through different paths, you either line it up to the top or the bottom of the operating piston. Obviously if you line it up to the bottom it opens the valve is all of the solenoids are energized, and if you line it up to the bottom of the valve, or the top of the valve, it would shut it in addition to venting the bottom.

Now if A and B de-energize, that alone will close the MSIF.

MR. BEARD: A and B would be SFRCS channels one and three?

MR. O'CONNOR: One and three would close main steam line one MSIF.

MR. ROSSI: That is logic channels one and three.

MR. BEARD: Logic channels one and three would constitute actuation channel No. 1.

MR. O'CONNOR: Yes.

MR. BEARD: So if that goes right there, that is sufficient to close the valve?

MR. O'CONNOR: To close that valve, yes. Channel two gets the C and D selenoids and channel four gets the E. So the opposite side SFRCS channels will also close the No. 1 side MSIV.

MR. BEARD: Okay. So I assume what you are saying is that neglecting A and B for a minute, which by themselves

Sim 9-8

are sufficient to close it.

MR. O'CONNOR: Yes.

MR. BEARD: And if C, D and E are all three de-energized, then that is also sufficient to close it.

MR. O'CONNOR: Yes.

MR. BEARD: And that would be actuation of channel two, the SFRCS.

MR. BELL: How about just SFRCS logic channel two, will it shut it?

MR. O'CONNOR: Just channel two, no. If all I did was these two solenoids, nothing would happen.

MR. BELL: These two, C and D.

MR. O'CONNOR: I would have a half trip present.

Now for the sake of discussion, let's just say that the only thing that picked up was actuation channel one. It would get the A and B solenoid for the No. 1 side MSIV and it would get the C, D and E solenoid for the No. 2. So both MSIVs would shut on a single actuation channel.

MR. ROSSI: And actuation channel would do the same thing?

MR. O'CONNOR: Yes. It would get the C, D and E solenoids on that main steam line one and the A and B solenoids on the other side. So the only thing it had to pick up to shut both MSIVs is one actuation channel.

MR. BEARD: There was a lot of confusion about this

thing, and it was obvious with five different ones and two getting together. It is very complicated. So we are trying to sort it out, but I was generally trying to get from you not the engineering details, but your own operational experience that this is what it takes.

MR. O'CONNOR: That is what it takes. I have a very good, little, simplified training drawing of this if you guys would like it and I will go get it for you. It has got actually the air valves and everything.

MR. BEARD: It would be handy, but we can do that after the meeting.

I am not certain. Ernie, is it necessary to put a training drawing like that on the record?

MR. ROSSI: I don't believe so, no.

MR. BEARD: It wouldn't hurt. Why don't we just show that it will be on the record and that way you don't have to worry about it.

MR. ROSSI: Fine.

MR. BEARD: We can get that after we finish this discussion.

MR. ROSSI: The only other thing is I had a question that I guess Wayne Lanning wanted the answer to, or maybe it was somebody here. There was a question on how sure are you that you didn't get water through the PORV during the event?

Sim 9-10

MR. O'CONNOR: This is just pure conjecture on my part, but based on the pressurizer level that was indicated, it doesn't appear that we were solid in the pressurizer. However, you can't always be positive with the pressure changes and the insurging that was going on that the indicated pressurizer level was necessarily accurate, especially since we had been venting out through the PORV.

So I would say there is probably a 50/50 chance that maybe we did have some, you know, either real wet steam or water leave the PORV, but I am sure engineering will have to get into that and tell us for sure.

MR. BEARD: I remember a question that came up in some of Wayne's other material that we might get clarified if you want, Ernie, having to do with the runback on the loss of one main feed pump.

Bill had talked in an earlier interview about how successful that is likely to be and that kind of thing. Do you know what I am thinking of?

What I was trying to get at, Bill, is if you were at say 90 percent power and you lose one main feed pump, what is the likelihood of, and no other problems, of the runback being succesful under the assumption that (a) the other pump is also an automatic and (b) the second pump is in manual?

MR. O'CONNOR: In other words, the conditions we were in that night.

MR. BEARD: And the alternate, which would be that the second pump was in automatic.

