NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:

THREE MILE ISLAND
SPECIAL INQUIRY DEPOSITIONS

DEPOSITION OF ROBERT KEATON

Place - Middletown, Pennsylvania

Date - Wednesday, October 10, 1979 **Pages** 1 - 98

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ACE - FEDERAL REPORTERS, INC.

Official Reporters

444 North Capitol Street
Washington, D.C. 20001

NATIONWIDE COVERAGE - DAILY

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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DEPOSITION OF ROBERT KEATON

Trailer #11
Three Mile Island
Middletown, Pennsylvania

Wednesday, October 10, 1979
9:30 a.m.

BEFORE:

For the Nuclear Regulatory Commission:

HARMUT SCHIERLING, Special Inquiry Group
DENNIS ALLISON, Special Inquiry Group
BARRY HORVICK, Special Inquiry Group

C O N T E N T S

WITNESS:	EXAMINATION
Robert Keaton	3

P R O C E E D I N G S

(10:00 a.m.)

MR. SCHIERLING: This is an interview of Mr. Robert Keaton of GPU by the NRC Special Inquiry Group. The interview is taking place at TMI-2 site on October 10, and the time right now is approximately 9:50.

The people present are -- why don't we introduce ourselves for the record?

MR. KEATON: I'm Bob Keaton from GPU.

MR. SCHIERLING: Excuse me, Bob, is that spelled K-E-A-T-E-N or O-N?

MR. KEATON: O-N.

MR. ALLISON: Dennis Allison for the NRC.

MR. HORVICK: Barry Horvick, Consultant with the NRC Special Inquiry Group.

MR. SCHIERLING: And my name is Harmut Schierling, also with the NRC.

Whereupon,

ROBERT KEATON

was called as a witness and was examined and testified as follows.

BY MR. SCHIERLING:

Q Bob, before we go on the record, I showed you our standard witness notification form. Did you read that notification and do you understand its meaning?

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A Yes, I did.

Q Okay. I want to talk today about your participation and knowledge of your -- of the TMI-2 accident. Before we go into details, let me ask you what other depositions or interviews were you involved in?

A There was the NRC/I&E interview. And then I have testified twice or reported twice before the -- in one case, the Subcommittee of the Advisory Commission and in the other case. the full Committee. I have had considerable informal dealings with the staff of the Kemeny Commission, the Presidential Commission.

MR. SCHIERLING: Okay, Dennis, why don't you at this time go ahead with the questions that address the areas of your concern?

MR. ALLISON: I would like to go off the record for a second.

(Discussion off the record.)

MR. ALLISON: Back on the record.

BY MR. ALLISON:

Q Mr. Keaton, your I&E interview on page 5 indicates that at about 11:00 in the morning when you were meeting with a group of engineers, you were talking with them about going to the site, your interview indicates that Mr. Wilson came in and told you that the accident was more serious than you had previously thought, to break the meeting up, to get

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the guys on the road, and I presume to come to the office and talk to him about it. Is that correct?

A Yes, yes, that is correct.

Q At that time, did he say why the accident was now more serious than had been previously thought?

A I don't remember the details of it, as I did not when I was in the I&E interview, but I think it's possible that that is the time when we first knew that the main coolant pumps had been turned off.

Q That possibility struck me, because he indicated in his interview that it was about 10:00 when he found out about that, and that that was a point of increasing concern.

A Yes.

Q For him?

A Yes, as it was for me since I learned of it.

Q Did you go to Mr. Wilson's office or Mr. Arnold's office and meet with him after you wrote that meeting up?

A My best memory is, I went first to Mr. Wilson's office, and we had some discussions there. I think maybe someone else was there, but I'm not 100 percent sure. And then I believe we went to Mr. Arnold's office. From that point on in the day, we were basically either in Wilson's office or in Arnold's office, or we were in between relating to something. Discussions during the day, we were joined

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by other people. I think it was at my suggestion that Mike Morell, M-O-R-E-L-L, was pulled out of the same meeting that I had started the day in. And he joined in the discussions, and I believe Ed Wallace also joined in. Both of those two gentlemen are ex-nuclear Navy, and that was the particular reason we wanted them.

Q Do you remember anything of that first discussion when you went to probably Mr. Wilson's office?

A Not really. The main thing I remember from that point in time is -- and also into the afternoon -- is the fact that we were concerned that the coolant pumps were off, and at that point we did not understand why somebody did not simply turn them back on. And we were saying that that was the line of action that we would recommend.

Of course today I understand that it wasn't quite as easy at that time as we thought it would have been, but our comments were very much along the line that those pumps are to be turned back on.

Q Are you pretty sure that you knew that the reactor coolant pumps were off during the morning?

A I think it's very likely. I can't be 100 percent certain. I think it was late morning when we first learned of that.

Q Your previous interview indicates pretty fully that you were very concerned about the reactor coolant pumps

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being off during that day. Did you or your people go through a logic process at that time when -- something like this -- reactor coolant pumps are off, the next way to cool the core is through natural circulation?

Now is natural circulation is working, the core is being cooled and things are all right. If things are not working, the core is not being cooled, and things are terrible. Or were you rather in a vague position of wanting the pumps to run without going through that logic?

A I don't believe we went through that careful of a logic process, but to the best of my memory, it was either early morning or late afternoon that we had -- excuse me, I meant to say late morning, early afternoon. I hope that's what I said. I believe it was right in that time frame that we received data on the hot leg and cold leg primary loop temperatures, and when we did receive that temperature data, it was certainly indicative of the fact that there was not a normal cooling mode for the core.

Q That indicated, then, to you that core cooling didn't seem to be progressing normally. Was that a point of increased level of concern?

A Very definitely. I'm sorry. I'm a little foggy about the times during the day that this actually happened, but I do remember being in Mr. Arnold's office sometime in the afternoon and getting an updated set of temperatures

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that somebody on the other end of the phone line out here -- and I don't even know who it was that we were talking to -- in that point of time indicated that there was some sub-cooling, and we were skeptical. And I personally remember going and getting a steam table, and we looked up and found that in fact the pressure was right on the saturation curve, and that definitely increased our concern.

Q Do you remember what temperature data you got which prompted this increased level of concern, and specifically, I guess, were they hot and cold leg temperatures, and did you have readings or just the fact that they were off-scale?

A The data that I was referring to when we were in Mr. Arnold's office was specifically the hot leg and the cold leg temperature readings from each of the two loops. And we did refer numerical values, and we quickly confirmed that the hot leg value was the upper end of the range of that instrument.

Q So you were given a reading?

A A numerical value.

Q 600 degrees or whatever?

A Right.

Q And you quickly found out that that was the upper limit of the instrument?

A Right. In fact, the person who called us may have

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told us that either that or someone there knew that. So we realized that they were off-scale high, as far as the hot legs were concerned. We did not receive any core temperature data at all.

Q So you had no core thermocouple readings at all?

A That's correct. In fact, I did not know the core thermocouples for approximately two weeks.

Q So we're at a point -- and I guess the time is uncertain -- but you knew that hot leg temperature, you had numerical values, you knew the hot leg temperatures were at least a certain value, and that was about the saturation level for the pressure to exist in?

A Right.

Q Did that tell you that natural circulation was not working, or did it only give rise to a lot of concern about whether it was working?

A The implication to me was certainly that natural circulation was not working.

Q Do you remember, if you can tell, that the system was highly superheated or just about the saturation temperature?

The reason I ask that -- let me follow up on this. I suppose -- and you can correct me if I'm wrong -- that temperature at about the saturation level doesn't conclusively prove that natural circulation is blocked.

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A I don't remember for sure how much superheat there was that was indicated by those readings. My reason for concluding that natural circulation was not occurring was the large difference between the hot leg and the cold leg temperature reading.

Q So at this point, am I correct, you had -- you were pretty sure that natural circulation was not working? And so that at this time, you had an even higher level of concern about starting reactor coolant pumps. Is that right?

A I think that is probably correct, but I should be honest and say that I don't remember that we went through the kind of careful analysis that we're doing today. I think it was more of a reaction to what appeared to be a very unusual and partly undesirable plant condition and strong feeling of discomfort with regard to whether the core was really being adequately cooled, and the natural reaction to that was to turn on the pumps.

And I do remember that during that time we were by that time -- I mean the afternoon -- we were recommending that they increase the primary system pressure.

Q Did you -- this concern about natural circulation, did you convey this to Mr. Arnold and Mr. Wilson?

A Well, Mr. Wilson and I shared the concern, and we agreed among ourselves that we thought the pumps ought to be

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turned back on. And, yes, we very definitely conveyed that to Mr. Arnold. I believe he was of the same opinion. It was also during that same time period that we became aware of the problems in the condenser and specifically with the vacuum in the condenser. We were told that the plant was wqorking to reestablish vacuum, and we definitely supported that activity on their part.

Q Do you remember any particular person or time when the concern about natural circulation initiated? The first question, whether natural circulation was working or when it was first questioned?

A I don't remember specifically when natural circulation itself was first questioned, but to the best of my memory in the discussion in Mr. Wilson's office late in the morning, in addition to knowing that the pumps were off, I believe that we had at that time some temperature data that made us feel uncomfortable.

Q So it sounds like your best recollection is probably about the time you found out the reactor coolant pumps were off is when the questioning of natural circulation came up?

A Yes, I believe that's the time period in which we first felt real uncomfortable with the condition of the plant, yes, sir.

Q Did you use this temperature data to further infer

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that there was steam in the core on Wednesday afternoon?

A I believe not. To the best of my recollection, I do not remember on Wednesday any real concern that I felt or that I had heard other people express about damage to the core. And I'm sure we would have felt that on Wednesday if we had thought that it had been vapor blanketed.

Q So you were able to conclude that natural circulation probably wasn't working and something had to be done to cool the core, but you were not able to conclude on Wednesday that the core had been badly steam blanketed for a long time?

A I think that is correct. To the best of my memory, and I confess I'm very much uncertain about this, but to the best of my memory, we were aware at the time we started getting numerical data that high pressure injection or at least makeup flow was being supplied. And so I do not remember anyone concluding that the core had been uncovered. Of course, it's hard to be sure because we know so much more now. It's hard to go back and remember what you knew at that particular moment in time.

