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ERRATA SHEET

ADDENDUM

Page	Line	Correction and Reason for Correction	
2	20	Change "Team" to "Senior"	transcription error
2	21	Insert "Systems" before "Engineering"	transcription error
4	12	Change "read" to "reed"	typographical error
5	16	Change "levet" to "level"	transcription error
6	14	Change "RPM's" to "APRM's"	transcription error
14	21	Change "circulation" to "recirculation"	transcription error
21	4	Change "tough" to "touch"	transcription error
24	15	Delete "will maintain,"	transcription/grammatical error
26	9	Insert "the reactor is" before "shutdown"	transcription error
32	6	Delete "probably"	transcription/grammatical error.
36	11	Delete "-- physically seen"	transcription/grammatical error.

Date 13 Oct 1991 Signature Philip S Smith

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

INCIDENT INVESTIGATION TEAM

Telephone Conference Call

Interview of Philip Smith

Nuclear Regulatory Commission

The Woodmont Building

Room W-102

8120 Woodmont Avenue

Bethesda, Maryland

Thursday, September 19, 1991

The meeting in the above-entitled matter convened, pursuant to notice, in closed session at 10:00 a.m.

P R O C E E D I N G S

[10:03 a.m.]

MR. CONTE: Good morning. My name is Richard Conte from Region I. I am a member of the Incident Investigation Team investing the event of August 13 at Nine Mile II. We are in a conference call with Mr. Philip Smith from GPU Nuclear. I believe he is at Parsippany, New Jersey. The NRC members are at the Woodmont Building in Bethesda, Maryland. The time is 10:03.

We will start out by going around the room here in Bethesda, and then we will ask you to identify yourself, Phil. My name, as I said, is Richard Conte.

MR. VATTER: Bill Vatter from INPO.

MR. JORDAN: Mike Jordan, member of the NRC IIT Team.

MR. KAUFFMAN: John Kauffman, NRC, AEOD.

MR. STONER: Jim Stoner, with Duke Power.

MR. CONTE: We have a Court Reporter here also. Phil, could you introduce yourself?

MR. SMITH: Sure. I am Philip Smith, Team Engineer, Engineering Department at GPU Nuclear. I am also Chairman of the BWR Owners Group Emergency Procedures Guideline Committee.

MR. CONTE: Thank you, Phil. We are ready to go around the room and get started. I think Mr. Vatter has one

of the first questions.

MR. VATTER: Phil, one of the problems that we are most interested in is when the operators did not have any indication of control rod position in this event, what could have been the worst reactivity situation that they would have had to deal with --

MR. CONTE: Let me interrupt here. I think we need to establish how much Mr. Smith knows about the Nine Mile II event. Phil, how much do you know; could you tell us?

MR. SMITH: I talked to several people at Nine Mile about the event. My understanding of it is that it was a loss of power or load reject out in the turbine, and that ended up causing a loss of off-site power and then failure of some transfer switches to go over to DC power or alternate. That resulted in a loss of some amount of control room indication for 20 to 25 minutes.

MR. CONTE: Let me see if we can get you up to speed a little more in terms of how the operators were implementing the EOP's. They are using Rev 4 of the Boiler EOP's. Primarily they were in RP -- when the event happened, as you said, there was a loss of power supplies. They lost all indication of rod position; five uninterruptable power supplies went down simultaneously.

That resulted in a lot of front panel information lost except for safety grade instrumentation on reactor

pressure and reactor vessel level. Post-accident monitors went in the fast -- recorders went into fast speed. Electrical distribution volt meters and amperages, that was still okay because they were apparently independently powered.

APRM readings were gotten from the back panel. The recorders for APRM's and IRM's were lost in the front panel. Are you following me so far?

MR. SMITH: Sure.

MR. CONTE: Once again, rod position indication, there are multiple ways of finding rod position indication. However, the read switches all come off of one power supply; therefore, that essentially disabled one of those five power supplies and others deal with the rod position indication -- rod minimizer, rod sequence control -- those are the things that were basically unavailable for rod position indication.

When the event happened the preliminary assessment was they had APRM's down scale less than four percent. No rod position. I guess they diagnosed or assessed that they were in a transient on the reactor besides the electrical transient, so they decided to manually scram. The other key thing here that gets you into the EOP's is that feedwater was lost because of that power supply problem, and that created a low level situation and an entry into the RPV control.

Are you with me?

MR. SMITH: The volume dropped off, and I can hardly hear you at all.

[Disconnected.]

MR. CONTE: We are going to call you back.

[Reconnected.]

MR. CONTE: Back on the record. For the record, we had a phone communication problem. We had to switch phones, so we are back on the record.

Phil, I was giving you a run down of equipment that was lost. I got to where there was a loss of feedwater and an entry into the RPV control on level. Did you understand everything up to that point?

MR. SMITH: I have it.

MR. CONTE: One of the key things in the RPV control and the lever leg was the operators were faced with a question, if all control rods are not inserted into at least position 02 and the reactor will not remain shutdown without boron, exit this section and go into C5 which is the contingency on power level control.

MR. SMITH: Correct.

MR. CONTE: The operator exited and went to C5, primarily on the information of rod position. He didn't have rod position, he didn't know where he was, and he didn't have a reactor analyst to tell him that the reactor

will remain shutdown so he went into the ATWS procedure.

Setting that stage, I am going to ask Bill Vatter to ask the question again.

MR. VATTER: Thank you, Rich. I am sorry. I sort of jumped in the middle of it, Phil. Basically what they had was a scram with loss of feed and they didn't know where the rod position was.

We are trying to postulate different ways that a loss of rod position indication could have been a serious problem. One of the ways that we are postulating is that they also had an ATWS combined with loss of rod position indication. If they did have an ATWS it would have had to have been a partial ATWS because they did know the power was down scale on the RPM's. A little bit later they had the IRM's driven in, and they could see that they were going down in there.

If some of the rods did not scram what kind of a reactivity situation might have existed such that if they added cold water that they would have had a recriticality and resultant core damage from the recriticality?

MR. SMITH: Let me preface answering the question with, it is my understanding that they could determine that the reactor was indeed shut down, and when you get into Contingency 5 procedure the first statement asks whether the operator can determine that reactor power is above or below

the down scale trip.

Understanding that the front panel indications of reactor power were unavailable, there are alternate means of determining reactor power, one of which is reactor period looking at steam flow, looking at vessel pressure and level trends, perhaps a number of open SRV's. Suppression pool temperature and temperature trends, all indications to the operator of what reactor power is doing and whether or not he is above or below the down scale trip; i.e., does he have the reactor shut down.

MR. CONTE: It seems like the exiting to the ATWS procedure is solely dependent on the rod position alone.

MR. SMITH: That is very true. When you get into Contingency 5, as I was trying to say, there is criteria for which the operator makes the decision on whether the reactor is making sufficient power and heating the containment. Under these conditions, as I understand them, he was not getting sufficient heat to the suppression pool and he did not have significant power in the reactor.

Therefore, he would have controlled water level in the same manner that you would had you had a normal scram. The level power control procedure, it directs the operator to make an assessment whether or not reactor power is above the down scale trip or cannot be determined. In addition to that, he has to have suppression pool temperature above a

curve in the EOP's called boron initiation injection temperature which is criteria for shooting boron into the core. Third he has to have an SRV open or drywall pressure above the high drywall pressure scram set point as an indication of the reactor is still at significant power and is rejecting significant amount of heat to the containment.

If that is true, then the operator goes through the steps of lowering reactor water level to suppress the reactor power and wait for the boron to shut the reactor down. In this case, I don't believe that he met those entry conditions to lower reactor water level. Therefore, the next step in the Contingency, Step C5-3, directs the operator to maintain water level within the normal band with his normal injection systems.

I believe that the operator would have controlled water level within the normal band.

MR. VATTER: That is basically what happened, Phil. He had a little problem with condensate booster pumps started injecting when pressure went down. That is the direction that he was going.

MR. SMITH: Okay.

MR. VATTER: The focus of my question is, the reactor is shut down but we don't know how much it is shut down. There may have been one or more rods that didn't insert or inserted partway, because he hasn't any position

indication.

What we would like to know is, if there has been any analysis done to determine what might happen if you had a large amount of cold water injected in that circumstance. We are particularly looking at a caution in Niagra Mohawk's procedure that says in the C5 procedure it says: "Caution. Raising injection flow rapidly may induce a large power excursion and result in substantial core damage."

He is in the C5 procedure because the entry condition that is spelled out in the RPV control procedure says that if the rods are not all at 02 and the reactor will not remain shut down without boron, he really didn't know either of those things so he went over to C5. That's where he was. He went past that caution that I just reiterated to you.

We don't understand the significance of that caution and what it is based on.