MR. O'CONNOR: In other words, both pumps were in automatic?

MR. BEARD: Yes.

MR. O'CONNOR: If both pumps were in automatic ---

MR. BEARD: And then you lose one.

MR. O'CONNOR: --- and we lose one, we would have I feel a better chance of making it than having the one in manual because the ICS immediately sees the loss of feed pump and runs it right up to the high-speed stop, where it took several seconds, probably 10 or 15, before the operator actually got there and ran the pump up.

So I feel that our odds would have been better had both pumps been in automatic to make the runback. But it is still touch and go whether high pressure will get you since you still have a net underfeed condition for the power level. You can't pump 90 percent power with one feed pump. You can only pump 60 to 65 percent power.

MR. BELL: But isn't the limiting thing the inability to turn reactor power very quickly in this situation? You were at your index limit, which says the bite on the control rods was very, very small. So they get a signal to start moving in and they move in at 30-inches a minute and almost a negligible amount of reactivity is added during the first part of the

Sim 9-12

runback?

MR. O'CONNOR: It does not move power very fast initially. Well, we got down to 80 percent where we tripped. So it was moving not too slow, but, you are right, Larry, that the rods are not worth a lot at 92 or 93 percent withdrawal. But I still think that had both pumps been in auto we would have had a better chance than we did with one in manual.

MR. BEARD: Well, just ball parking it, would you say that if they were both in automatic you would have a 50 percent chance or 80 percent chance?

MR. O'CONNOR: I would say 50/50 for that and probably less than a 30 percent chance with one in manual from 90 percent power.

MR. BELL: Let's take the same situation in group 7 at 75 percent.

MR. O'CONNOR: We can't run that way.

MR. BELL: Well, I know.

(Laughter.)

I know that there are other limits.

MR. O'CONNOR: You would probably make it every time.

MR. BELL: That is what I thought.

MR. ROSSI: Do you have anything more?

MR. BEARD: No, sir.

Sim 9-13

MR. BELL: No.

MR. ROSSI: Okay. Why don't we go off the record then and finish this.

(Whereupon, at 2:12 p.m., the meeting concluded.)

- - -

end Sim

Sim fols

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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: DAVIS BESSE INCIDENT
(Interview & Meeting)

(CLOSED)

DOCKET NO.: --

PLACE: OAK HARBOR, OH

DATE: TUESDAY, JULY 9, 1985

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

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Exhibit #1
(O'Connor)

Alarm	Setpoint	Location
Mn. Stm Line 2 Lo Press. Trip	Press Less Than 600 psig	Panel 12 Row 5 Column 4
Mn. Stm Line 1 Rad. Hi	10 x Background	Panel 12 Row 6 Column 3
Mn. Stm Line 2 Rad. Hi	10 x Background	Panel 12 Row 6 Column 4
HPT Mn Stm Press	High 935 psig Low 835 psig	Panel 15 Row 1 Column 3
MSR 1 1st Stg DT LVL	17.5 in Above C/L 17.5 in Below C/L	Panel 15 Row 2 Column 4
MSR 2 1st Stg DT LVL	17.5 in Above C/L 17.5 in Below C/L	Panel 15 Row 2 Column 5
MSR 1 2nd Stg DT LVL	17.5 in Above C/L 17.5 in Below C/L	Panel 15 Row 3 Column 4
MSR 2 2nd Stg DT LVL	17.5 in Above C/L 17.5 in Below C/L	Panel 15 Row 3 Column 5
MSR 1 MOIS SEP DT LVL Hi	17.5 in Above C/L	Panel 15 Row 4 Column 4
MSR 2 MOIS SEP DT LVL Hi	17.5 in Above C/L	Panel 15 Row 4 Column 5
MSR 1 MOIS SEP DT LVL Lo	17.5 in Below C/L	Panel 15 Row 5 Column 4
MSR 2 MOIS SEP DT LVL Lo	17.5 in Below C/L	Panel 15 Row 5 Column 5
MSR 1 HI LVL TURB TRIP	3 in. Below Bottom of Vessel	Panel 15 Row 6 Column 4
MSR 2 HI LVL TURB TRIP	3 in. Below Bottom of Vessel	Panel 15 Row 6 Column 5