Q Well, you led perfectly into my next question. I guess another way to cool the core is to run the HPI pumps, and you knew the relief was open. Were you aware that morning of a B&W analysis on how to cool the core that way without natural circulation or for circulation from the

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reactor coolant pumps?

A I was not personally aware of it, no.

Q Do you remember if your people were aware of it and talked about this method of cooling -- well, pardon me. Let me rephrase the question.

Did people mention to you either the B&W analysis, or did they state as a fact that this method of cooling would work?

A I honestly don't remember. The man who reports to me that I would normally go to with that type of a question was on the way to the site. That's Gary Broughton, B-R-O-U-G-H-T-O-N.

I think it's possible that one of the other people mentioned it, but I just really don't remember.

Q Were you ever aware on Wednesday that that was a plan the operators were using, that at sometime during Wednesday they felt that that was the way that they were cooling the core, by pumping in HPR water and discharging steam through the PORV?

A I don't believe so.

Q So far as you knew on Wednesday, the two plans for cooling the core were forced circulation with the reactor coolant pumps or natural circulation?

A Yes, to the best of my memory, that's all. I think I do remember talking about using makeup or high pressure injection as a method of repressurizing the system,

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but I don't remember any explicit discussion of it as providing core cooling. But again, I must tell you that I'm not certain about that at all.

Q It sounded like from some of your previous remarks that you might have drawn some comfort about core cooling from the fact that they were telling you the HPI was on?

A Perhaps, but I don't remember feeling very comfortable frankly. I remember feeling very uncomfortable.

Q So that statement didn't give you much comfort about core cooling?

A But I think it is true that to the extent that I knew that it might have not forced me to conclude that the core was not covered, but I would not have felt any comfort from simply knowing the core was covered without having any circulation path.

MR. ALLISON: Let's go off the record for a second.

(Discussion off the record.)

MR. ALLISON: Let's go back on the record.

BY MR. ALLISON:

Q Another plan that the operators had during that day was to depressurize and start the decay heat system. I'm drawing a distinction here because maybe it was all balled up with the previous plan we were talking bout -- flowing the steam out and pumping in high pressure injection

water. But anyway I will draw the distinction and say another way is to depressurize the system and start the decay heat pumps.

Were you aware on Wednesday that that was a plan that they had in mind?

A I'm reasonbly sure that I was not aware of that. I have absolutely no memory of it -- any recollection of that being discussed.

Q Then if you weren't aware of that plan, did you see any point in having the pressure low?

A No, and as soon as I heard about the pressure, I remember immediately feeling that the pressure should be increased. Also, though I guess I should make sure that you understand that not only were the communications between us and the plant obviously very limited, but we were aware of the fact that they were very limited, and we were aware of the fact that they plant might have much more detailed plans and/or knowledge of conditions than we had.

So we realized that we were sort of on the outside looking in.

Q So you were very aware of the limitations on your information and, thus, on your ability to make the correct recommendations?

A Right. And that changed with time during the day. And by late afternoon when we were more or less

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permanently meeting in Mr. Arnold's office, and he had been directly on the phone with Jack Herbein and with others out there, we felt that the quality of our information was substantially improved. And that was the period of time that we actually, formally fed back through Mr. Arnold our recommendation to increase the pressure and try to restart the cooling pumps.

Q Was that a strong recommendation, as you recall?

A Yes, sir. I recall Bob Arnold talking to Jack Herbein on the phone and stating the equivalent that that was a unanimous recommendation on the part of the people who had reviewed the situation there, there in Parcippany.

Q So you were pretty sure by that time that you had enough data to say that was the correct course of action?

A Yes.

Q But that sureness was something that developed during the day?

A Yes.

Q So at noon you would not say the same thing or sometime earlier?

A To the best of my memory, along about noon it was simply a feeling of discomfort with what we saw, particular discomfort that the pumps were not running, but also discomfort with the amount of information that we had available.

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Q In between those two times, Mr. Arnold in the I&E interview says that at 1400, about 1400, he called the control room and expressed strong concerns about wehether the primary system was solid. Do you recall that phone call?

A I think it is quite possible that that call is the one that he made after we had gotten data in his office, and as I described earlier, had gone and gotten a steam table and then looked and compared the temperatures and pressure conditions in the primary loop. And that would be approximatley the correct time frame.

Q That sounds logical, because that's the time then at which you knew the system wasn't solid.

A Yes.

Q Do you recall what was -- well do you have any idea why that concern was rejected in the control room?

A I don't remember receiving the impression that it was rejected. I think it's quite possible that it was at this time that we were told that we were trying to reestablish the vacuum in the condenser and that they had regarded that as a necessary step in the progress of reestablishing core circulation.

Q Well, that really isn't necessary for forced circulation, is it?

A It's not necessary for forced circulation, but

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it's necessary or at least it was regarded as necessary for the heat sink for the forced circulation.

Q The point I'm getting to is that you don't need it for heat circulation either if you are willing to dump steam in the atmosphere. But the operators were working under a restriction at that time.

A We did note that we had been told at the request of the Governor that the dump to the atmosphere had been terminated.

Q Let me diverge just a second and ask you, do you have any firsthand knowledge about the state's pressure in this area?

A No, I do not.

Q Do you know who told you about it?

A To the extent that we knew about it on Wednesday, I'm reasonably certain that the information would have come in through Bob Arnold. I was again told about it later by Gary Broughton, but that was on Friday.

Q Okay. Then the reactor coolant pump was started, strong recommendation was made at about 1630 by Mr. Arnold to Mr. Herbein. It was accepted and the pumps were started?

A Right.

Q Your I&E interview -- first, by the way, I'm just going to mention for the record that with the damaged core, I don't think any of these other methods would have worked,

mgcDAR

or at least there is a good chance, so in my previous questioning, I have indicated -- well, natural circulation would work. Well, you didn't know you had a damaged core, a badly damaged core. The chances are good it would not have worked, and starting the reactor coolant pump is the only thing that would.

A Can I comment on that?

Q Yes.

A In fact, if we had been able to reestablish a solid primary system, I think natural circulation would have worked, even with the damaged core. But of course --

Q Maybe with the pressure high, it would have.

A Well, I think not only the pressure high, but I think it would have helped to eliminate most or all of the voids in the primary system, and that would have been very difficult at that time. We didn't know that.

Q You didn't now that at the time. Well, anyway that's not the point of the interview. To go on then, your I&E interview on pge 6 indicates that on Wednesday evening when you went home, you were comfortable with the situation, and you stated one of the reasons at least was that the radiation releases had been small.

A At that point in time, we -- at least I -- believed that they had been small. Yes, sir.

Q. Now, was it also a large part of the reason that you felt comfortable that you had established a core cooling again?

A. Yes, very definitely, because after the pump was turned back on, we were given new data from the hot leg and cold leg temperatures which indicated that they had been converged back into a perfectly normal cooling mode.

Q. So you knew the core was being cooled?

A. We knew the core was being cooled and I, at least -- I believe it is true for most of the others, did not realize that there had been significant radiation releases and so I am fairly positive on this point, because I remember having discussed with people and specifically with Mr. Arnold on Thursday that were directed toward what was going to need to be done to get the plant back on line, a type of discussion that was thoroughly inconsistent with what we now know was the condition of the plant.

Q. I wonder if you could describe for me the idea that you had in mind on Thursday. I have a couple more questions to come back to later on Wednesday afternoon, but what kind of an effort did you think would have to be done to get the plant back operating?

A. I don't remember too much of the details. As you know, on Thursday Dick Wilson had left to come to the site, and Thursday afternoon Bob Arnold called me into his office

rmg 2

and was trying to start to think of the organization that would be necessary to get the plant back on line, and the tasks that would be needed, and we spent just a couple of hours discussing it, and things changed so radically the next day that I don't remember very much of the details.

I am sure one part of it was investigation of the transient itself, similar to what we had done approximately a year later, when the main system safety valves had stuck open.

Q. Did you have in mind investigating what happened possible making some equipment changes to prevent reoccurrences?

A. Yes, from that part of it I am fairly sure that we were thinking in terms of the effort a year earlier in which that is exactly what we did. We went through both a qualitative analysis of what the transient had been on a little slow time scale, and qualitative statement.

We did recommend and carry through some recommendations to instrumentation and so forth. And I think those were the kinds of things we were thinking of.

Q. Possibly some procedure changes that had to be done. Did you also then think you had to meet with the NRC and satisfy them that the necessary equipment procedure change had been made so it wouldn't happen again?

A. I am sure that was underlying our thinking. I don't specifically remember discussing that, but it may have not been discussed simply because we all knew it was something

rmg 3

that needed to be done.

Q. And were you also thinking you would have to clean up the containment, possibly strip insulation and clean chlorides off the pump?

A. I think -- I'm sure we were thinking of some clean-up. I don't remember the details regarding that.

Q. Okay. Back to Wednesday evening. Do you remember specifically what you knew about the radiation levels or radiation readings?

A. As far as I personally am concerned, I believe that I thought that there had been no significant off-site releases.

Q. And I guess that was a key part of your knowledge, then, the radiation readings at that time?

A. Very definitely.

Q. Were you aware of the containment dome monitor readings?

A. No, none of us would have felt even the slightest bit comfortable if we had known what the readings were.

Q. So had you know levels of radiation inside the containment, either the dome monitor or the lower monitors, I guess you would not have been comfortable with that?

A. My perception would have been quite different as to what had very likely happened. There again, I think what you are seeing is a reflection of the various limited information that we had.

rmg 4

Q So I guess you made no interpretation -- did you make an interpretation about what you did know? Did you make any interpretation from what you did know about radiation concerning core damage?

A I don't remember explicitly discussing it. I think it's rather the case that not knowing about the radiation releases, we simply didn't really worry about core damage.

Although I think it is likely that in the discussions on Thursday that we included in our thoughts, either some analytical approach to whether the core had been uncovered and maybe even some physical inspection of fuel, in spite of what we thought then was the restart effort.

I suspect, again, we were guided by our experience of a year previously when we had been able to show analytically that the core had not been uncovered, and even though there was some void formation in the primary system and I am not sure, but I suspect that we were planning to do the same type of thing.