MR. SMITH: The significance of the caution is based on having the operator aware that because he cannot be certain that the reactor is shut down then care must be taken in establishing injection flow rates into the reactor. The criteria for systems to be used is systems which inject outside of the reactor shroud, understanding that when they inject in the downcomer that the water as it is transported through the recirculation loops mixes with warmer water in

the reactor and, therefore, reduces the cold water addition to the reactor core and hence your reactivity addition.

He is directed to go to outside the shroud systems first. He would not try inside the shroud systems unless he could not maintain water level with those outside shroud systems. If he decided he needed to go to inside the shroud systems, he is directed to terminate and prevent all injection from inside the shroud systems and to depressurize the reactor, realizing that as pressure drops down you don't want to have the low pressure ECCS systems injecting at an uncontrolled rate because the reactivity excursion could be significant.

There is some work that has been done by General Electric, I think, many years ago which suggested that the reactivity addition due to uncontrolled LPCI injection into the reactor core could be in excess of one dollar of reactivity. There is some debate on how much in excess of one dollar it is, but I think it's sufficient to say that if it is in excess of one dollar that's too much.

That was the basis for that caution that was in there, to say that be aware operator that if the reactor is not shut down to be careful on the rate at which you increase flow rates into the reactor because of the cold water effect.

MR. VATTER: Phil, do you know if there was any

analysis for a partial ATWS that shut the plant down but there was a potential for recriticality with perhaps adverse rod configuration that would cause one region of the core to have maybe some fuel damage. Was there any work on partial ATWS and trying to figure out what the worst case might be?

MR. SMITH: I don't recall that there was any specific work on partial ATWS. I know that they looked at all rods out condition. In fact, I think you would agree that the worst case for reactivity addition would be if the reactor was several decades below the heating range when you injected the cold water, because the power and reactivity addition rate and -- power would continue to increase on almost an exponential basis until either Doppler or voids turned it around.

I think you would agree that that would be the worst case in terms of depositing energy to the fuel.

MR. VATTER: Right. What we would like to know is if anybody has tried to quantify how bad that worst case is?

MR. SMITH: As I said, I have seen numbers that have ranged upwards from one dollar up to eight or nine dollars worth of reactivity. I don't know that people have gone and connected the reactivity addition with what sort of fuel damage or fracture or cladding perforations you may expect because of that.

MR. VATTER: I think eight or nine dollars worth

of reactivity will be a big deal.

MR. SMITH: It will certainly get your attention, yes. Understand that the way Contingency 5 is structured that first making the operator aware that uncontrolled or rapidly increasing injection into the reactor core can result in these conditions; that he is sensitized to that, and that he would use systems which inject outside the shroud first to minimize the effect of reactivity addition on to the core.

MR. VATTER: I understand that. Of course, the normal feedwater system is outside the shroud.

MR. SMITH: True.

MR. VATTER: In this event they had an unexpected injection from the condensate booster pumps. The pressure drifted down fairly slowly, and the condensate booster pumps caught them unaware. It put in a large amount of water and they went off scale high. We don't think that they put water in the steam lines, but they got close.

MR. CONTE: I would like to emphasize that this was not an ATWS also.

MR. SMITH: True.

MR. VATTER: Right. All the rods were in, but if all the rods were not all in -- if they were in that sort of an undesirable configuration that we were talking about which, apparently there has not been any analysis done, what

do you think might be the worst case reactivity recriticality kind of an event from just condensate booster pumps shooting in water?

MR. KAUFFMAN: As an aside here, the feedwater reg valves failed in their 100 percent open position, so they were wide open.

MR. SMITH: Again, I can tell you where I would expect reactor power to end up. If reactor water level is up into the normal range or slightly above the normal range, if the rods were completely withdrawn or were significantly out, you might expect to have a steady state power in the range of 40 to 60 percent power.

Certainly, the rate at which the condensate booster pumps would slug the water in there and whether or not there was any feedwater heating left would certainly affect the peak power before it steadied out in around the 40 to 60 percent range.

MR. VATTER: Of course, we started now from below the heating range. The operator knows that reactor is subcritical, he has no APRM indication, but it might be only slightly subcritical.

MR. SMITH: I would be hesitant to quote you a number of what the spike could be, because there are just several fairly important variables that would influence how high the peak would be. Certainly, it could twice or three

times the average power. Anything above that, I would be hesitant to kind of offer an opinion on.

MR. VATTER: I guess one scenario that has been going through our minds is that several rods in a very bad configuration failed to scram but the reactor is subcritical. Then, this power drifts down below the heating range a few decades, and the condensate booster pump injection causes a recriticality with a power peak in that area of the core where the rods didn't scram; and that, maybe the core gets hurt from all of that.

Is that a potential concern do you think, or do you think it couldn't happen?

MR. SMITH: I would say it wouldn't be a very large concern. Understanding the mixing of the condensate booster pump water with the rest of the water in the reactor, understanding how it would mix as it came through the diffusers from the recirc loops back into the lower plenum of the reactor vessel, and it would kind of homogenize out. I think you need to look at some relative flow rates of the water in the reactor vessel, the circulation flow, versus what you are going to inject from the condensate booster pumps.

I would think that the cold water effect would have been reduced significantly by the mixing. Certainly, a way to tell that is to look at recirc loop temperature and

to see how far that fell off during the condensate booster pump injection. That would give you a feel for what the temperature of the water was that was going into the core.

MR. VATTER: That's a good thought, although we won't get much out of that, Phil. The process computer went down with the event and none of that data is available.

MR. CONTE: Phil, how do you expect operators to implement this caution?

MR. SMITH: That caution?

MR. CONTE: Yes, practically speaking.

MR. SMITH: I would expect the operator to understand that injection of the water can have a detrimental effect on his ability to control reactor water level and power. I would expect that in trying to control reactor water level where this caution does appear, that he would be careful in terms of how much he opened up for example the feedwater regulating valves or whatever injection valve on the system he was using and would not just try and open the valve to full position immediately.

The EPG's do provide him a fairly wide level control band for this action. It does not necessitate that he take rapid and potentially too rapid operator action which could result in the high reactivity addition rate.

MR. CONTE: What I think I am hearing you say is an operator tweaks on whatever controller he has and looks

for a level response, it doesn't get a level response and tweaks a little more. Once he gets a level response, he kind of holds it there and makes sure the level is slowly coming up. You really can't put a GPM number on this; is that correct?

MR. SMITH: You surely can't, because the state of being in this contingency procedure is that you are unsure first whether the reactor is shut down or what the rod configuration is. Certainly, you just wouldn't want to arbitrarily establish a flow number because it would work for several cases but not for all. It could be that for one of the cases for which it did not work would be the one where that could give you some reactivity addition.

As you said, I believe he would look at level response. He would also look at power response if he had power indication available. By tweaking the controller and little bit and saw a little bit of level response and didn't see too much on the power, that may give him an indication that he can tweak it a little bit more until he starts seeing power come up with that.

That is my opinion on how the operator would implement that caution.

MR. CONTE: Okay. I had another question -- I have two more questions. Let's back up when he exits the RP level control, he exits the C5. What do you think about

that situation? Basically rod position, you may or may not know this, but the rod position indication is not considered safety grade. The power supplies for this event were not safety grade.

What do you think about the situation where there was no ATWS and the operator was forced into being fooled that he had an ATWS; what do you think about that?

MR. SMITH: I would not characterize it that he was fooled into thinking he had an ATWS. I would characterize it as he could not confirm the reactor was shut down. If he could not confirm that, I believe that it is prudent to take actions and precautions that would be sensitive to the fact that the reactor may not be shut down rather than trying to make a determination initially that the reactor is shut down and that a normal reactor level control kind of initiating injection without regard to whether it is inside the shroud or outside shroud, or without regard to the rate of flow increase.

I think it is very appropriate that if the operator cannot determine that the reactor is shut down, that he should take precautions and assume that it is not. Understand in this condition that because I believe that the operator could make a determination that really the APRM's were probably down scale and that he was not heating the containment, his actions in terms of controlling reactor

water level would not be different than what he would do for normal scram with the exception of this precaution on how fast to increase the flow rate.

He is not really doing anything different than he would if he had known that all the rods went in and he was recovering from the scram.

MR. CONTE: What I am hearing is that you are supporting the operator actions to enter C5?

MR. SMITH: Absolutely.

MR. CONTE: You mentioned something earlier, that it is appropriate to go into C5 because it gets the operator to take a look at the situation in the containment and the situation with respect to reactor power. I realize and I wanted to emphasize this point, you are probably talking from your knowledge of the Rev 4 emergency procedure guidelines that are generically applied and we are talking from the Nine Mile II specific procedures.

In the C5 for Nine Mile II, you really don't see -- there is an ongoing statement here that says are rods inserted to position two or the reactor will shut down under all conditions without boron, exit this procedure and enter RPV control RL section.

I really don't see the flavor of what you are talking about in these procedures about the analysis on the reactor being shut down or making a determination if reactor

is shut down. Let me add here, because you don't have these procedures in front of you, there is another ongoing step that is combined with a number of other conditions with respect to the suppression pool and the SRV's opening.