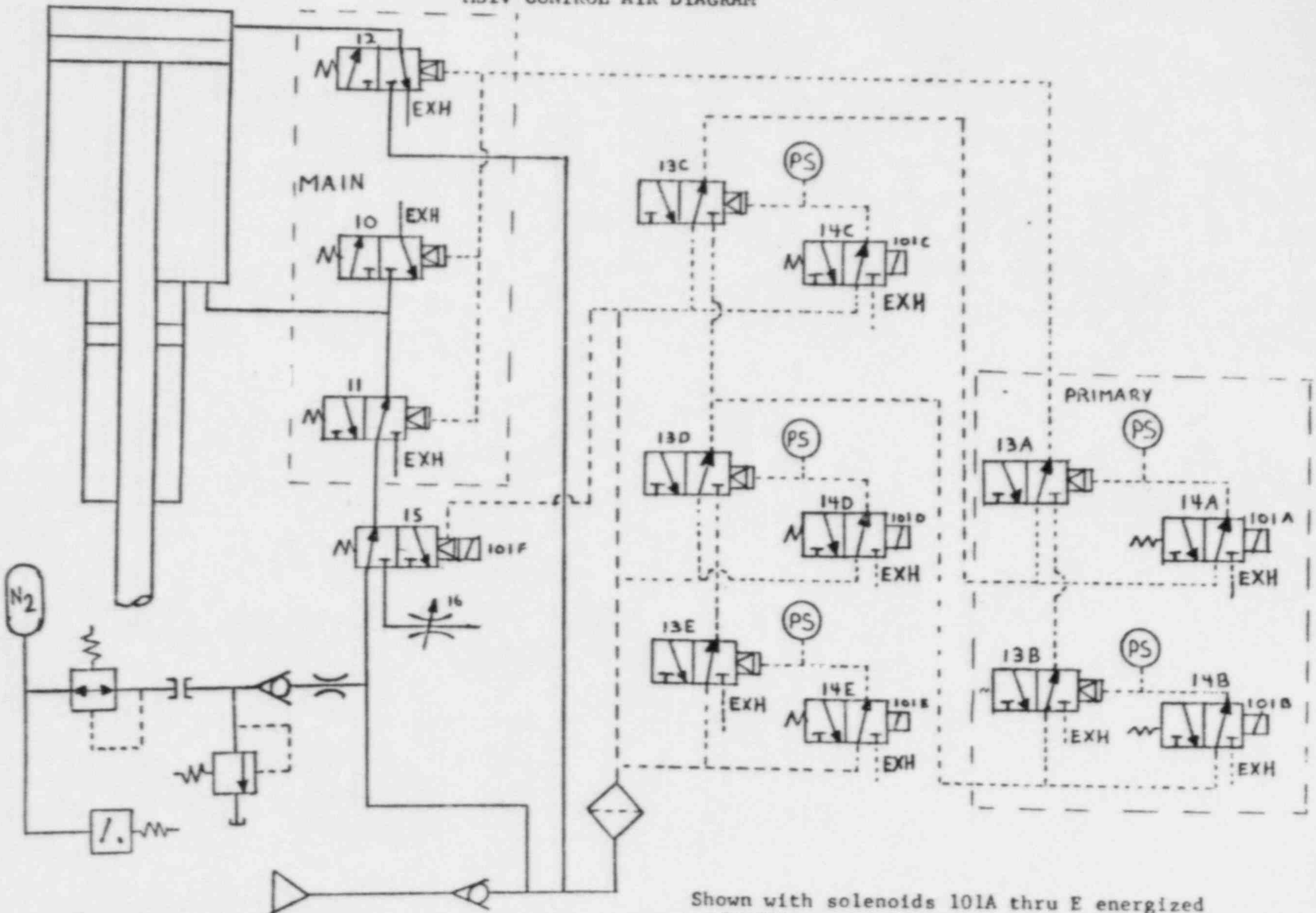
→ C. Control Functions And Interlocks

1. MSIV Control

Refer to Figure A-9 for MSIV operation. The MSIV's are controlled using three main air operated three-way valves, number 10, 11, and 12. Solenoid actuated air operated three way valve #15 is a MSIV test valve. As shown valve #15 is de-energized admitting air through valve #11 to the underside of the MSIV piston. Valve number 12 is venting the top of the piston allowing air pressure to overcome the spring pressure on top of the piston to open the MSIV. Valves 10, 11, and 12 are shown with control air admitted to them, to open the MSIV. Removing control air from valve 10, 11, and 12 causing valve 10 and 11 to align to the exhaust port to vent the underside of the MSIV piston and aligning valve 12 to admit air to the top of the piston will cause the MSIV to close with an air assist to the spring pressure.