Q And you suspect that you thought if it couldn't be done that way, you can expect --

A That is as good as I can remember, yes.

Q But you do think that that feeling persisted through your Thursday discussion?

A Yes. In fact, I believe that I actually told somebody from Argonne National Laboratory, who called me

rmg 5

personally on the transient, I believe I told him on Thursday that there had been no significant off-site releases.

Q. And I presume that your inference in terms of public health was that there had been no effect?

A. That there had been no problem, exactly.

Q. Some key pieces of information that you said you didn't have on Wednesday are core thermocouple readings, containment radiation levels, the hydrogen, the containment pressure spike, and I guess you didn't have the actual core thermocouple readings -- or pardon me, I guess you didn't have the actual hot leg temperature readings either. You only knew that they were pegged high?

A. That's correct.

Q. So you didn't know actually how much superheating there was in the hot legs?

A. That's right. In fact, it was a very long time before we got that piece of data.

Q. So do you think that your reaction would have been much different if you had known any or all of those pieces of information?

A. I think there is no doubt that our perception of the magnitude of the core damage would have been quite different had we known about either the thermocouple readings or the real radiation levels in the containment building. I doubt if having the actual hot leg temperatures would

rmg 6

necessarily have led us to the same conclusion, if that had been the only extra piece of data that we had.

Q. Sir, so there is no doubt if you had known the thermocouple readings or the core re dings in the containment, that you would have reacted differently?

A. That we would have perceived differently the core damage. Now, our immediate reaction, of course, would have been the same, to repressurize the system and get the pumps running, but I don't think we would have gone home feeling comfortable on Wednesday evening.

Q. You might not have gone home at all.

A. That's very possible.

Q. How about the containment pressure spike, do you think that would have clearly indicated anything to you?

A. If we had simply known that piece of data without any of the other things that we were talking about, I don't know, because there might have been a temptation to interpret that as simply a noise spike on the instrumentation.

Q. Is that exactly how many of the operators interpreted it?

A. Had we known that and also known things like the core temperature readings and the general radiation level in the building, then yes, we might have correctly interpreted that.

Q. But just that sharp pressure spike.

rmg 7

A. That by itself might very well have not.

Q. Now, on Thursday, did you learn any more about the condition of the plant? Did you learn about any of the key things that we were just talking about that would tell you that there was core damage?

A. To the best of my memory, no. I believe that I did have a conversation with one or more of the GPU people who had left on Wednesday to go to the site, but the best of my memory is that the feedback we got from them on Thursday was that they were just in the process of collecting the data and would be prepared to give us a better report the following morning.

This is borne out by the fact that the notebook I keep notes in of telephone conversations doesn't really have a record of that conversation. And had they been giving me plant data, I would have been sitting there writing it down, and I did on Friday morning.

Q. Even if you didn't know there was a big problem, you would have written the data down?

A. Right, because there were lots of people who were interested in what was going on and I would have been taking notes to make sure that I passed that along accurately.

So I think it is reasonable to infer from that that I did not get any significant data on Thursday.

Q. Okay. Now, I think you did get that report on Friday

rmg 8

morning from Gary Broughton?

A. Yes.

Q. About what had happened. Can you recall what data, what information he gave you that indicated that you had major core damage at that time?

A. I'm sorry, I didn't bring the notebook along with me. And as this is a critical point, I can get a copy of the notes I took during that period of time.

What I remember Gary giving me was a fairly clear description of the transient, including the fact that the PORV had stuck open, including the fact that the emergency feedwater valves had initially been closed, and including the fact that the pumps were turned off 100 minutes into the transient.

At that time we still did not know about the in-core thermocouple readings that had been taken from March 28th.

Q. You didn't know about containment pressure spike, did you either?

A. I'm not sure. We did know at that time that there was still a bubble in the primary system and that it was assumed to be a hydrogen bubble. And that of course immediately leads the presumption of very much more core damage that we had thought up until that time.

Q. Right.

A. I suspect, although I don't remember completely or clearly, I suspect it was the information on the hydrogen

rmg 9

bubble that led us to think there was massive core damage.

Q. Do you remember if you know about the containment radiation levels?

A. I'm not sure, but I suspect that we did at that point.

Q. About the reactor coolant pumps being turned off at 100 minutes, do you remember if Mr. Broughton had looked at temperature traces of what happens in the hot legs and cold legs when those reactor coolant pumps were turned off?

A. Again, I'm not sure, but I believe he had.

Q. Do you remember if you interpreted in terms of natural circulation, if it was blocked and the core became uncovered?

A. To the best of my memory, yes, but again, if it is a critical point, I can go back and inspect the notes.

Our understanding was growing very fast in this time period. And to the best of my memory, I got a pretty good rundown on all of that from the very first time I talked to him on Friday, but it is possible that over the next 24 hours that some of it became clearer.

Q. Have you given those notes to the NRC, to your knowledge?

A. To the best of my memory, I have not. I think I mentioned them to them in the I&E interview and they are available.

rmg 10

MR. ALLISON: Off the record.

(Brief recess.)

MR. ALLISON: Back on the record.

BY MR. ALLISON:

Q. Mr. Keaton, will you provide copies of your notes up until April 7th related to the TMI accident to Mr. Guerin to afford to us?

A. Yes, I will.

Q. Despite some uncertainty as to which pieces of data you had and didn't have when Gary Broughton briefed you on the transient on Friday morning, because it is very clear there was substantial core damage?

A. I would say yes, I also had the benefit of Friday morning of an earlier brief conversation with Dick Wilson, who by that time was on-site and he communication both that the damage had been more severe than we had originally believed, and also that the plant was not yet in a stable cool-down mode, and specifically the problem with the hydrogen bubble.

So based on those two conversations, I think there was no question in my mind at that standpoint that we had suffered core damage.

Q. And you also knew that the plant was not yet is a stable cooling mode.

A. That's correct.

rmg 11

Q So the situation had yet to be brought under control?

A That's right. And shortly after the telephone call with Mr. Broughton, by prior arrangement I went and talked to Mr. Dieckamp and Mr. Koons and communicated this information to them.

Q Did you go into much detail with Mr. Dieckamp and Mr. Koons?

A Yes, I went into basically the same amount of detail that Mr. Broughton had given me.

Q Pretty much everything he told you you told them?

A Yes, yes.

Q And Mr. Dieckamp has a strong nuclear background, does he not?

A Yes.

Q So he understood the meaning of all this, all the data?

A Yes.

Q Does Mr. Koons have a nuclear background?

A I don't know to what technical steps he has any nuclear background. He is certainly generally conversant in nuclear power.

Q But did you tell him massive core damage and the situation had yet to be brought under control?

A Generally, yes, I don't remember the exact words that I used, but it was certainly that type of thing and

rmg 12

specifically I communicated the fact that Dick Wilson whom both of them know and have a lot of respect for, had found it very uncomfortable when I talked to him on the phone Friday morning.

Q. So you are pretty certain that Mr. Dieckamp and Mr. Koons understood what the situation was when you briefed them that morning?

A. I think so. Also, you might remember that during this period of time the radiation releases that were occurring on Friday morning were getting publicity and were known to them, so there was no question in anyone's mind that we had a radiation problem at that point.

In fact, they asked me if I knew anything about why the releases were occurring, but I did not.

Excuse me, off the record.

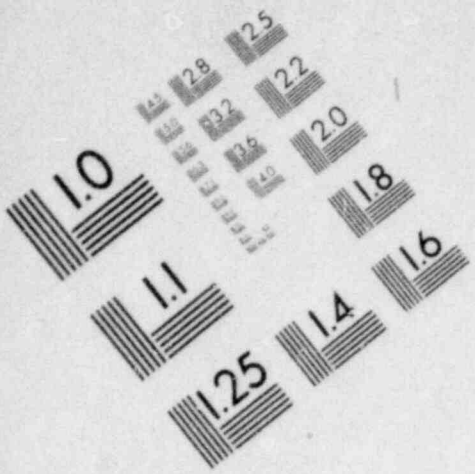
(Discussion off the record.)

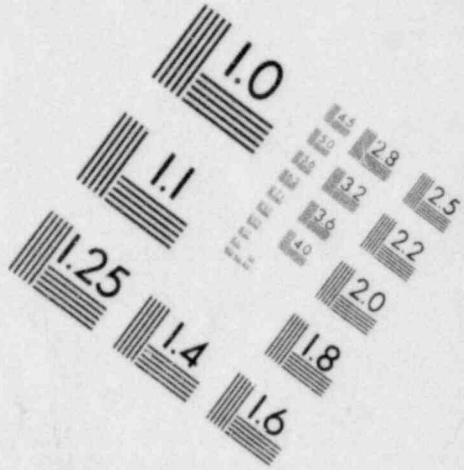
MR. ALLISON: Okay, we will go back on.