It says if reactor power is above four percent or cannot be determined, then continue at another point which is looking at main steam lines and another leg of the C5 situation. Let me add another piece of information. The licensee has given instructions to the operator that a shut down reactor is less than range six and seven on the IRM's.

MR. KAUFFMAN: And, subcritical.

MR. CONTE: And, subcritical. What do you think? I have said a mouth full here. Can you comment?

MR. SMITH: Sure. I have an opinion on most any subject you want to bring up.

MR. CONTE: Go ahead.

MR. SMITH: First of all, the steps that you just quoted, reactor power is above the four percent number. There should be a subsequent -- two other subsequent conditions on suppression pool temperature and SRV open.

MR. CONTE: There is.

MR. SMITH: That is the criteria for the operator to lower reactor water level. Those three criteria in step C5-2, at least in the generic guidelines, are indicative of the reactor is at significant power; it is not shut down;

and, significant heat is being rejected in the containment.

That is where the operator makes the determination of whether or not he wants a lower level. What I have spoken to earlier about alternate ways to determine reactor power given that the APRM's were not working that day that, I am getting out of what is called Appendix B to the emergency procedure guidelines which is the technical basis document, which goes through each one of the steps within the emergency procedure guidelines and describes the basis for them.

This is guidance that is in the technical basis report in terms of how he would determine reactor power.

MR. CONTE: This is for the Rev 4 of the EPG's.

MR. SMITH: Yes. The intent of how this technical basis document is to be used was to provide this to the procedure writer and the training people in order to use this an ensure that all the thoughts that were made in developing the emergency procedure guidelines are somehow incorporated into the training program to at least allow the operator to get the wisdom or the knowledge that we use to try to come up with these.

I can't comment on whether Nine Mile has incorporated that into their training program, but that information is available as part of the generic procedure guidelines to be incorporated into the training program. I

think that answers the first part.

MR. CONTE: Should rod position indication be safety grade?

MR. SMITH: I wouldn't tough that thing with a ten foot pole.

MR. CONTE: That's an honest answer. We can appreciate that. Say that again, about your plant?

MR. SMITH: I might end up having to implement that commitment at my plant, and my management would not be too pleased if they saw this in print.

MR. CONTE: Thank you.

MR. JORDAN: I have one question. I think you mentioned the fact that Appendix B gives a criteria. Can you give us what you know as far as when it says the reactor will not remain shut down without boron. Can you give me an idea of what guidelines you expect the utility to give to the operators on what that means and how he can or cannot determine that?

MR. SMITH: I really think that determination of condition that reactor will maintain -- will be shut down under all conditions without boron is not a decision that the operator really probably has the indication or perhaps the knowledge to make on the fly.

I believe that the intent of that step was to have the operator consult the reactor engineer and the reactor

engineer, based on his training and his understanding of the core configuration or rod configuration, would make a determination that the reactor could be cooled down even though all the rods were not fully inserted.

The example that I would offer would be if one rod was notched out several notches in two quadrants -- the rods were notched adjacent to each other by one rod out and the northwest quadrant of one out in the southeast quadrant -- I think after looking at that, that the reactor engineer would have a fair confidence that the reactor is not going to go critical again during a cool down.

The intent was to not leave the operator in the Contingency 5 level power control procedure if the reactor engineer could make that determination that the reactor will be shut down. The condition was superimposed of not having any boron in the reactor to assure that if there was any boron washout that the reactor would not return to power. I hope that answered your question.

MR. JORDAN: You did. Thank you, Phil.

MR. CONTE: I think I will get complicated on you again here, Phil. In looking at the actual situation that the operators had with the low power, they were trying to implement these EOP's. On the one section on level control they were in the C5 and were very much aware of a stop statement or wait statement before exiting C5 in order to

get out and back into RL leg of the RPV control.

The wait statement says that all rods are inserted to at least position 02 or the reactor will remain shut down without boron. I think you explained that. Once again, they didn't have the rod position indication and they didn't have an analyst telling them that the reactor will remain shut down, so they were on hold at that point.

They didn't have feed and condensate but at least feed and condensate was kind of behind the stops because pressure was high. Then, there's another wait statement on the RP leg of RPV control which has four conditions. Two of them are duplicative of the two that I just mentioned, in order to exit C5 and then it adds another or. If boron is being injected SLC tank drops to 900 gallons or, the reactor was shut down and boron has been injected.

This stop sign appears right after the stabilize reactor pressure. It is apparently a go for cool down.

MR. SMITH: Yes.

MR. CONTE: What we get out of it is that it's an analysis that permits you to cool down to assure that you won't go critical again. However, if it gives you the go ahead there is an ongoing statement that says the reactor is not shut down return to B, which takes you back up to stabilize pressure.

MR. SMITH: Correct.

MR. CONTE: The operators were trying to -- because they were using RCIC, RCIC was bringing them down. There was no ATWS, it was a very low heat load and RCIC was able to handle it. They were initially confused. They eventually figured out that all I need my go ahead here is the reactor is shut down -- they were below the range six and seven on the IRM's. They had SRM indication, so they made the go ahead.

Those two legs appear to be in conflict with one another, appear to be. Do you have an opinion on that?

MR. SMITH: Sure. I don't think they are. The criteria in vessel pressure control, at least in the guidelines set that I am looking at here is RC/P-3, which specifies when either -- all the rods are inserted to position 02 or you know that the reactor will maintain, will be shut down under all conditions without boron, or you have injected the cold shut down boron wait which is your 900 gallon number. That assures that the reactor will be shut down under cold conditions with no voids, no xenon. There are a number of functions that go into calculation of that weight.

The last one is the reactor is shut down now but I haven't injected boron and I don't have a confidence that the reactor will be shut down as I cool down. Understand if the operator is trying to use that last bullet as the

criteria for cooling down, he should also be in Contingency 5 which gives him all the guidance on be careful how fast you inject into the reactor and be careful where that injection source is, either inside the shroud or outside the shroud.

He is conscious of that, and as he begins his cool down at less than 100 degrees per hour, he still has conditional statement which applies that if, while you are cooling down the reactor is not shut down and begins to return to power then stop the cool down and stabilize pressure again and take a look again at the conditions which would allow you to cool down again.

I really don't think they are in conflict. In fact, I think they work well together in terms of allowing the operator to depressurize if he needs to. An example of where he would is if he had this event plus he had a leak. Certainly, there is impetus if you have a leak to depressurize the reactor to reduce the rate at which you are losing inventory, even though the reactor may not be shut down and there's a possibility that as you depressurize and get low in pressure the reactor may start to return to power.

You are counting on the operator in Contingency 5 being conscious of the rate at which injection should be put into the reactor to assure that he doesn't have an excessive

reactivity spike.

MR. CONTE: I am not going to repeat everything you have said, but I think the message you are sending us is that the last condition the reactor is shut down and no boron has been injected is to combat another situation where you do have a leak, you want to stop the leak, and there is impetus to get depressurized; is that correct?

MR. SMITH: That is the first. It also gives the operator the flexibility that if he can determine shut down now while he is waiting for his reactor engineer to determine that it will be shut down forever with the rod configuration he has, he is allowed to start his cool down. If it takes 20, 30 minutes or an hour for the reactor engineer to make that determination at least the operator has been given some guidance on permitting himself to cool down to get the reactor pressure vessel into a lower energy state, both for the leak concerns and in general cooling the reactor down.

I believe that the conditional statement which applies to terminating the cool down if the reactor -- if it is determined that the reactor cannot be assured to be shut down, covers the case where the reactor may return to criticality during depressurization.

MR. KAUFFMAN: Phil, that covers the part of the event to where in Nine Mile's definitions they had not

determined that they were shut down until they had looked at the IRM's or source range monitors. Initially in this event, they couldn't say yes we were shut down, we were allowed to depressurized.

At that point they were at a point where, if they ran RCIC they would depressurize. Yet, they had a step that said stabilize pressure. I guess what I am trying to understand is, what does the stabilize term mean and how do you expect them to implement the level and pressure before they can say yes we are shut down and it's okay to cool down?

MR. SMITH: The stabilize step is intended that the operator stops a trend of increasing or decreasing pressure. The stabilization of the pressure, if the reactor is not shut down, it is important to stabilizing reactor water level and is important to stabilizing reactor power. Without having stabilized the pressure it would be difficult for the operator to control the other two parameters if the reactor was indeed not shut down.

Let's see if there is a definition for stabilize. What the operator is supposed to do -- I would interpret that the operator should have tried to control pressure within a certain band, and as part of implementation of the emergency procedure guidelines different plants have chosen a band for what constitutes stabilize. Maybe it's within

100 pounds, 150 pounds of the high pressure scram setpoint.