Valve #15 when energized to test the MSIV positions to vent air from the underside of the piston through valve #11. The throttle valve #16 slowly exhausts the air and the MSIV will

MSIV CONTROL AIR DIAGRAM



Shown with solenoids 101A thru E energized
and MSIV open

Figure A-9

slowly close due to the spring pressure. At 90% open position a switch is actuated de-energizing the solenoid on valve 15 to position 15 to align air to the underside of the piston reopening the MSIV (refer to Figure A-10 for the electrical diagram).

A failure of valve 10, 11, or 12 which causes only one of the valves to reposition with the MSIV open will cause the MSIV to slowly close due to spring pressure. If valve 12 repositions air would be admitted to the top of the piston and air pressure would be equal on both sides of the piston with Spring pressure acting to close the valve. If valve 10 or 11 repositions air would be vented from under the piston and both sides of the piston would be vented and the MSIV would slowly close due to spring pressure. A break in the control air line to valves 10, 11, and 12 would cause all three valves to reposition to close the MSIV with air assisted spring pressure, the same as the normal closure operation.

Solenoid operated three way valves 14A thru 14E control air to air operated valves 13A thru 13E. Solenoid valves 14A thru 14E are shown energized admitting control air to air operated valves 13A thru 13E, which positions 13A thru 13E to open the MSIV.

13A and 13B are the primary control valves. If 13A repositions to its exhaust port 13B supplies air to 13A to hold the MSIV open. If 13B repositions to the exhaust port it aligns 13A's exhaust port to be vented, however 13A still supplies pressure to the three main MSIV control valves to hold the MSIV open. If 13A and 13B repositions 13A aligns to air out of 13B and 13B aligns to its exhaust port venting air from the main MSIV control valves and they will reposition to close the MSIV.

13C, 13D, and 13E supply air to 13A and 13B. 13C and 13D work as a pair. If 13C and 13D reposition 13C aligns to receive air from 13D and 13D aligns to receive air from 13E, so that 13E is supplying all air. 13C supplies 13A and 13D supplies 13B, so that both primary valves still have air at there inlets and unless both 13A and 13B are repositioned as above the MSIV remains open. If only 13E repositions the only thing that happens is that 13D exhaust port is vented, and the MSIV will remain open. If 13C, D, and E reposition then valve 13A is vented through valve 13C to 13D to 13E and valve 13B is vented through 13D to 13E which will remove air pressure from the main control valves causing the MSIV to close regardless of the position of 13A or 13B.

As discussed above to close the MSIV both 13A and 13B must reposition or 13C, 13D, and 13E must reposition. Refer to Figure A-10 for control logic of solenoid valves 14A thru 14E which operate air valves 13A thru 13E.