BY MR. ALLISON:

Q. So you didn't understand the reason for the radiation releases at that time?

A. Not on Friday morning, no. And I think that's understandable in that Gary Broughton had been sent out -- at that point we thought -- what had caused the original transient and we had not, at the time of Friday morning, really switched over from an investigation into a support





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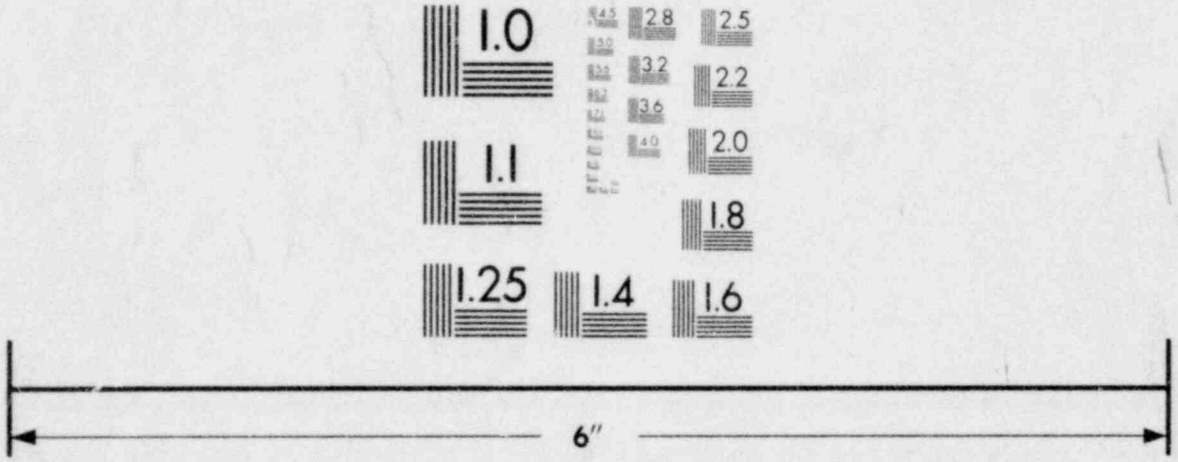

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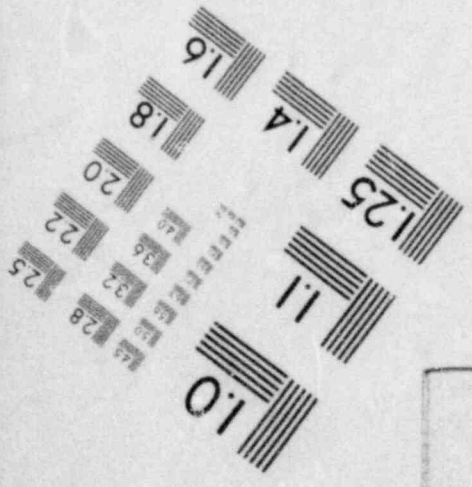

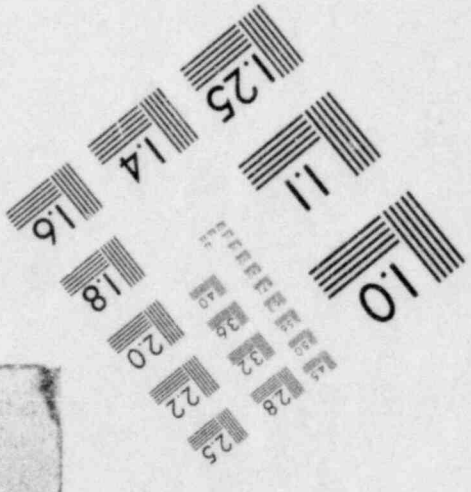

rmg 13

organization.

Q. Do you know if this understanding of the plant's condition that you gave to Mr. Dieckamp and Mr. Koons was news to them at the time?

A. Certainly I believe some of the details that I gave them were news, and I honestly don't know to what extent they had a better, big picture than I did prior to Friday morning.

Q. So you don't really know if the fact that there had been core damage and that further action was needed, you don't know if that was news to them, whether they may have gotten that from some other source?

A. No, I don't know that, but I would suspect that they already had some awareness of that.

One piece of data along that line is that Bob Arnold had elected to go to the site first thing Friday morning, I presume with the knowledge of Mr. Dieckamp and that certainly would indicate a discomfort with the current situation.

Q. Do you recall if after that briefing they told you what they were going to do?

A. No, I don't remember specifically what they said they were going to do. I do remember discussing with them the fact that we were starting to set up a support operation there in Parsipanny. That's really all I remember about that conversation.

Q. Do you remember what data told you that there was a

rmg 14

bubble in the reactor coolant system, a gas bubble? Apparently you said Mr. Wilson, Mr. Broughton, both told you that there was one, and in fact at that time < operators, I have from other sources, were trying to degas and get rid of it.

Do you remember if there was any specific information that was based on when they told you, or was it a conclusion that they gave you?

A. I don't remember being given the specific data that they used to determine they had a bubble, but simply I remember being told that there was a bubble.

Q. Were you aware of the news accounts of the accident on Thursday?

A. Yes, I think so. I don't remember them very well right now, but I do remember that Thursday was the last day I read a newspaper for quite some time to come.

Q. Did you listen to any radio programs on that day?

A. I think I probably went home and watched the 7:00 o'clock news Thursday night. I'm not prepared to swear to that, but I think it is likely that I did.

Q. Did you have any reason to think on Thursday evening or afternoon that things were worse than what you were hearing in those news accounts?

A. No, and I am reasonably confident of that, because you have got a couple of facts.

One is that I did not work real late on Thursday evening.

rmg 15

Second is, late Thursday evening I got a call at home from Bob Arnold who said that he wanted at that time, himself and myself, to get together with Mr. Dieckamp on Friday morning after I had been able to get data back from people who were at the site.

And even with this, I was sufficiently unconcerned, that Friday morning I went down to the local airport and took my previously scheduled flying lesson from 7:00 to 8:00 o'clock in the morning, which I certainly wouldn't have done if I had realized wnat the rest of the thing was going to be.

Q. Do you remember about what time Bob Arnold called you?

A. I think it was about 10:00 o'clock in the evening, to the best of my memory.

Q. Do you recall any more about what he said, other than he wanted -- what you just told me?

A. I don't really remember any more details, but I did not come out of that conversation with a feeling of alarm or renewed concern.

Q. In subsequent days, Friday, Saturday, Sunday, Monday, were you ever aware of any plans to vent containment?

A. You mean the containment building?

Q. Right.

A. No.

Q. Were you aware of any plans to build a huge charcoal

rmg 16

filter in the spent fuel pool for any purpose?

A. I believe there may have been some mention of it perhaps on Sunday when I was out there with the industry advisory group, but I don't believe I took part in any detailed discussions.

MR. ALLISON: I think that's all the questions I have, at least for now.

MR. SCHIERLING: I have a few follow-up questions on the items which Dennis talked about.

First let me ask you, Mr. Wilson -- Mr. Keaton, you mentioned earlier that you were engaged in other activities on March 28th. Were they not related to the TMI-2 event?

THE WITNESS: Initially, on the morning of March 28th, I was in a meeting in a motel down the street discussing administrative systems, and I was called out of that meeting by Dick Wilson, maybe 9:00 o'clock or something like that.

From that time on on March 28th I don't recall having done anything other than concentrating on what was happening at TMI.

BY MR. SCHIERLING:

Q. The first telephone call from the site upon which you were called in by Mr. Wilson, were you aware at that time of a site or general emergency that had been declared at Three Mile Island-2?

A. No, I was not.

rmg 17

Q. You were not. As you indicated earlier, during the entire day of March 28th, starting at about 11:00 o'clock, you became more and more aware of the seriousness of the event at TMI-2 based on the information that gradually became available to you.

Did you make any attempts to get in touch with the control room to obtain additional information to substantiate your concern or evaluate your concern?

A. I did not personally make any direct attempt to contact the control room.

Q. You mentioned earlier that your information was that you had available in Parsippany was limited and that you felt that because the control probably had more information available then you -- could that have been a reason why maybe you did not attempt to get in touch with the control room to substantiate your concerns?

A. I don't think so. I think, insofar as I can remember, I think that we were made aware early on, the communication with the control room was very difficult and that I think -- I'm not sure of this -- so I believed that we discussed whether we ought to try and directly make contact with the plant and get more data. We, being Dick Wilson, myself, and maybe a couple of other people.

And decided not to do that because of what was known to be the difficulty of communication. And I think we were relying

rmg 18

on the channel which had been set up which I think was primarily through Mr. Arnold to get the data.

Q. That was the channel of communication between the control room? Was that a direct line from the control room to Mr. Arnold's office?

A. I don't believe so. Well, I think -- in some cases, yes, he directly talked to the control room and in other cases he talked to the people, and specifically Jack Herbein, who was located across the river at the visitor's center.

I think it is possible, in fact, that we had actually been asked not to tie up communication lines by having superfluous calls into the control room.

Q. Did the control room staff ask you for advice?

end #2

A. No that I am aware of.

Q. Do you recall any discussion that went on on March 28 between Parcippany and B & W in Lynchburg regarding recommendations to pressurize or to run the reactor coolant pumps?

Did you personally have any discussions on that day with B & W?

A. I did not personally initiate any, no. What I'm uncertain about is late in the afternoon on the 28th, when we were in the process of really developing and communicating the strong recommendation to repressurize and start the cooland pumps, there may have been a telephone call from Mr. Arnold's office to B & W on that subject. I'm just not sure. I have what seems like a faint memory that there was some, and, if I had, I would have participated in the sense of being in the room while it was going on, but I'm not sure.

Q. Were there any discussions on the event between GPU and the NRC on March the 28th?

A. There were none that I participated in.

Q. Did you receive any feedback from the group, the first GPU group that went to the site on Wednesday? Did they provide you with any information on that day?

A. I believe we did receive a telephone call from someone in the group who reported that they had gotten out here. I don't remember -- and they might at that time have told us that it was difficult for them to get on site, but I certainly do not remember getting any data on the plant status back from

them.

Q. Did you make any attempt to contact that group to direct them to obtain information?

A. No, because we had already asked them to do that as part of their initial charter, but again, on Wednesday, when we sent them out, it was as an investigative team, not as a technical support team.

And so we still thought that what we wanted was to understand the transient so we would know how to go into the recovery and restart program.

Q. You discussed earlier your -- the briefing that you received by Mr. Broughton on Friday morning and that at that time there was concern expressed regarding a bubble. And you mentioned that you concluded it had to be a hydrogen bubble.

A. Excuse me. I don't think so. I believe that I was told that it was believed to be a hydrogen bubble.

Q. I see. What was the concern with regard to that hydrogen bubble? Was it with regard to establishing natural circulation in the loop, or was there any indication regarding a potential for an explosion?

A. I do not remember any concern regarding the possibility or an explosion within the reactor coolant system ever being expressed by anyone from GPU.

Q. At that time?

A. At that time or any other time being expressed by

GPU. As far as the problem of hydrogen bubble interfering with the ability to go on natural circulation, just how quickly that became a concern, I can't remember. Certainly during the period Saturday, Friday, Saturday, Sunday, that became a very overriding concern. But whether that was first thing Friday morning, I just honestly don't know. Certainly I think right from the beginning there was a feeling that it would be a good idea to get that hydrogen out of the primary loops, but I'm not sure whether our thoughts were as clear Friday morning as they were at the end of the day Sunday when we had very specific ideas of getting rid of the gas bubbles.