That is the band that the operator is given to try and control the pressure within until he comes to the next step in trying to make the determination on whether the reactor is shut down enough for him to depressurize the reactor vessel. Concurrent with this, he should be in Contingency 5, trying to control water level within the normal band, understanding the caution about increasing flow too much.

I am not sure that I have answered your question real clean.

MR. KAUFFMAN: I am going to continue on here. I am the operator, I am running RCIC, and I see that I am depressurizing --

MR. CONTE: My level is high.

MR. KAUFFMAN: My level is high. I guess I am trying to visualize if I am an operator what options I have in front of me. One is, I have a very wide level band. I can turn off RCIC, watch level, coast down, and repressurize and attempt to stabilize pressure that way. I can run RCIC and maybe, since I have some steam loads, I can secure my auxillary steam loads. That may have some negative effect later of maintaining condenser available -- it's nice to have -- steam seals, air ejectors, that sort of thing.

What I might be really concerned about this de-

stabilization and say I am going to shut my MSIV's and turn off RCIC and control pressure with my SRV's. In the back of my mind I know that gets me closer to SLC injection.

I guess what I am trying to say is, are these reasonable thoughts for him to go through? Is it reasonable to make this guy have to pick between these different options? How would you expect people to respond to this situation?

MR. SMITH: Understand first, I don't have a reactor operator license. So, I am speaking based on my knowledge of the emergency procedure guidelines. If RCIC was the system that I had available and RCIC by itself was depressurizing me, that would make me a little more confident that the reactor was probably shut down. Understanding how much steam RCIC happens to draw off of the reactor vessel and what it would inject, that it doesn't match decay heat for a while after shutdown, at least on some representative BWR 4's or 3's.

I don't believe that he would go and try and isolate the main condenser to try and stabilize pressure. As I said, the level control guidance gives him a fairly wide band in order to control water level within. I would say that he would use RCIC as necessary to stay within that band, also trying to keep reactor vessel pressure as stable as he could. If there were not a lot of other steam loads

that were sucking reactor level pressure down, he would probably be in pretty good shape.

If these auxillary steam loads were sucking vessel pressure down that, to me, would be more of an indication that the reactor really was not at power. I think I have done this in a roundabout way for you.

MR. CONTE: Let me rephrase that question here. The stabilize steps says -- the EOP's say stabilize RPV pressure below 1070 psig using the main turbine bypass valves of the RPV pressure control with the systems listed below if necessary.

You almost get the impression that this step is written on a high pressure situation and not a low pressure situation.

MR. SMITH: Certainly, the high pressure situation does represent more of a challenge to the integrity of the reactor vessel. The stabilize step was there primarily to have the operator prevent SRV cycling that may be impacting his control of the other parameters.

I am trying to find in the generic technical basis where it talks about the stabilize step. Bear with me for a moment here, because my fingers aren't working very well turning the pages. The generic technical basis does describe that there is no low end of the pressure control range; that thereby permits vessel pressure to be reduced to

below the shut of head of low pressure systems if injection from these systems is necessary to establish and maintain adequate core cooling.

Primarily, it is concerned with the high pressure end and the top end of that -- I think you quoted 1070 pounds -- is likely to be the high vessel pressure scram setpoint. You want to stay below that setpoint to assure that if the reactor was indeed not shut down that you would be allowed to reset the scram and potentially drive rods again.

MR. CONTE: Thank you. Are there any other questions?

MR. KAUFFMAN: I had a question back to when the reactor is depressurizing and you talked about it would be reasonable for him to have control of his level valves and slowly put water in.

I guess the background on this event is that his feedwater reg valves were filled full up. In this event, to some extent the operator, if he was going to prevent that uncontrolled injection it would have to anticipate the booster pump injection. Your first answer indicated that that really wouldn't be where his thoughts were or how this was intended to be implemented.

I guess I am saying I thought the operator should have anticipated booster pump injection and had the pumps

turned off or the valves shut. I guess what I am asking is, are my expectations too high? Do you think I am wrong?

MR. SMITH: Certainly, condensate and feedwater is one of the systems he would be using to maintain reactor water level and Contingency 5. In fact, that would probably be probably his first choice of systems to use. Whether or not he should have been conscious that the reg valves had failed in their full open position or he had indication that the valves were in their full open position, is something I don't know.

I think that if you were going to error and permit an injection from a system, condensate booster pumps would probably be the one I would pick to error on, understanding the mixing that happens before the water gets to the bottom of the core.

Perhaps in hindsight, that he should have made some efforts to try and close the parallel valve -- not the parallel valve but feed reg valves -- perhaps. Certainly, I think he was awful busy at that time and he had to take some priorities on what actions he was going to take. Understanding that the transient seemed to turn out okay, I would say he probably chose the right things.

MR. KAUFFMAN: I guess it is going to get back to the importance of that caution in that, that caution sounds like there are pretty dire consequences if this injection

occurs. I guess the question I have is, if he is busy doing other things, should he be looking real closely at his EOP's or should he be running around and doing other things.

MR. SMITH: I think that if he is in Contingency 5, my opinion is that he ought to be more conscious of controlling the injection into the vessel and controlling the vessel parameters, understanding that lack of control of these parameters has certainly a much greater impact if the reactor is truly not shut down.

Perhaps from that standpoint he should have -- perhaps he should have taken more action to assure that the condensate booster pumps did not inject uncontrolled.

MR. CONTE: That's all we have for questions. We have some closing comments for you, Phil. Mike Jordan.

MR. JORDAN: Phil, I just want to thank you for your assistance in helping us clarify some points on the EOP's. We would ask also that you not relate your concerns that we have addressed here to anybody outside of yourself because, until we have come up with our final conclusion on our report -- until our report is issued. A lot of these are just concerns that we have that may or may not appear anyplace else.

MR. SMITH: I understand that, and I will abide by that.

MR. JORDAN: Do we have your address?

MR. SMITH: It's GPU Nuclear Corporation, 1 Upper Pond Road, Parsippany, New Jersey 07054.

MR. JORDAN: We will see if we can get a copy of this transcript mailed to you. We ask that you not copy it. If you want a copy of the transcript we will be glad to send that to you after we issue our report, when it becomes a public document. If you wish to request a copy of it when you send your transcript back, annotate that you want a copy of the transcript.

MR. SMITH: That would be fine.

MR. CONTE: I have two more comments -- one is a question. When we were talking about this study -- in review of my notes here and the thought just came to me -- when we were talking about this study with the LPCI injection and so many dollars of reactivity, this seems to be a beyond design basis event.

Why did General Electric do this study? Was it in response to a staff concern, was it their own volition or what?

MR. SMITH: This was in response to questions from the Emergency Procedures Committee as we were developing Contingency 5 as to whether there was a real downside to distinguishing between inside the shroud and outside the shroud systems, and whether there was a need for the operator to have some additional guidance or precaution in

terms of how fast he would inject water into the reactor.

Understand that that analysis or evaluation, from what I remember of it -- since it was probably 1981 or 1982 timeframe -- I believe was looking at a complete injection of LPCI into an unrodded core. The water basically accumulated in the upper plenum above the core and then fell into it almost as a slug. That's where the reactivity excursion came from.

MR. CONTE: One more question before we go off the record. I am going to ask you to stay on the line after we go off the record because the Court Reporter may have some questions for you on some terminology that you used. One more question.

Have we asked the right questions? Do you have anything to offer or would you like to clarify anything that you have made statements on about the topics this morning?

MR. SMITH: Maybe a quick summary of points. I believe the operator was correct in entering the Contingency 5 procedure based on not being inserted and the reactor was shut down. It would appear that he made that determination and correctly left that procedure that the reactor was shut down. I guess those are the only summary of what I have of it.

MR. CONTE: I guess the other main point that you made based on the situations that we gave you was that these

legs are all consistent with one another.

MR. SMITH: Yes, that is true. I believe that they are. I believe that the Procedures Committee has taken significant efforts to assure that they are consistent with each other.

MR. JORDAN: Phil, the document that you mentioned about the calculation of the cold water injection, is that GE's?

MR. SMITH: That is General Electric's. I believe that it is probably GE proprietary. It is not a document that I have ever seen physically -- physically seen. I have no knowledge in what state of documentation it is, whether it is a formalized calculation that General Electric did, whether it is just some analysis that one of the engineer's happened to run. I don't know in what condition it is.

As I said, I have never physically seen it.

MR. CONTE: Okay, we are going to go off the record and ask you to stay on.

[Whereupon, at 11:09 a.m., the meeting concluded.]

REPORTER'S CERTIFICATE

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

in the matter of:

NAME OF PROCEEDING: Philip Smith

DOCKET NUMBER:

PLACE OF PROCEEDING: Bethesda, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Mary C. Larkin

Official Reporter
Ann Riley & Associates, Ltd.

07-638-91 B

OFFICIAL TRANSCRIPT OF PROCEEDINGS

Agency: U.S. Nuclear Regulatory Commission
Incident Investigation Team

Title: Telephone Conference Call
Interview Of Philip Smith

Docket No.