MSIV SIMPLIFIED ELECTRICAL LOGIC

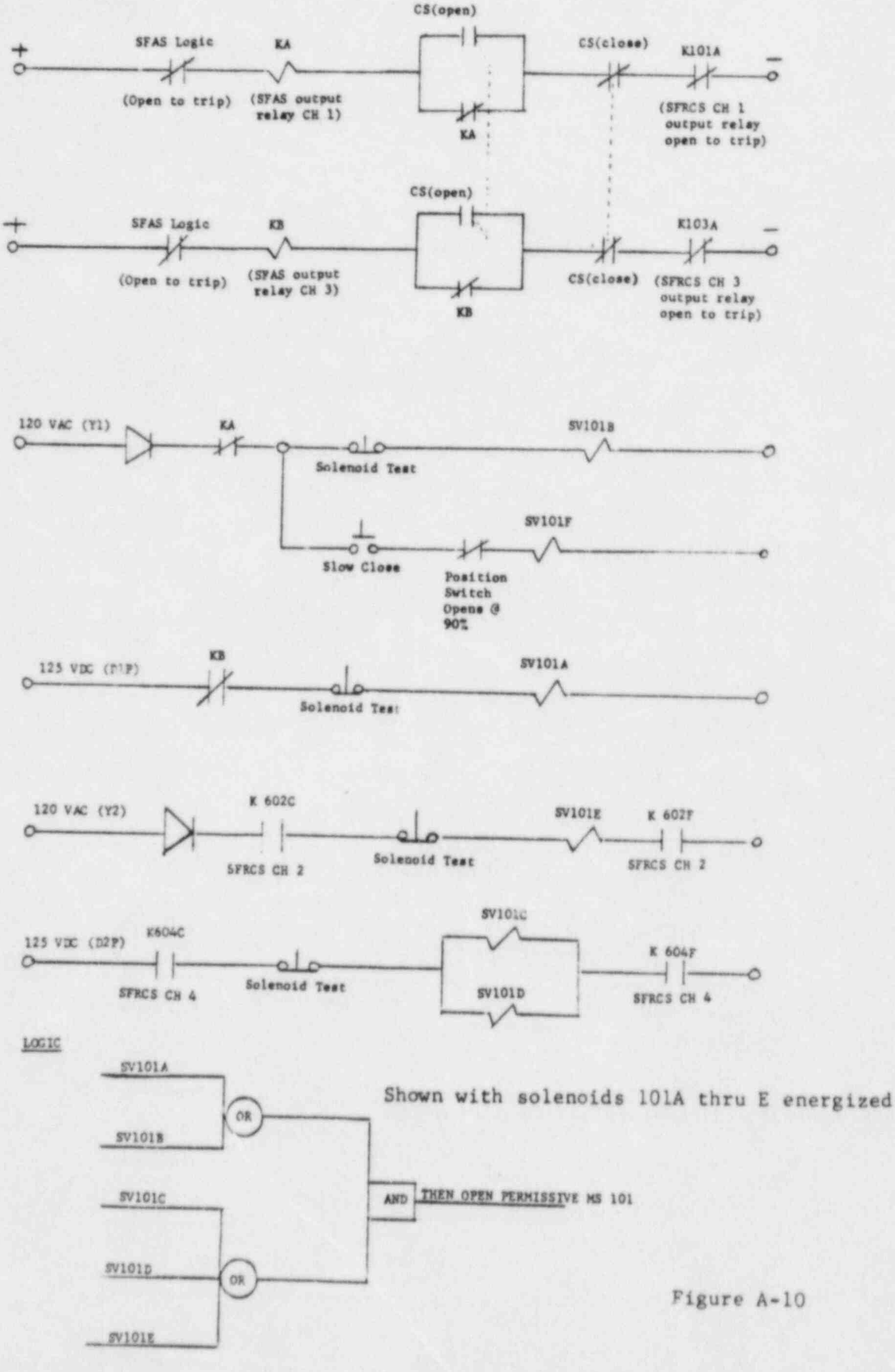


Figure A-10

Primary control valves 13A and 13B are controlled thru 14A and 14B which are controlled by solenoids SV101A and SV101B, respectfully. Solenoid SV101A is controlled by relay KB and solenoid SV101B is controlled by relay KA. The Control Switch to open and close the MSIV is on the SFAS Panel Level 4. The diagrams show relays KA and KB energized with no SFAS or SFRCS trips. The open and close contacts are controlled by pushbuttons that return to normal which is the position shown in the diagram. Pushing the close switch breaks the CS (close) contacts de-energizing KA and KB which in turn open the KA and KB contacts which de-energize the SV101B and SV101A solenoids which cause the MSIV to close as described earlier.