But I'm not sure that we had as clear of a concern about being able to go on natural circulation that we did, for example, by the end of the day on Sunday.

Q. Do you recall if there was any discussion on the bubble with B & W in Lynchburg on Friday on the impact of that bubble?

A. I do not remember myself participating in any discussions with B & W on Friday on the bubble, and I'm not aware of anyone else in the home office that did that. Perhaps I should say a few words about what was happening in the home office on Friday.

Basically the mode that we set up was to provide assistance on request to the people that were here at the site and our contacts from the home office or to the GPU people who had come

here to the site.

So that we would not and did not, for example, hear of something like the hydrogen bubble and ourselves start trying to take independent action to evaluate it. Rather, we were in the mode of supporting the people out here who we felt had a better understanding of what was going on.

So we took on, during the course of the day, Friday -- day, evening, and night -- a wide variety of different technical projects, but they were all things that were requested from the site where we were asked to carry them out or get Burns and Roe to carry it out.

But the primary organization that I remember as dealing with on Friday and Saturday was Burns and Roe, and I think the primary contacts with B & W were made directly here from the site to B & W rather than through us.

Q. We will get into those aspects later on -- the support of Burns and Roe of B & W. Right now, back to the hydrogen.

Was the hydrogen of any concern to you in Parcippany, and I'm talking about the hydrogen inside the containment, not in the reactor vessels. Were you aware of the hydrogen concentration that existed at that time, and were you requested to come up with a recommendation what to do about it?

A. At that point in time, we did not know what the hydrogen concentration in the containment was, although we did believe there was hydrogen in there. I specifically remember

this because I personally carried out several conversations with Atomics International personnel.

Atomics International had supplied the hydrogen recombiner for units 2, and we were concerned with getting their support to get the unit on line. And during the period of Friday and Saturday, when I was involved in these activities at the home office, Atomics International raised the concern of lighting off the hydrogen recombiner without knowing the concentration of hydrogen and the possibility that it might cause a flame to propagate back to the containment building.

And so as a result of that concern, there was a new installation put in in a fashion that allowed the containment building atmosphere as it was transported to the hydrogen recombiner to be diluted, so that there was no possibility of igniting a flame in the hydrogen recombiner. And we did that up to the time the recombiner was in operation, and then we could use the measured temperatures in the recombiner as a means of measuring the high concentration in the incoming gas.

Q. And was that diluted with nitrogen?

A. Yes.

Q. This all took place on Friday, Saturday?

A. That's right, because, well, the discussions with the Atomics International and the concern about lighting off the hydrogen recombiner and the desire to have it diluted occurred on Friday and Saturday. I don't remember exactly when the final

installation was completed. I believe it was another couple of days before we actually had it in operation, but the concern and decision-making process was in the Friday, Saturday time frame.

Q. Who was the individual at Atomics International that you talked with?

A. Wayne Meyers -- M-e-y-e-r-s.

Q. In your I & E interview, you stated that on Friday in the afternoon Parcippany was doing analytical and design tests in support of requests from the site. Can you elaborate on that or give an example what you mean by that?

A. I just can't by my memory tell you exactly things that were started specifically on Friday, but I can give you examples of the type of things that were done somewhere in that time frame.

For example, between our home office and Burns and Roe, there were calculations done of the peak pressure that could be withstood by the containment building. There was a lot of analysis done regarding the possibility of flooding the containment building with water as an ultimate heat removal mode. There were attempts to analyze the various degassification possibilities for the primary system, and many, many more.

And let me tell you that I believe that we have reasonably good records of those task requests that came into the home office and the dates which they came in. We have what was done with them.

Q. These were task requests that came from the site to the home office?

A. Right.

Q. Which you then either evaluated at the home office or worked to gather with Burns and Roe?

A. Right. And we may have, upon occasion, during Friday and Saturday, to an organization other than Burns and Roe. I just remember very heavy involvement with Burns and Roe plus work that we were doing ourselves. And it was on Friday that we at the home office set up and implemented a 24-hour operation.

MR. SCHIERLING: Off the record for a moment.

(Discussion off the record.)

MR. SCHIERLING: Okay, we can go back on the record.

BY MR. SCHIERLING:

Q. Mr. Keaton, we discussed the existence of task requests that were issued to the site to the GPU office, and you indicated that these, indeed, are available at the site. Would it be possible for us to look through these records in Parcipanny and, if necessary, request specific copies of specific tasks that we identify?

A. Yes, I'm sure that can be done.

Q. Okay. We will probably come back to you on that issue --

A. You understand that these task requests that I'm

referring to are largely items which were written down in Parcippany as a result of a telephone request from the site. They are not a piece of paper that originated here at the site and then was transmitted to Parcippany.

Q. You mentioned earlier that the involvement of B & W during the first few days -- and I think we probably are talking March 28th through Saturday the 31st?

A. Yes.

Q. -- was primarily from the site to B & W?

A. I think that is correct, and, in fact, it extends over the entire period, and not just those first few days.

Q. You also mentioned that the site -- by the site I mean the operation staff here -- would request your assistance at the home office. Was there at any time the need that you, from Parcippany, had to contact B & W? Were there cases where you were not able to -- where you were not able to respond to the site or provide the information requested?

A. I think there were probably cases where the home office staff did contact B & W, yes. Certainly we would have had no reluctance to contact B & W. It's just that my memory is that the types of problems that B & W was involved in -- they were being turned on more by the GPU people here at the site or by the Met. Ed. people here.

Q. You mentioned that during Friday, Saturday, that there were quite a few requests where you called in the Burns

& Roe people from -- I think it's Paramus.

A. That is spelled P-a-r-a-m-u-s.

Q. Can you elaborate on that, what some of the items were? You mentioned already containment peak pressure, the flooding of containment.

A. Yes. They certainly worked with us on the containment pressure, and I'm sorry, I just don't remember other specifics, but I think we can recover that information for you.

Q. All right. Now, these were mostly items as follow-ups to some of your earlier statements. I would like now to get into questions regarding your participation in the recovery effort here at the site.

Off the record.

(Discussion off the record.)

MR. SCHIERLING: Back on the record.

BY MR. SCHIERLING:

Q. Mr. Keaton, during earlier statements, you mentioned already your contacts with Atomics International, Burns & Roe. Can you indentify any additional contacts that you had with organizations outside the GPU, Met. Ed. organization through Saturday the 31st?

A. In terms of the support operations at the home office, as I mentioned earlier, we may have contacted B & W directly. I don't remember for sure whether we had contacts with some of the consulting firms that we normally use, such as Pickard,

Lowe & Garrick; MPR -- I just don't remember. I know they were involved later on, and I can't remember whether we, from there, contacted them.

Now on Saturday, I did have fairly extensive discussions with representatives from Cumbustion Engineering. This was really the start of the -- what later became known as the Industry Advisory Group.

Q. Would you -- can you recall who these contacts were with at CE?

A. Off the record for a minute.

(Discussion off the record.)

THE WITNESS: There was John West, Fred Stern, Jack Moulton, and two or three others on Saturday. I don't remember. They had come down to Parcippany at the request of Mr. Dieckamp, and also at Mr. Dieckamp's request, I met with them on Saturday afternoon and discussed their knowledge of the situation.

Q. Do you recall what the purpose was to call these people to Parcippany -- why they were called?

A. Yes. Mr. Dieckamp already at this time intended to set up what became known as the Industry Advisory Group, and the Combustion Engineering Contingency was simply the first of that group.

They stopped by Parcippany on Saturday afternoon on their way out here to the site, and, in fact, on Sunday morning I came out here with them. During that same time frame, Mr. Dieckamp was

calling individuals from a large number of other organizations, most of whom came directly to Harrisburg, rather than going via Parcippany, and were here in Harrisburg on Sunday.

Q. These individuals became part of the Industry Advisory Group?

Q. What was your personal involvement in the formation of that industry advisory group? It's my understanding that Mr. Dieckamp had asked you on, I think, Saturday, to come to the site and coordinate or direct the efforts of the Industry Advisory Group from the GPU management.

A. Yes. I think that is correct, and I think coordinate is a better description than direct their activities. He asked me to serve as a liaison between the remainder of the GPU and Met. Ed. organization and this industry advisory group.

Q. What was the basis for the selection of different organizations or individuals to that group?

A. I think it was partly to try to get a good representative cross-section of the nuclear industry in this country, to get individuals who could serve as an entry point back into their organization, so that it was not visualized that the individuals here on site would be the only ones working in support of the activities, but that, simply, they would be the focal point for anything that was being done by their orgnization back home, and, in many cases, which is exactly what happened.

The selections were also made based on Mr. Dieckamp's personal knowledge of people. Of course, he has a very broad knowledge of the nuclear industry, and in a couple of cases, I discussed with him suggestions of people.

We were looking for people with a broad understanding that could come in, understand what we had been through, and understand what the current problems were, and help to bring to bear all the resources that we could find.

Q. When were the first requests for participation filed at on the Industry Advisory Group? When were they made?

A. I believe that they started on Friday. In fact, I'm reasonably certain that they started on Friday. If there were any before Friday, I'm not aware of it.

MR. SCHIERLING: Off the record.

(Discussion off the record.)

MR. SCHIERLING: Back on the record.

BY MR. SCHIERLING:

Q. Mr. Keaton, to what degree was Mr. Dieckamp involved in the operations of the Industry Advisory Group once it had been formulated on Sunday?

A. Mr. Dieckamp was very directly involved in the -- what I might describe as the kick-off activities of the Industry Advisory Group. He came down to the armory on Sunday afternoon and spent a significant amount of time talking to the group about the types of things that he wanted the group to do and

the kind of support that he was hoping to obtain from them.

Once that was done, then over the course of the next week or two, Milt Levenson became the spokesman for the activities in this group, and, with assistance from a few others such as Ed Zebrowski, participated in the major decision-making meetings, which were held largely at the time in a trailer sitting across the river from the island. And I don't remember Mr. Dieckamp getting back with the total Industry Advisory Commission and participating in detailed technical discussions after the initial kick-off of the activities.