LOCATION: Bethesda, Maryland

DATE: Thursday, September 19, 1991 **PAGES:** 1 - 36

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ERRATA SHEET

ADDENDUM

Page	Line	Correction and Reason for Correction
2	20	Change "Team" to "Senior" transcription error
2	21	Insert "Systems" before "Engineering" transcription error
4	12	Change "read" to "reed" typographical error
5	16	Change "lever" to "level" transcription error
6	14	Change "RPM's" to "APRM's" transcription error
14	21	Change "circulation" to "recirculation" transcription error
21	4	Change "tough", to "touch" transcription error
24	15	Delete "will maintain," transcription/grammatical error
26	9	Insert "the reactor is" before "shutdown" transcription error
32	6	Delete "probably" transcription/grammatical error.
36	11	Delete "-- physically seen" transcription/grammatical error.

Date 13 Oct 1991 Signature Philip S Smith

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

INCIDENT INVESTIGATION TEAM

Telephone Conference Call

Interview of Philip Smith

Nuclear Regulatory Commission
The Woodmont Building
Room W-102
8120 Woodmont Avenue
Bethesda, Maryland
Thursday, September 19, 1991

The meeting in the above-entitled matter convened, pursuant to notice, in closed session at 10:00 a.m.

PROCEEDINGS

[10:03 a.m.]

MR. CONTE: Good morning. My name is Richard Conte from Region I. I am a member of the Incident Investigation Team investing the event of August 13 at Nine Mile II. We are in a conference call with Mr. Philip Smith from GPU Nuclear. I believe he is at Parsippany, New Jersey. The NRC members are at the Woodmont Building in Bethesda, Maryland. The time is 10:03.

We will start out by going around the room here in Bethesda, and then we will ask you to identify yourself, Phil. My name, as I said, is Richard Conte.

MR. VATTER: Bill Vatter from INPO.

MR. JORDAN: Mike Jordan, member of the NRC IIT Team.

MR. KAUFFMAN: John Kauffman, NRC, AEOD.

MR. STONER: Jim Stoner, with Duke Power.

MR. CONTE: We have a Court Reporter here also. Phil, could you introduce yourself?

MR. SMITH: Sure. I am Philip Smith, Team Engineer, Engineering Department at GPU Nuclear. I am also Chairman of the BWR Owners Group Emergency Procedures Guideline Committee.

MR. CONTE: Thank you, Phil. We are ready to go around the room and get started. I think Mr. Vatter has one

of the first questions.

MR. VATTER: Phil, one of the problems that we are most interested in is when the operators did not have any indication of control rod position in this event, what could have been the worst reactivity situation that they would have had to deal with --

MR. CONTE: Let me interrupt here. I think we need to establish how much Mr. Smith knows about the Nine Mile II event. Phil, how much do you know; could you tell us?

MR. SMITH: I talked to several people at Nine Mile about the event. My understanding of it is that it was a loss of power or load reject out in the turbine, and that ended up causing a loss of off-site power and then failure of some transfer switches to go over to DC power or alternate. That resulted in a loss of some amount of control room indication for 20 to 25 minutes.

MR. CONTE: Let me see if we can get you up to speed a little more in terms of how the operators were implementing the EOP's. They are using Rev 4 of the Boiler EOP's. Primarily they were in RP -- when the event happened, as you said, there was a loss of power supplies. They lost all indication of rod position; five uninterruptable power supplies went down simultaneously.

That resulted in a lot of front panel information lost except for safety grade instrumentation on reactor

pressure and reactor vessel level. Post-accident monitors went in the fast -- recorders went into fast speed. Electrical distribution volt meters and amperages, that was still okay because they were apparently independently powered.

APRM readings were gotten from the back panel. The recorders for APRM's and IRM's were lost in the front panel. Are you following me so far?

MR. SMITH: Sure.

MR. CONTE: Once again, rod position indication, there are multiple ways of finding rod position indication. However, the read switches all come off of one power supply; therefore, that essentially disabled one of those five power supplies and others deal with the rod position indication -- rod minimizer, rod sequence control -- those are the things that were basically unavailable for rod position indication.

When the event happened the preliminary assessment was they had APRM's down scale less than four percent. No rod position. I guess they diagnosed or assessed that they were in a transient on the reactor besides the electrical transient, so they decided to manually scram. The other key thing here that gets you into the EOP's is that feedwater was lost because of that power supply problem, and that created a low level situation and an entry into the RPV control.

Are you with me?

MR. SMITH: The volume dropped off, and I can hardly hear you at all.

[Disconnected.]

MR. CONTE: We are going to call you back.

[Reconnected.]

MR. CONTE: Back on the record. For the record, we had a phone communication problem. We had to switch phones, so we are back on the record.

Phil, I was giving you a run down of equipment that was lost. I got to where there was a loss of feedwater and an entry into the RPV control on level. Did you understand everything up to that point?

MR. SMITH: I have it.

MR. CONTE: One of the key things in the RPV control and the lever leg was the operators were faced with a question, if all control rods are not inserted into at least position 02 and the reactor will not remain shutdown without boron, exit this section and go into C5 which is the contingency on power level control.

MR. SMITH: Correct.

MR. CONTE: The operator exited and went to C5, primarily on the information of rod position. He didn't have rod position, he didn't know where he was, and he didn't have a reactor analyst to tell him that the reactor

will remain shutdown so he went into the ATWS procedure.

Setting that stage, I am going to ask Bill Vatter to ask the question again.

MR. VATTER: Thank you, Rich. I am sorry. I sort of jumped in the middle of it, Phil. Basically what they had was a scram with loss of feed and they didn't know where the rod position was.

We are trying to postulate different ways that a loss of rod position indication could have been a serious problem. One of the ways that we are postulating is that they also had an ATWS combined with loss of rod position indication. If they did have an ATWS it would have had to have been a partial ATWS because they did know the power was down scale on the RPM's. A little bit later they had the IRM's driven in, and they could see that they were going down in there.

If some of the rods did not scram what kind of a reactivity situation might have existed such that if they added cold water that they would have had a recriticality and resultant core damage from the recriticality?

MR. SMITH: Let me preface answering the question with, it is my understanding that they could determine that the reactor was indeed shut down, and when you get into Contingency 5 procedure the first statement asks whether the operator can determine that reactor power is above or below

the down scale trip.

Understanding that the front panel indications of reactor power were unavailable, there are alternate means of determining reactor power, one of which is reactor period looking at steam flow, looking at vessel pressure and level trends, perhaps a number of open SRV's. Suppression pool temperature and temperature trends, all indications to the operator of what reactor power is doing and whether or not he is above or below the down scale trip; i.e., does he have the reactor shut down.

MR. CONTE: It seems like the exiting to the ATWS procedure is solely dependent on the rod position alone.

MR. SMITH: That is very true. When you get into Contingency 5, as I was trying to say, there is criteria for which the operator makes the decision on whether the reactor is making sufficient power and heating the containment. Under these conditions, as I understand them, he was not getting sufficient heat to the suppression pool and he did not have significant power in the reactor.

Therefore, he would have controlled water level in the same manner that you would had you had a normal scram. The level power control procedure, it directs the operator to make an assessment whether or not reactor power is above the down scale trip or cannot be determined. In addition to that, he has to have suppression pool temperature above a

curve in the EOP's called boron initiation injection temperature which is criteria for shooting boron into the core. Third he has to have an SRV open or drywall pressure above the high drywall pressure scram set point as an indication of the reactor is still at significant power and is rejecting significant amount of heat to the containment.

If that is true, then the operator goes through the steps of lowering reactor water level to suppress the reactor power and wait for the boron to shut the reactor down. In this case, I don't believe that he met those entry conditions to lower reactor water level. Therefore, the next step in the Contingency, Step C5-3, directs the operator to maintain water level within the normal band with his normal injection systems.

I believe that the operator would have controlled water level within the normal band.

MR. VATTER: That is basically what happened, Phil. He had a little problem with condensate booster pumps started injecting when pressure went down. That is the direction that he was going.

MR. SMITH: Okay.

MR. VATTER: The focus of my question is, the reactor is shut down but we don't know how much it is shut down. There may have been one or more rods that didn't insert or inserted partway, because he hasn't any position

indication.

What we would like to know is, if there has been any analysis done to determine what might happen if you had a large amount of cold water injected in that circumstance. We are particularly looking at a caution in Niagra Mohawk's procedure that says in the C5 procedure it says: "Caution. Raising injection flow rapidly may induce a large power excursion and result in substantial core damage."

He is in the C5 procedure because the entry condition that is spelled out in the RPV control procedure says that if the rods are not all at 02 and the reactor will not remain shut down without boron, he really didn't know either of those things so he went over to C5. That's where he was. He went past that caution that I just reiterated to you.

We don't understand the significance of that caution and what it is based on.