With the MSIV closed and KA and KB de-energized the KA and KB contacts are open. Pushing the open switch completes the circuit to energize KA and KB contacts in parallel with the CS (open) contacts so that when the switch is released the relays remain energized. A KA contact also closes that energizes solenoid SV101B and a KB contact closes that energizes solenoid SV101A to operate 14B and 14A respectfully to admit air to 13B and 13A to open the MSIV as long as 13 C, D, and E are aligned. A level 4 SFAS Channel 1 trip or a SFRCS Channel 1 trip will de-energize the KA relay causing 13B to reposition. A level 4 SFAS channel 3 trip or a SFRCS Channel 3 trip will de-energize the KB relay causing 13A to reposition. Therefore, either a SFAS Channel 1 or a SFRCS Channel 1 trip plus either a SFAS Channel 3 or a SFRCS Channel 3 trip will de-energize both KA and KB causing 13B and 13A respectfully to reposition causing the closure of the MSIV.

Control valves 13C, D, and E are controlled thru 14 C, D, and E which are controlled by solenoids SV101C, D, and E. Solenoids SV101C and SV101D are in parallel and an SFRCS Channel 4 trip will de-energize SV101C and SV101D which in turn causes 13C and 13D to reposition. Solenoid SV101E will de-energize on a SFRCS Channel 2 trip. Therefore, a SFRCS Channel 4 and Channel 2 trip will cause SV101C, D, and E to de-energize which will cause 13C, D, and E to reposition and close the MSIV as described earlier. Note that if only solenoids SV101C, D, and E tripped due to an SFRCS Channel 4 and Channel 2 trip that 13A and 13B are not affected and should the trips be reset then SV101C, D, and E would energize causing 13C, D, and E to realign to the position shown on the diagram and open the MSIV. If this is the case and the MSIV's should remain closed the close switch on SFAS Panel Level 4 must be pressed to de-energize KA and KB relays which in turn will realign 13A and 13B to the close position, preventing opening of the MSIV upon resetting the SFRCS trips.

A level 4 SFAS trip will open the SFAS contacts and any one of the following will open the SFRCS contacts:

a. SG pressure >FW pressure by 177 psid.
b. Main steam line pressure drops below 612 psig.
c. S/G level decreases to 25.6 inches on S/G startup range instrumentation.

Operation below 612 psig main steam line pressure is accomplished by depressing both "BLOCK" swiches HIS 100B and HIS 100C (for MS 100) and HIS 101B and HIS 101C (for MS 101) between 650 and 612 psig to defeat the SFRCS trip of the MSIV's.

2. Other System Interlocks

There is a pressure switch on L.P. Turbine 1-1 which actuates at 10% steam load. Below 10% load this switch causes the RSSV's to auto close, holds open the first stage drains to the condenser, and holds open the moisture separator drains to the condenser. Above 10% load this switch allows the RSSV's to be opened, transfers the first stage drains to level control mode, and transfers the moisture separator drains to level control mode.

There is a pressure switch on L.P. Turbine 1-1 which actuates at 20% steam load. Below 20% load this switch holds open the second stage drains to the condenser. Above 20% load this switch places the second stage drains on level control mode.

There is a pressure switch on the H.P. Turbine exhaust to the MSR which actuates at 65% steam load. At 65% load increasing this switch opens the RSHLV. At 65% load decreasing this switch closes the RSHVL.

The ICS has interlocks which prevent the turbine bypass valves from passing flow to the condenser when condenser pressure is greater than 10 inches HgA and/or total circulating water flow is less than 210 KGPM.

Moisture Separator Drain Tank level is interlocked with the turbine. When Drain Tank Level reaches 3 inches from the bottom of the MSR vessel the turbine will trip.

The ICS controls the TBV and the Atmospheric Vent Valves. The TBV pressure setpoint is set by the operator. The TBV pressure setpoint is normally set at 870 psig. The Atmospheric Vent Valves are set at 1025 psig.

D. Inputs To The RPS/SFAS/SFRCS

There are no inputs to the RPS or SFAS from the Main Steam System.

There are 12 pressure switches upstream of each MSIV that provide control signals to the SFRCS. 4 pressure switches per header actuate at 650 psig decreasing to provide a "BLOCK" permissive

signal. The other 8 pressure switches per header actuate at 612 psig with 2 pressure switches per SFRCS channel to provide a trip signal. See the SFRCS Study Guide for SFRCS logic.