He did frequently, however, in the meetings that I referred to, where he and Milt Levenson and others were present, he did ask Milt Levenson to get the Industry Advisory Group to do this or something else.

Q. You mentioned that you were acting as a coordinator and also as liaisonbetween GPU and IAG?

A. Right.

Q. Can you elaborate on that? What specifically were the functions that you performed?

A. Yes. My initial function was to brief the members of the Industry Advisory Group on what we knew of both the transient that had occurred on the current status of the plant. I mentioned earlier discussions with the Combustion Engineering people on Saturday. And then I had a much more extensive briefing with the majority of the group on Sunday here and then

continued in the role of feeding the Industry Advisory Group information, updated information on the status of the plant.

I participated in the group's deliberations, primarily on Sunday afternoon, late, and on Monday, in which the advisory group itself set up som substructure assigned task, and then I worked with some of the groups in actually carrying out their tasks, and also served to get people to obtain information on -- for them.

I had three or four people from GPU who were working for me, simply in an information gathering role for the advisory group, and then carried out a function of communicating the results of the Industry Advisory Group's activities back into the GPU organization here at the site.

Q. That brings me to the next question on this issue.

How were the results and recommendations of the Industry Advisory Group -- how were they integrated and implemented within the Arnold recovery organization?

A. In more than one way. For the first two or three days -- by that I mean Sunday, Monday, and I think Tuesday -- the Industry Advisory Group had been assigned a certain number of aspects of the operation in which their recommendation was sought, and they prepared written documents which did this evaluation and made certain recommendations. These documents were used by myself and others to feed the information back into the remainder of the Arnold organization.

I think more effectively than that, however, was simply the direct participation of Milt Levenson in the planning and decision making meetings. Starting on Sunday afternoon, this organizational structure under Bob Arnold was developed, and there were a number of what in a conventional organization might then be called department heads, who were set up under Bob Arnold and who participated in these planning and decision making meetings. And Milt Levenson was one of those.

So that when the meetings were held, and there were decisions to be made, Arnold would ask for the input from the Industry Advisory Group through Milt Levenson as well as, for example, asking for the NRC viewpoint, requesting for the technical support organization's viewpoint.

Then, a little later, and this is perhaps past the time frame that you're addressing, there were cases where, for example, a specific plan or a specific procedure even was reviewed by members of the Industry Advisory Group, and their comments factored back in.

For example, the procedure for transition to natural circulation was reviewed this way. During the first two days, I think, the major contribution that the Industry Advisory Group made was on the subject of the possibility of a hydrogen explosion inside the primary system, and specifically, Ed Zebrowski from EPRI took the lead in pulling together a cross-section of the industry knowledge on whether such an explosion

was possible and, in fact, arranging for an outside expert in hydrogen explosions from NASA, N-A-S-A, to come and work with us on this issue.

So I would say that the feedback from the Industry Advisory Group on that subject was probably the first concrete assistance that this organization, as a whole, had. And, of course, in that case, the feedback was primarily into the NRC who had been the one who had taken the lead in the concern on this.

Q. You mentioned that the input was primarily to the NRC --

A. In the specific case of the possibility of a hydrogen explosion, the primary system, this is a concern that had been raised by the NRC, and the NRC was very anxious to get all the possible information in order to see whether their original concern had been valid or not. And so in this case, although the input came into the total organization, the people that it was really directed toward was the NRC, in an attempt to convince them that they concern was not valid.

end T-3

pv DAR

Q Can you comment on the interaction of the industry advisory group and the NRC?

A In general, it was only through the total organization that was set up under Bob Arnold, the senior NRC person present, sat in on the planning in the same way that the senior advisers did; and interaction was largely through the mechanisms of those meetings.

In the particular case of the possibility of a hydrogen explosion, I believe that there was some more direct interaction in the sense that Ed Zebrowski and the people supporting him, I believe, fed directly to the NRC some reference in the technical literature that were relevant to the question being considered.

Q You mentioned that the potential for a hydrogen explsion was one of the IAG evaluations of the aspects, was one of the major contributions by the IAG. Can you mention any others, any major contributions?

A Yes, I think there were others. One was the general considerations associated with the transition to natural circulation. This wasn't a unique contribution from the industry by the group in the sense that there were other organizations and other groups also working on this, but the industry advisory group was asked to participate in making the recommendations and to review the plans and to independently critique the idea of what we wanted to do, and

DV DAR

they did in fact do this.

And in the case of the transition to natural circulation, they and the other parts of the organization, our own support organizations and so forth, were able to agree on what was a desirable plan. And so -- but it was a strong contribution in the sense that it gave us confidence that an independent review arrived in the same result as what we had arrived at.

Q Do you know of any difficulties that were encountered in the operation of the IAG in its interaction with GPU or with NRC? And let me expand on that a little bit and ask you what the GPU response to the accident would have been without IAG?

A The first part of your question -- I am not aware of any peculiar difficulties that arose in the relationship between the industry advisory group and either the GPU or the NRC. I am sure you understand that there were continuing difficulties of the type associated with the fact that this was a very newly formed organization which had been sort of, in some sense, grown on and ad hoc basis. Communications, even once we were here all on site, were extremely difficult.

It was very difficult to get accurate information to everyone and make sure that everyone had the same information. So, there were continuing difficulties of that

BY DAR

type that the industry advisory group simply shared in along with all the rest of us.

And as time went on, the organizational portion of those difficulties at least did tend to smooth out as we got a better understanding of how the organization functioned and, in fact, made some provisions to the way that the organization functioned.

In general, I think our operations here would have proceeded pretty much the same way without the industry advisory group as they functioned with it. Generally speaking, as for an example, in the case of the transition to natural circulation, the industry advisory group simply concurred with the plans which we had already developed independent of them, or they participated in developing the plans, in many cases but it's impossible to single out their specific contribution rather than just being a group activity that made the decisions.

I think that one important part of their activity, though, was to give us a confidence that an independent review didn't show any oversight, or, if there were any oversights, that they suggested them to us. There were specific things that participants in the industry advisory group did that maybe we would have found it more difficult to do without their assistance. I mentioned already the hydrogen explosion issue, and certainly GPU itself did not

BY DAR

have immediate access to all of the resources that the industry advisory group was able to draw in order to address that issue.

Another example had to do with the core thermocouples. And it was, in fact, the activities of the industry advisory group, or at least participants in the industry advisory group, that eventually led to a direct readout in the control room of some of the core thermocouples. This was specifically Bert Ackermann -- A-c-k-e-r-m-a-n-n -- I think, who was of great assistance in some of the electronic arrangements there.

And then in sitting in the planning meetings, I can remember many cases where there were specific suggestions that came from the representative of the industry advisory group, who was initially Milt Levenson, that were incorporated into the basic plan. My memory is not good enough to completely list them off, because they were participating as part of the planning group, and certainly they, you know, were of assistance, but it's hard for me to answer the question would we have gotten to the same place without their assistance, and as far as those planning things are concerned. And doubtless we are better off with them there.

Q Do you recall any disagreements on technical issues between the IAG and other participants?

pv DAR

A I don't remember any continuing disagreements, no. I think, to the best of my memory, we were generally able to arrive at a consensus position that was basically shared by everyone. There might have been differences of opinion on some of the details, but I don't think that there were differences of opinions on any of the discussions.

Sometimes it took a few days to arrive at that consensus.

Q How long did you participate as a liaison for the IAG?

A Only three days: Sunday, Monday, and Tuesday. By Tuesday, it had become clear that the industry advisory group had gotten itself organized and was functioning. And we assigned a couple of people to continue to work with them as information gatherers. But on Tuesday evening, to the best of my memory, Dick Wilson asked me if I could relieve myself from the advisory group in order to become his deputy on the technical support group.

Q The GPU people that provided the information to the IAG, were they under Mel Lieb? Is he the person who was involved there?

A I am sorry, I don't know that name. That does not ring a bell. It could be. I don't want to say "No."

Q Mr. Keaton, you mentioned earlier of planning sessions that were being held. Are those the meetings that were conducted in the technical working group?

BY DAR

A Yes.

Q Could you identify briefly what the operation of that group was and what its purpose was? And I am also interested in how Mr. Arnold acted within that group.

A Yes. As the group finally settled into its operations, it met initially twice a day: at 9:00 o'clock in the morning and early evening -- I don't remember the exact hour.

Mr. Arnold served as the chairman of that group and ran the meetings, both in the sense of setting the agendas for meetings and in the sense of actually physically personally running the meetings and making sure that his objectives were achieved during the meeting.

The meeting typically consisted of a review of the plant status, a review of the current status of ongoing activities such as some of the emergency modifications that were being made to the plant and then a discussion of plans, new courses of action or important decision points.

Typically, for example, a decision item would be taken up twice. It would be taken up at one meeting at which someone, very frequently from the support group, would make a recommendation for a specific course of action, usually with some written support, although perhaps only in outline fashion. This would be discussed at the meeting, whatever written material was available would be passed out to the

pv DAR

participants. And then Mr. Arnold would ask the various members to have this recommendation reviewed by their support staffs and come back, typically to the next meeting, either the one later that day or the next morning, as the case may be, prepared to make a recommendation on that course of action.

Then, at the second meeting, individuals would be asked to literally, by going around the table, to specifically indicate what their portion of the organization recommended with respect to that course of action and whether they had any questions, whether they thought there was additional analysis or other support activities that needed to be carried out before the decision was made, and then, provided that there was a concurrence or that a consensus could be reached, then Mr. Arnold would instruct us to go ahead and carry this out.

If a consensus was not reached, then we attempted to understand what was the problem, what was keeping whoever it was out of the consensus group. And assuming that there was time to do so, we would then be instructed to do the necessary additional work in order to try and arrive at the consensus.

So the basic decisionmaking process was an attempt to reach consensus among the technical support group, the Nuclear Regulatory Commission, Babcock & Wilcox, the Met Ed

pv DAR

operations people, and Bob Arnold himself.

Q Whenever consensus could not be reached, were there cases where the issues were so that you could not reach agreement?