MR. SMITH: The significance of the caution is based on having the operator aware that because he cannot be certain that the reactor is shut down then care must be taken in establishing injection flow rates into the reactor. The criteria for systems to be used is systems which inject outside of the reactor shroud, understanding that when they inject in the downcomer that the water as it is transported through the recirculation loops mixes with warmer water in

the reactor and, therefore, reduces the cold water addition to the reactor core and hence your reactivity addition.

He is directed to go to outside the shroud systems first. He would not try inside the shroud systems unless he could not maintain water level with those outside shroud systems. If he decided he needed to go to inside the shroud systems, he is directed to terminate and prevent all injection from inside the shroud systems and to depressurize the reactor, realizing that as pressure drops down you don't want to have the low pressure ECCS systems injecting at an uncontrolled rate because the reactivity excursion could be significant.

There is some work that has been done by General Electric, I think, many years ago which suggested that the reactivity addition due to uncontrolled LPCI injection into the reactor core could be in excess of one dollar of reactivity. There is some debate on how much in excess of one dollar it is, but I think it's sufficient to say that if it is in excess of one dollar that's too much.

That was the basis for that caution that was in there, to say that be aware operator that if the reactor is not shut down to be careful on the rate at which you increase flow rates into the reactor because of the cold water effect.

MR. VATTER: Phil, do you know if there was any

analysis for a partial ATWS that shut the plant down but there was a potential for recriticality with perhaps adverse rod configuration that would cause one region of the core to have maybe some fuel damage. Was there any work on partial ATWS and trying to figure out what the worst case might be?

MR. SMITH: I don't recall that there was any specific work on partial ATWS. I know that they looked at all rods out condition. In fact, I think you would agree that the worst case for reactivity addition would be if the reactor was several decades below the heating range when you injected the cold water, because the power and reactivity addition rate and -- power would continue to increase on almost an exponential basis until either Doppler or voids turned it around.

I think you would agree that that would be the worst case in terms of depositing energy to the fuel.

MR. VATTER: Right. What we would like to know is if anybody has tried to quantify how bad that worst case is?

MR. SMITH: As I said, I have seen numbers that have ranged upwards from one dollar up to eight or nine dollars worth of reactivity. I don't know that people have gone and connected the reactivity addition with what sort of fuel damage or fracture or cladding perforations you may expect because of that.

MR. VATTER: I think eight or nine dollars worth

of reactivity will be a big deal.

MR. SMITH: It will certainly get your attention, yes. Understand that the way Contingency 5 is structured that first making the operator aware that uncontrolled or rapidly increasing injection into the reactor core can result in these conditions; that he is sensitized to that, and that he would use systems which inject outside the shroud first to minimize the effect of reactivity addition on to the core.

MR. VATTER: I understand that. Of course, the normal feedwater system is outside the shroud.

MR. SMITH: True.

MR. VATTER: In this event they had an unexpected injection from the condensate booster pumps. The pressure drifted down fairly slowly, and the condensate booster pumps caught them unaware. It put in a large amount of water and they went off scale high. We don't think that they put water in the steam lines, but they got close.

MR. CONTE: I would like to emphasize that this was not an ATWS also.

MR. SMITH: True.

MR. VATTER: Right. All the rods were in, but if all the rods were not all in -- if they were in that sort of an undesirable configuration that we were talking about which, apparently there has not been any analysis done, what

do you think might be the worst case reactivity recriticality kind of an event from just condensate booster pumps shooting in water?

MR. KAUFFMAN: As an aside here, the feedwater reg valves failed in their 100 percent open position, so they were wide open.

MR. SMITH: Again, I can tell you where I would expect reactor power to end up. If reactor water level is up into the normal range or slightly above the normal range, if the rods were completely withdrawn or were significantly out, you might expect to have a steady state power in the range of 40 to 60 percent power.

Certainly, the rate at which the condensate booster pumps would slug the water in there and whether or not there was any feedwater heating left would certainly affect the peak power before it steadied out in around the 40 to 60 percent range.

MR. VATTER: Of course, we started now from below the heating range. The operator knows that reactor is subcritical, he has no APRM indication, but it might be only slightly subcritical.

MR. SMITH: I would be hesitant to quote you a number of what the spike could be, because there are just several fairly important variables that would influence how high the peak would be. Certainly, it could twice or three

times the average power. Anything above that, I would be hesitant to kind of offer an opinion on.

MR. VATTER: I guess one scenario that has been going through our minds is that several rods in a very bad configuration failed to scram but the reactor is subcritical. Then, this power drifts down below the heating range a few decades, and the condensate booster pump injection causes a recriticality with a power peak in that area of the core where the rods didn't scram; and that, maybe the core gets hurt from all of that.

Is that a potential concern do you think, or do you think it couldn't happen?

MR. SMITH: I would say it wouldn't be a very large concern. Understanding the mixing of the condensate booster pump water with the rest of the water in the reactor, understanding how it would mix as it came through the diffusers from the recirc loops back into the lower plenum of the reactor vessel, and it would kind of homogenize out. I think you need to look at some relative flow rates of the water in the reactor vessel, the circulation flow, versus what you are going to inject from the condensate booster pumps.

I would think that the cold water effect would have been reduced significantly by the mixing. Certainly, a way to tell that is to look at recirc loop temperature and

to see how far that fell off during the condensate booster pump injection. That would give you a feel for what the temperature of the water was that was going into the core.

MR. VATTER: That's a good thought, although we won't get much out of that, Phil. The process computer went down with the event and none of that data is available.

MR. CONTE: Phil, how do you expect operators to implement this caution?

MR. SMITH: That caution?

MR. CONTE: Yes, practically speaking.

MR. SMITH: I would expect the operator to understand that injection of the water can have a detrimental effect on his ability to control reactor water level and power. I would expect that in trying to control reactor water level where this caution does appear, that he would be careful in terms of how much he opened up for example the feedwater regulating valves or whatever injection valve on the system he was using and would not just try and open the valve to full position immediately.

The EPG's do provide him a fairly wide level control band for this action. It does not necessitate that he take rapid and potentially too rapid operator action which could result in the high reactivity addition rate.

MR. CONTE: What I think I am hearing you say is an operator tweaks on whatever controller he has and looks

for a level response, it doesn't get a level response and tweaks a little more. Once he gets a level response, he kind of holds it there and makes sure the level is slowly coming up. You really can't put a GPM number on this; is that correct?

MR. SMITH: You surely can't, because the state of being in this contingency procedure is that you are unsure first whether the reactor is shut down or what the rod configuration is. Certainly, you just wouldn't want to arbitrarily establish a flow number because it would work for several cases but not for all. It could be that for one of the cases for which it did not work would be the one where that could give you some reactivity addition.

As you said, I believe he would look at level response. He would also look at power response if he had power indication available. By tweaking the controller and little bit and saw a little bit of level response and didn't see too much on the power, that may give him an indication that he can tweak it a little bit more until he starts seeing power come up with that.

That is my opinion on how the operator would implement that caution.

MR. CONTE: Okay. I had another question -- I have two more questions. Let's back up when he exits the RP level control, he exits the C5. What do you think about

that situation? Basically rod position, you may or may not know this, but the rod position indication is not considered safety grade. The power supplies for this event were not safety grade.

What do you think about the situation where there was no ATWS and the operator was forced into being fooled that he had an ATWS; what do you think about that?

MR. SMITH: I would not characterize it that he was fooled into thinking he had an ATWS. I would characterize it as he could not confirm the reactor was shut down. If he could not confirm that, I believe that it is prudent to take actions and precautions that would be sensitive to the fact that the reactor may not be shut down rather than trying to make a determination initially that the reactor is shut down and that a normal reactor level control kind of initiating injection without regard to whether it is inside the shroud or outside shroud, or without regard to the rate of flow increase.

I think it is very appropriate that if the operator cannot determine that the reactor is shut down, that he should take precautions and assume that it is not. Understand in this condition that because I believe that the operator could make a determination that really the APRM's were probably down scale and that he was not heating the containment, his actions in terms of controlling reactor

water level would not be different than what he would do for normal scram with the exception of this precaution on how fast to increase the flow rate.

He is not really doing anything different than he would if he had known that all the rods went in and he was recovering from the scram.

MR. CONTE: What I am hearing is that you are supporting the operator actions to enter C5?

MR. SMITH: Absolutely.

MR. CONTE: You mentioned something earlier, that it is appropriate to go into C5 because it gets the operator to take a look at the situation in the containment and the situation with respect to reactor power. I realize and I wanted to emphasize this point, you are probably talking from your knowledge of the Rev 4 emergency procedure guidelines that are generically applied and we are talking from the Nine Mile II specific procedures.

In the C5 for Nine Mile II, you really don't see -- there is an ongoing statement here that says are rods inserted to position two or the reactor will shut down under all conditions without boron, exit this procedure and enter RPV control RL section.