A I do not remember any significant issue in which we were not able finally to reach a consensus. There were some which required a great deal of time to finally achieve the consensus.

I guess the one that I remember as having taken the longest time was the technical question of once an attempt was made to put the plant on natural circulation, as we intended to do, what would be the specific criteria that would be used to decide whether or not natural circulation was in fact satisfactorily achieved and specifically what other criteria that you would use to determine that you would try to restart the reactor coolant pumps or the high-pressure injection system.

And that was debated over a course of, I believe, a couple of weeks, off and on, among various bodies, and it's a complicated enough issue that everybody had their private ideas. We were essentially able to achieve something that everyone would accept, and we were able to do this prior to the time that we transitioned to natural circulation.

Now, I should clarify that. In the sense that it sounds perhaps even worse than it was, we did have, right from the

pv DAR

beginning, a set of criteria that had in written down, if you go on natural circulation and if these criteria are exceeded, then you try to restart the pumps or take other actions that were defined. And those were, in fact, present all the time that this debate was going on. And the debate was simply to arrive at an improved set of criteria.

But had it been necessary to use a natural circulation at any time during the time the debate was going on, this was an approved set-up in the control room, so we were not going without criteria; we were just going with a set of criteria that I believe everyone thought could be improved upon.

(Brief recess.)

BY MR. SCHIERLING:

Q Mr. Keaton, based on earlier statements, it appears that you were very little involved in the support provided by B&W during the first days of the accident; is that correct?

A Yes, that generally is correct, although I had some contact with the B&W people here as part of the three-phase liaison with the industry advisory group.

Q Did your interaction with B&W increase after about Sunday, April 1?

A Yes. There were, as you know, certain B&W people here at the site, and there was interaction between those people and the industry advisory group.

BY DAR

In addition, there was a presentation made by B&W personnel from Lynchburg, who came here to have discussions with the industry advisory group. I don't remember specifically what day that was.

Q You mentioned that B&W people were here at the site. Was that John McMillan?

A Yes. And others.

Q And others?

A Yes.

Q Where would they fit into this organizational structure that we are looking at? Were they only in the technical -- in the industry advisory group, or where else would they interact?

A They were primarily not in the industry advisory group. Their primary interaction was through the technical working group. The senior B&W representative, who was initially John McMillan, was a member of the technical working group; and they were also represented in the discussions which led to plans and decisions.

Q Is it correct to assume that maybe somewhere else on this organization there is a B&W element that was not directly integrated into the GPU recovery organization, but only indirectly through John McMillan into the technical working group?

A That is very definitely correct. I think probably

pv DAR

that the reason it was not shown on this particular chart was that most of that most of that type of support personnel remained in Lynchburg rather than coming here. And this chart really was addressing primarily those people that were physically located here at the site.

But it is certainly true that the interactions with B&W, right from the beginning of this organization, were very strong. And they really occurred in two different manners. One was through the B&W senior representative here and through the technical working group, but also the GPU technical support group had constant interactions with B&W and was constantly drawing from them technical information on specific questions that we requested.

In fact, we had, from the time that the support trailer was initially set up, we had an open line to B&W, Lynchburg, which would function 24 hours a day. They had an organization in operation 24 hours a day. And it simply required one of us to pick up the telephone and talk to whoever was the senior watch-stander at that hour of the day or night, to institute a new support task.

Frequently, these were of a nature that we would call at 1:00 or 2:00 o'clock in the morning and ask for technical analysis, and by 8:00 or 9:00 o'clock the next morning, it would go on the telecopier.

Q Those requests would initiate here in the

BY DAR

technical support group by -- primarily, that is where they would originate?

A I think that is primarily true, in the sense that the technical support group was doing the background work for a lot of detailed technical planning that was going on,. But there certainly were many, many examples of questions which were raised in the general technical working group meeting where the requests went from the B&W representative here on site rather than going through the technical support group. So, really, it's both ways.

MR. SCHIERLING: For the record, I think we should identify the recovery organization chart that we are looking at. We will make this organizational chart part of the transcript, I suppose. It is an organization chart, dated April 4, at 11:00 o'clock in the morning. It's handwritten. I think that that suffices.

THE WITNESS: In discussing the B&W support, let me be very specific, that particularly starting on the Wednesday after the accident, when I took over as deputy director of the technical support functions --

BY MR. SCHIERLING:

Q That would be April 4, I think?

A The 4th. Yes, I think that is correct.

Q April 4.

A Right. From the period of time from then on, we

pv DAR

had almost constant interactions with the B&W organization in Lynchburg, as well as with the people here. And they made every attempt to be fully responsive to our requests for technical support.

Q Can you identify any difficulties that were encountered in the interaction with B&W where there was maybe difficulties in disagreements in technical approaches that were taken or recommended?

A I will have to tell you honestly that the major difficulty may sound trivial, but it simply was that the telecopier equipment that we were using was such that frequently the B&W technical support documentations arrived here in an almost unreadable fashion. And that was not a problem with the B&W equipment so much as it was a problem with the equipment that we had here on site.

In terms of general technical support, I do not recall any disagreement on really major items. There was disagreement between ourselves and B&W on some of the technical details, particularly areas that were subjective in nature, such as the one I mentioned earlier on what should be the specific criteria for determining whether natural circulation was successful or not. And there was a very subjective decision to be made as to how conservative these criteria should be, and we had technical disagreements on those.

BY DAR

But as far as basic matters, I don't remember any substantial problems in that area.

Q You mentioned that Babcock & Wilcox made a presentation on their recommended approach to natural circulation. Do you recall when that was made and who the individuals were?

A There was more than one presentation made on natural circulation. But the first presentation I remember Babcock & Wilcox making was, I believe, more on their perception of what the transient had been and what the current status of the reactor was. This was a presentation that was made to the industry advisory group by a team, and the two members that I am sure participated in this were Allen Wolmack -- W-o-l-m-a-c-k -- and Bruce Karrasch -- K-a-r-r-a-s-c-h -- maybe.

They were on the subject of natural circulation, many communications back and forth between the on-site technical support group and B&W, both verbal communications and written telecopied communications.

Subsequently, a team of, I believe, four of us from GPU went to Lynchburg and spent the day discussing the B&W results and their prediction of what natural circulation would be, and comparing them with results that we had both from GPU analyses and from analyses from other organizations then --

BY DAR

Q Do you recall when that trip was made?

A No, I don't. But that's probably recoverable.

Q Okay. Would you know if it happened before April 7 or afterwards?

A I am sure it was after April 7, but it happened before the final transition to natural circulation.

And then, subsequently, when some questions were raised -- I think this is after we were on natural circulation -- then B&W sent a team of two or three people up here to work with us.

And so interactions on natural circulation extended over a very long period of time in a variety of different interactions.

Q You mentioned that the meeting in Lynchburg on natural circulation -- you used GPU analyses and those of other organizations?

A Yes.

Q What were the other organizations that provided input to that? Were there other NSSS vendors?

A Yes. We had analysis done by both Combustion Engineering and Westinghouse.

Q Let's talk about the support by Burns & Roe Company. First of all, where would they fit into the organizational structure that we are looking at here?

A Okay. The primary -- let me address that question

pv DAR

in two parts.

Q Yes, sir.

A Initially, from Friday, March 30, until this organization was really set up and operating, which was about Wednesday, April 4, the primary focus of the Burns & Roe effort was through the GPU home office support organization, although I believe there were some contacts made directly from GPU people here at the site or Metropolitan Edison people here at the site, to Burns & Roe.

Primarily, the contacts went through the Parsippiny support organization. When the so-called "TMI recovery organization" was set up, this underwent some change in that one of the major sections in that organization was called "plant modifications," and the director of that section was Buzz Cobean -- C-o-b-e-a-n -- who is vice president of Burns & Roe.

So, for those types of plant modification activities, then, Burns & Roe fit directly into the on-site organization and, in fact, brought over a very substantial engineering organization to work here on the site on those modifications.

But it's also true that during that time there was continuing Burns & Roe support both to the on-site GPU technical support organization and to the continuing

pv DAR

Parsippiny engineering support organization.

So, the Burns & Roe really plugged into the organization really more than one place.

Q How many Burns & Roe people do you estimate were here at the site?

A I believe at the peak it was of the order of a hundred, but there were other people who would know that number better than I do.

Q You mentioned Buzz Cobean as probably the major contact between GPU and Burns & Roe. Who else on the Burns & Roe staff were the major individuals involved?

A Right. Buzz Cobean was the senior Burns & Roe representative all the time, but we had other, what might be called "project engineers" or "project managers" from Burns & Roe, particularly during the time that we were on two- and three-shift operations, and those were -- one was Scott Dam -- D-a-m -- I think is how he spells it. I am just drawing a blank. I would recognize the names.

Q That is all right. I just wondered if you can recall any.

A Yes, I can, but they just won't come up right now.

Q Fine. Can you identify any of the major Burns in your activities here at the site --

A Yes.

Q -- as far as the modifications are concerned?

A Yes, very definitely.

Burns & Roe took the lead in the so-called bee-closed-cooling loop, which was the fallback cooling system for the bee sting generator. They were heavily involved in many of the other modifications, including some of the changes that were made to the rad waste systems.

Q Were they involved in the filter system that was installed?

A Yes. In one way or another, they were involved in basically every modification that was done.

Q Is it correct to assume that they more or less acted as an engineer here on sight?

A Yes, in general, that's true. There were a few specific modifications where the load was taken by another organization. For example, the added decay heat system was done for us by Westinghouse rather than being a Burns & Roe project; but generally speaking, yes, it is true that Burns & Roe served as the engineer here on site.

Q How would the assignments be made to the plant modifications group? How was the interaction been Burns & Roe and Mr. Arnold. Did he make the assignments, or

JIDAR

how did that take place?

A In terms of a decision to start or contruction of a major modification, those decisions were made in the technical working group under the direction of Mr. Arnold; that's right. An Burns & Roe would be asked to carry out that activity.

From there on in, the primary interaction became between the GPU technical support group and Burns & Roe. The technical support group would either provide the criteria for the new systems, or it would review the Burns & Roe criteria for the new systems, and would continue to interact with Burns & Roe in and overseeing mode as far as the technical characteristics of the jobs being performed.