I really don't see the flavor of what you are talking about in these procedures about the analysis on the reactor being shut down or making a determination if reactor

is shut down. Let me add here, because you don't have these procedures in front of you, there is another ongoing step that is combined with a number of other conditions with respect to the suppression pool and the SRV's opening.

It says if reactor power is above four percent or cannot be determined, then continue at another point which is looking at main steam lines and another leg of the C5 situation. Let me add another piece of information. The licensee has given instructions to the operator that a shut down reactor is less than range six and seven on the IRM's.

MR. KAUFFMAN: And, subcritical.

MR. CONTE: And, subcritical. What do you think? I have said a mouth full here. Can you comment?

MR. SMITH: Sure. I have an opinion on most any subject you want to bring up.

MR. CONTE: Go ahead.

MR. SMITH: First of all, the steps that you just quoted, reactor power is above the four percent number. There should be a subsequent -- two other subsequent conditions on suppression pool temperature and SRV open.

MR. CONTE: There is.

MR. SMITH: That is the criteria for the operator to lower reactor water level. Those three criteria in step C5-2, at least in the generic guidelines, are indicative of the reactor is at significant power; it is not shut down;

and, significant heat is being rejected in the containment.

That is where the operator makes the determination of whether or not he wants a lower level. What I have spoken to earlier about alternate ways to determine reactor power given that the APRM's were not working that day that, I am getting out of what is called Appendix B to the emergency procedure guidelines which is the technical basis document, which goes through each one of the steps within the emergency procedure guidelines and describes the basis for them.

This is guidance that is in the technical basis report in terms of how he would determine reactor power.

MR. CONTE: This is for the Rev 4 of the EPG's.

MR. SMITH: Yes. The intent of how this technical basis document is to be used was to provide this to the procedure writer and the training people in order to use this an ensure that all the thoughts that were made in developing the emergency procedure guidelines are somehow incorporated into the training program to at least allow the operator to get the wisdom or the knowledge that we use to try to come up with these.

I can't comment on whether Nine Mile has incorporated that into their training program, but that information is available as part of the generic procedure guidelines to be incorporated into the training program. I

think that answers the first part.

MR. CONTE: Should rod position indication be safety grade?

MR. SMITH: I wouldn't tough that thing with a ten foot pole.

MR. CONTE: That's an honest answer. We can appreciate that. Say that again, about your plant?

MR. SMITH: I might end up having to implement that commitment at my plant, and my management would not be too pleased if they saw this in print.

MR. CONTE: Thank you.

MR. JORDAN: I have one question. I think you mentioned the fact that Appendix B gives a criteria. Can you give us what you know as far as when it says the reactor will not remain shut down without boron. Can you give me an idea of what guidelines you expect the utility to give to the operators on what that means and how he can or cannot determine that?

MR. SMITH: I really think that determination of condition that reactor will maintain -- will be shut down under all conditions without boron is not a decision that the operator really probably has the indication or perhaps the knowledge to make on the fly.

I believe that the intent of that step was to have the operator consult the reactor engineer and the reactor

engineer, based on his training and his understanding of the core configuration or rod configuration, would make a determination that the reactor could be cooled down even though all the rods were not fully inserted.

The example that I would offer would be if one rod was notched out several notches in two quadrants -- the rods were notched adjacent to each other by one rod out and the northwest quadrant of one out in the southeast quadrant -- I think after looking at that, that the reactor engineer would have a fair confidence that the reactor is not going to go critical again during a cool down.

The intent was to not leave the operator in the Contingency 5 level power control procedure if the reactor engineer could make that determination that the reactor will be shut down. The condition was superimposed of not having any boron in the reactor to assure that if there was any boron washout that the reactor would not return to power. I hope that answered your question.

MR. JORDAN: You did. Thank you, Phil.

MR. CONTE: I think I will get complicated on you again here, Phil. In looking at the actual situation that the operators had with the low power, they were trying to implement these EOP's. On the one section on level control they were in the C5 and were very much aware of a stop statement or wait statement before exiting C5 in order to

get out and back into RL leg of the RPV control.

The wait statement says that all rods are inserted to at least position 02 or the reactor will remain shut down without boron. I think you explained that. Once again, they didn't have the rod position indication and they didn't have an analyst telling them that the reactor will remain shut down, so they were on hold at that point.

They didn't have feed and condensate but at least feed and condensate was kind of behind the stops because pressure was high. Then, there's another wait statement on the RP leg of RPV control which has four conditions. Two of them are duplicative of the two that I just mentioned, in order to exit C5 and then it adds another or. If boron is being injected SLC tank drops to 900 gallons or, the reactor was shut down and boron has been injected.

This stop sign appears right after the stabilize reactor pressure. It is apparently a go for cool down.

MR. SMITH: Yes.

MR. CONTE: What we get out of it is that it's an analysis that permits you to cool down to assure that you won't go critical again. However, if it gives you the go ahead there is an ongoing statement that says the reactor is not shut down return to B, which takes you back up to stabilize pressure.

MR. SMITH: Correct.

MR. CONTE: The operators were trying to -- because they were using RCIC, RCIC was bringing them down. There was no ATWS, it was a very low heat load and RCIC was able to handle it. They were initially confused. They eventually figured out that all I need my go ahead here is the reactor is shut down -- they were below the range six and seven on the IRM's. They had SRM indication, so they made the go ahead.

Those two legs appear to be in conflict with one another, appear to be. Do you have an opinion on that?

MR. SMITH: Sure. I don't think they are. The criteria in vessel pressure control, at least in the guidelines set that I am looking at here is RC/P-3, which specifies when either -- all the rods are inserted to position 02 or you know that the reactor will maintain, will be shut down under all conditions without boron, or you have injected the cold shut down boron wait which is your 900 gallon number. That assures that the reactor will be shut down under cold conditions with no voids, no xenon. There are a number of functions that go into calculation of that weight.

The last one is the reactor is shut down now but I haven't injected boron and I don't have a confidence that the reactor will be shut down as I cool down. Understand if the operator is trying to use that last bullet as the

criteria for cooling down, he should also be in Contingency 5 which gives him all the guidance on be careful how fast you inject into the reactor and be careful where that injection source is, either inside the shroud or outside the shroud.

He is conscious of that, and as he begins his cool down at less than 100 degrees per hour, he still has conditional statement which applies that if, while you are cooling down the reactor is not shut down and begins to return to power then stop the cool down and stabilize pressure again and take a look again at the conditions which would allow you to cool down again.

I really don't think they are in conflict. In fact, I think they work well together in terms of allowing the operator to depressurize if he needs to. An example of where he would is if he had this event plus he had a leak. Certainly, there is impetus if you have a leak to depressurize the reactor to reduce the rate at which you are losing inventory, even though the reactor may not be shut down and there's a possibility that as you depressurize and get low in pressure the reactor may start to return to power.

You are counting on the operator in Contingency 5 being conscious of the rate at which injection should be put into the reactor to assure that he doesn't have an excessive

reactivity spike.

MR. CONTE: I am not going to repeat everything you have said, but I think the message you are sending us is that the last condition the reactor is shut down and no boron has been injected is to combat another situation where you do have a leak, you want to stop the leak, and there is impetus to get depressurized; is that correct?

MR. SMITH: That is the first. It also gives the operator the flexibility that if he can determine shut down now while he is waiting for his reactor engineer to determine that it will be shut down forever with the rod configuration he has, he is allowed to start his cool down. If it takes 20, 30 minutes or an hour for the reactor engineer to make that determination at least the operator has been given some guidance on permitting himself to cool down to get the reactor pressure vessel into a lower energy state, both for the leak concerns and in general cooling the reactor down.

I believe that the conditional statement which applies to terminating the cool down if the reactor -- if it is determined that the reactor cannot be assured to be shut down, covers the case where the reactor may return to criticality during depressurization.

MR. KAUFFMAN: Phil, that covers the part of the event to where in Nine Mile's definitions they had not

determined that they were shut down until they had looked at the IRM's or source range monitors. Initially in this event, they couldn't say yes we were shut down, we were allowed to depressurized.

At that point they were at a point where, if they ran RCIC they would depressurize. Yet, they had a step that said stabilize pressure. I guess what I am trying to understand is, what does the stabilize term mean and how do you expect them to implement the level and pressure before they can say yes we are shut down and it's okay to cool down?

MR. SMITH: The stabilize step is intended that the operator stops a trend of increasing or decreasing pressure. The stabilization of the pressure, if the reactor is not shut down, it is important to stabilizing reactor water level and is important to stabilizing reactor power. Without having stabilized the pressure it would be difficult for the operator to control the other two parameters if the reactor was indeed not shut down.

Let's see if there is a definition for stabilize. What the operator is supposed to do -- I would interpret that the operator should have tried to control pressure within a certain band, and as part of implementation of the emergency procedure guidelines different plants have chosen a band for what constitutes stabilize. Maybe it's within

100 pounds, 150 pounds of the high pressure scram setpoint.

That is the band that the operator is given to try and control the pressure within until he comes to the next step in trying to make the determination on whether the reactor is shut down enough for him to depressurize the reactor vessel. Concurrent with this, he should be in Contingency 5, trying to control water level within the normal band, understanding the caution about increasing flow too much.

I am not sure that I have answered your question real clean.

MR. KAUFFMAN: I am going to continue on here. I am the operator, I am running RCIC, and I see that I am depressurizing --

MR. CONTE: My level is high.

MR. KAUFFMAN: My level is high. I guess I am trying to visualize if I am an operator what options I have in front of me. One is, I have a very wide level band. I can turn off RCIC, watch level, coast down, and repressurize and attempt to stabilize pressure that way. I can run RCIC and maybe, since I have some steam loads, I can secure my auxillary steam loads. That may have some negative effect later of maintaining condenser available -- it's nice to have -- steam seals, air ejectors, that sort of thing.

What I might be really concerned about this de-

stabilization and say I am going to shut my MSIV's and turn off RCIC and control pressure with my SRV's. In the back of my mind I know that gets me closer to SLC injection.

I guess what I am trying to say is, are these reasonable thoughts for him to go through? Is it reasonable to make this guy have to pick between these different options? How would you expect people to respond to this situation?

MR. SMITH: Understand first, I don't have a reactor operator license. So, I am speaking based on my knowledge of the emergency procedure guidelines. If RCIC was the system that I had available and RCIC by itself was depressurizing me, that would make me a little more confident that the reactor was probably shut down. Understanding how much steam RCIC happens to draw off of the reactor vessel and what it would inject, that it doesn't match decay heat for a while after shutdown, at least on some representative BWR 4's or 3's.

I don't believe that he would go and try and isolate the main condenser to try and stabilize pressure. As I said, the level control guidance gives him a fairly wide band in order to control water level within. I would say that he would use RCIC as necessary to stay within that band, also trying to keep reactor vessel pressure as stable as he could. If there were not a lot of other steam loads

that were sucking reactor level pressure down, he would probably be in pretty good shape.

If these auxillary steam loads were sucking vessel pressure down that, to me, would be more of an indication that the reactor really was not at power. I think I have done this in a roundabout way for you.

MR. CONTE: Let me rephrase that question here. The stabilize steps says -- the EOP's say stabilize RPV pressure below 1070 psig using the main turbine bypass valves of the RPV pressure control with the systems listed below if necessary.

You almost get the impression that this step is written on a high pressure situation and not a low pressure situation.

MR. SMITH: Certainly, the high pressure situation does represent more of a challenge to the integrity of the reactor vessel. The stabilize step was there primarily to have the operator prevent SRV cycling that may be impacting his control of the other parameters.

I am trying to find in the generic technical basis where it talks about the stabilize step. Bear with me for a moment here, because my fingers aren't working very well turning the pages. The generic technical basis does describe that there is no low end of the pressure control range; that thereby permits vessel pressure to be reduced to

below the shut of head of low pressure systems if injection from these systems is necessary to establish and maintain adequate core cooling.

Primarily, it is concerned with the high pressure end and the top end of that -- I think you quoted 1070 pounds -- is likely to be the high vessel pressure scram setpoint. You want to stay below that setpoint to assure that if the reactor was indeed not shut down that you would be allowed to reset the scram and potentially drive rods again.

MR. CONTE: Thank you. Are there any other questions?

MR. KAUFFMAN: I had a question back to when the reactor is depressurizing and you talked about it would be reasonable for him to have control of his level valves and slowly put water in.

I guess the background on this event is that his feedwater reg valves were filled full up. In this event, to some extent the operator, if he was going to prevent that uncontrolled injection it would have to anticipate the booster pump injection. Your first answer indicated that that really wouldn't be where his thoughts were or how this was intended to be implemented.

I guess I am saying I thought the operator should have anticipated booster pump injection and had the pumps

turned off or the valves shut. I guess what I am asking is, are my expectations too high? Do you think I am wrong?

MR. SMITH: Certainly, condensate and feedwater is one of the systems he would be using to maintain reactor water level and Contingency 5. In fact, that would probably be probably his first choice of systems to use. Whether or not he should have been conscious that the reg valves had failed in their full open position or he had indication that the valves were in their full open position, is something I don't know.

I think that if you were going to error and permit an injection from a system, condensate booster pumps would probably be the one I would pick to error on, understanding the mixing that happens before the water gets to the bottom of the core.

Perhaps in hindsight, that he should have made some efforts to try and close the parallel valve -- not the parallel valve but feed reg valves -- perhaps. Certainly, I think he was awful busy at that time and he had to take some priorities on what actions he was going to take. Understanding that the transient seemed to turn out okay, I would say he probably chose the right things.

MR. KAUFFMAN: I guess it is going to get back to the importance of that caution in that, that caution sounds like there are pretty dire consequences if this injection

occurs. I guess the question I have is, if he is busy doing other things, should he be looking real closely at his EOP's or should he be running around and doing other things.

MR. SMITH: I think that if he is in Contingency 5, my opinion is that he ought to be more conscious of controlling the injection into the vessel and controlling the vessel parameters, understanding that lack of control of these parameters has certainly a much greater impact if the reactor is truly not shut down.

Perhaps from that standpoint he should have -- perhaps he should have taken more action to assure that the condensate booster pumps did not inject uncontrolled.

MR. CONTE: That's all we have for questions. We have some closing comments for you, Phil. Mike Jordan.

MR. JORDAN: Phil, I just want to thank you for your assistance in helping us clarify some points on the EOP's. We would ask also that you not relate your concerns that we have addressed here to anybody outside of yourself because, until we have come up with our final conclusion on our report -- until our report is issued. A lot of these are just concerns that we have that may or may not appear anyplace else.

MR. SMITH: I understand that, and I will abide by that.

MR. JORDAN: Do we have your address?

MR. SMITH: It's GPU Nuclear Corporation, 1 Upper Pond Road, Parsippany, New Jersey 07054.

MR. JORDAN: We will see if we can get a copy of this transcript mailed to you. We ask that you not copy it. If you want a copy of the transcript we will be glad to send that to you after we issue our report, when it becomes a public document. If you wish to request a copy of it when you send your transcript back, annotate that you want a copy of the transcript.

MR. SMITH: That would be fine.

MR. CONTE: I have two more comments -- one is a question. When we were talking about this study -- in review of my notes here and the thought just came to me -- when we were talking about this study with the LPCI injection and so many dollars of reactivity, this seems to be a beyond design basis event.

Why did General Electric do this study? Was it in response to a staff concern, was it their own volition or what?

MR. SMITH: This was in response to questions from the Emergency Procedures Committee as we were developing Contingency 5 as to whether there was a real downside to distinguishing between inside the shroud and outside the shroud systems, and whether there was a need for the operator to have some additional guidance or precaution in

terms of how fast he would inject water into the reactor.

Understand that that analysis or evaluation, from what I remember of it -- since it was probably 1981 or 1982 timeframe -- I believe was looking at a complete injection of LPCI into an unrodded core. The water basically accumulated in the upper plenum above the core and then fell into it almost as a slug. That's where the reactivity excursion came from.

MR. CONTE: One more question before we go off the record. I am going to ask you to stay on the line after we go off the record because the Court Reporter may have some questions for you on some terminology that you used. One more question.

Have we asked the right questions? Do you have anything to offer or would you like to clarify anything that you have made statements on about the topics this morning?

MR. SMITH: Maybe a quick summary of points. I believe the operator was correct in entering the Contingency 5 procedure based on not being inserted and the reactor was shut down. It would appear that he made that determination and correctly left that procedure that the reactor was shut down. I guess those are the only summary of what I have of it.

MR. CONTE: I guess the other main point that you made based on the situations that we gave you was that these

legs are all consistent with one another.

MR. SMITH: Yes, that is true. I believe that they are. I believe that the Procedures Committee has taken significant efforts to assure that they are consistent with each other.

MR. JORDAN: Phil, the document that you mentioned about the calculation of the cold water injection, is that GE's?

MR. SMITH: That is General Electric's. I believe that it is probably GE proprietary. It is not a document that I have ever seen physically -- physically seen. I have no knowledge in what state of documentation it is, whether it is a formalized calculation that General Electric did, whether it is just some analysis that one of the engineer's happened to run. I don't know in what condition it is.

As I said, I have never physically seen it.

MR. CONTE: Okay, we are going to go off the record and ask you to stay on.

[Whereupon, at 11:09 a.m., the meeting concluded.]

REPORTER'S CERTIFICATE

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

in the matter of:

NAME OF PROCEEDING: Philip Smith

DOCKET NUMBER:

PLACE OF PROCEEDING: Bethesda, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Mary C. Larkin

Official Reporter
Ann Riley & Associates, Ltd.