As far as the scheduler aspects of those jobs, that was normally reviewed on a day-by-day basis in the technical working group sessions.

Q Can you identify any other outside organizations that contributed to or participated in this review, recovery effort?

I'm speaking now about NSSS vendors, and I am also thinking about the use of reactor operators from other utilities.

A Okay. As part of the so-called GPU technical support group, we had very extensive participation both NSSS representatives and by representatives from other

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utilites. We specifically had working with us, on a day-by-day or, in many cases, night-by-night basis, personnel from Combustion Engineering, General Electric, and Westinghouse; and, in addition, MPR and Pickard, Lowe & Garrick, and Energy, Incorporated.

From the utilities we had support from Duke Power, D-u-k-e, TVA, Florida Power & Light, and a variety of others. I don't think I could recall them all.

Q How were the utilized within that organization?

Let's first talk about reactor operators, if there were any. Do you have any knowledge of how they were utilized?

Was it in this organization -- I knew Dick Wilson -- or were they also used in plant operations and Herbein?

A Let me address what I know first. I know we had in the technical support group many people, whose specialty was reactor operations, that came to us from from outside; and they were put into assignments most closely related to reactor operation, such as preparation for emergency procedures. They were also assigned to duty in the control room, since during all of this time the GPU technical support group was maintaining at least one person in the control room on a 24-hour-a-day basis.

I do know, of my own knowledge, know whether there were other operational people that went into the Met Ed plant, plant operation organization.

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Q Can you comment on the effectiveness of technical people from GE, Westinghouse, and CE being familiar with their design as compared to people from B&W.

A There was a necessary transition period for the people from the other vendors. In the case of Westinghouse and Combustion Engineers, the transition would typically take a couple of days and consisted of, in part, simply learning the B&W terminology, because the different PWRs do call the same thing something different. But there were also problems in that many of these people who had intimate knowledge of their own designs would tend to jump to conclusions that might not be applicable for the B&W design.

And so we and they, as well, had to carefully cross-check this type of thing to make sure we were not being led astray by their knowledge of the wrong system.

So there was a learning curve. In the case of the General Electric representatives, the learning curve was, of course, more extenseive; and we tended to use those people in specific systems, rather than something that required broad knowledge of the plant.

Q Can you identify, in broad terms, the assignments that were given to these engineers from GE, Westinghouse, and CE? What activities were they involved in?

A They were involved in a wide spectrum of activities. One of the key groups within the technical

support organization was the technical planning group. And we used, to my memory, representatives from all three of the vendors in that. This group was lending the plans for what would be done over the next several weeks and months with the plant, both big picture and then some technical detail.

We also used people from the nuclear vendors in the shift operation, the technical short shift operations, where they were located either in the control room or here on the island, supporting tasks that were going on, supporting procedure-writing, and the other activities that were being carried out by the shift operations.

So, in general, with all the support people that came in, whether they were from NSSS or from a utility or from a consultant, we tended to bring them in, talked to them on an an individual basis about what their background and capabiltiy was, plugged them into the organization at a place that looked like they would fit the best; and then we constantly encouraged these people to come back to us, the managers, if they saw a place where they could fit better, because they knew their capabilities better than we did.

So we had many examples of where someone came in after two or three days and would come back and say, "Hey, that operation over here, I really know about that," then -- then so we would reassign him over to that one.

And the other thing is that in some cases where we saw a

JIDAR

particular need, where we had to remove somebody from a particular type of operation, we might call, for example, Combustion Engineering and say, "Hey, send us somebody with these specific characteristics. We need that in our organization." And they would attempt to respond to this request.

Q Another element in this organization chart is what is identified as task management and scheduling under Fred Stern..

A Yes.

Q Do you know what this organization was assigned to do?

A Yes, the idea was to set up a detailed schedule for the various tasks, including both a plant modifications and analytical task, then planning tasks to have identification of all of the various tasks and sub-tasks in detail with an individual assigned to them, a completion date.

And then this organization was intended to track that and to report back as to what extent we were meeting the overall schedule and where the problem areas seemed to lie.

I should comment that while that activity did go on -- and I'm sure it did perform some useful functions -- my personal interaction with it was such that I don't believe that it ever really functioned as productively as that type

JIDAR

of an operation would function in a more well-defined organization in a more stable environment.

There were severe problems in those people being able to carry out what they were assigned to do, partly do to the fact that during the period that we initially started this our perception of what needed to be done was still changing very rapidily.

And what was perceived to be realistic scheduling was changing very rapdily, and partly because the organization as a whole did not function as smoothly as an organization that had been in place for some period of time.

Q Talking about this organization as a whole, there are quite a few places, individuals with management responsibilities that are outside the GPU-Met Ed organization.

Can you comment on their effectiveness as you, as a GPU employee, on bringing in this outside expertise, and tell them to take over such major management functions and interject them into this organization?

A I almost have to answer that on a case-by-case basis in looking through the organization. The direct operation of the plant, of course, continued to be under the management of Metropolitan Edison. I think it would have been very difficult to put an outsider into the position that was occupied by, for example, Jack Heroine.

Similarly, the technical support was under the management of GPU people. And I think it might not have been easy to have an outsider there.

The waste management organization was managed by outsiders. Eventually, as you know, it was Ben Rusche who really became the director of this. And, frankly, my perception is that this has been fairly effective, though I will tell you, honestly, that I have had less contact with the waste management organization than I have had with almost anything else on here.

But certainly I am not aware of any lack of effectiveness there, associated with the fact that it was an outsider who was running the organization. I suspect the contrary is true because of Mr. Rushe's very particular capabilities.

Plant operations activities under Buz Cobean really, I think, was not an indication of having an outside manager, in the sense that all of the people working on these plant modification activities were basically Burns & Roe people.

So Buz was really managing his own staff, and we still had the control of the criteria for the these modifications under the GPU people.

As far as the task management and scheduling activities under Fred Stern, I don't believe that having an insider manage that would have made that job any easier. I think Fred did as much as anybody could have done there.

JLDAR

And administration and logistics, under Robidieux, will -- of course, he is Metropolitan Edison, so if you look at the line responsibilities, I don't see any case where having an outsider, I see, was a detriment.

Q From your experience, it didn't create any problems?

A From my experience, I don't think that bringing in an outsider created any problems, no.

I want to return, also, to something else. In talking about the bringing in of people into the technical support operation from outside, I want to comment that while there was an educational period involved for most of the people from the nuclear vendors, that was not necessarily true for the people that came in from other utilities.

And, in fact, we had people from some of the other utilities in from various -- and very specifically from Duke, who walked on this site and were productive the moment they arrived.

Q Who was that in particular?

A Duke Power was the outstanding example because of these people's knowledge of the Oconee Plant and the very great similarities of that and TMI. And either in advance or on the airplane up, these guys had done enough homework that by the time they got here they knew already where TMI was different from the other plant. And some of those

JIDAR

people were enormously valuable to us.

Q Let me propose this, or propose to you the following: Some people gave us to understand that while maybe some of the outstanding management people were indeed needed, however you probably could have done without them, they were extremely valuable in making their entire organization accessible to you.

And, for example, in the case of Oconee and Duke Power Company, that through Mr. Lee or Mr. Owen, you had access to that organization. And without those people you probably would not have been able to obtain these operational people from Oconee.

Can you comment on having outside management available in that aspect?

A Well, certainly it is true that the ability to draw on the resources of organizations such as Duke, who was -- was extremely important to us. I think that it would be possible to set up an emergency response organization that was managed simply by GPU and Metropolitan Edison people.

I think that one of the things that is -- that is characteristic of this specific organization was, number one, it was an organization that was really put together very quickly, and therefore had to be built around the resources that were immediately at hand; and, secondly, that there was deliberate desire to involve outsiders in the

JIDAR

organization partly because of just making sure there was ready access to the resources of those organizations.

So in terms of what would be done in the future, I'm not sure that this is the optimum organization. It appeared to be the optimum for the particular characteristics that we had right following March the 28tth.

Q Mr. Keaton, I think you answered most of my questions, including evaluation of the entire GPU recovery organization.

Two final items that I have regarding the evaluation: Do you know of any requests that you made for support that could not be met to organziations? And the other one is -- well, let's answer this one first, the requests that could not be met or where you had extreme difficulty in obtaining the help or the equipment that you needed.

A That was somewhat variable in time. I would say that for the first two weeks, three weeks, maybe even four weeks, that we really got what we asked for, to the extent that it was possible to do it.

I think the support of the industry as a whole was really outstanding during the early periods of time. As time wore on and, as I say, this transition maybe started after a couple of weeks and continued on -- and as support organizations, such as, for example, the Westinghouse or Combustion Engineering or General Electric, became aware

JIDAR

that the situation here was more stable, that the major part of the emergency had passed, then there was more of a tendency to regard our requests as simply one more competitor for their attention.

And so the response was a little less dramatic than it was in the beginning of the accident. For example, in order to free up some of our own staff -- and now this is like five weeks after the accident, we wanted to get two or three people to come here and stay on-site, full-time people from nuclear vendor who would be doing day-by-day analysis of the plant.

And where it stood, it was something that fell into the capability of GPU, but our resources had been spread so think that we were trying to supplement it from outside. And we had more difficulty in doing this because the people that we were going to perceived this was not an emergency need on our part, and balanced this against the other aspects of their business.

But during the first period, when we clearly did have an emergency situation here, every case that I am aware of, people did everything they knew how to do to answer our request.

Q One last item, regarding the timeliness in requesting the support: Do you think GPU could have requested assistance in certain areas earlier, and how would

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that have made any difference in the development of the accident?

A From the period of, say, Friday, March the 30th, on, I think we were requesting assistance in getting help in here as far as we knew how to use it, maybe in some cases faster. We had people pouring in.

Q And more.

A And more.

And our real challenge was not that we had enough people, but how to get it organized and productive in the shortest length of time. In principle, had we really understood what the situation was, maybe we would have been requesting that help on Wednesday or Thurday, but we just didn't know at that time that we needed it.

MR. SCHIERLING: Mr. Keaton, that concludes my questions.

Do you have any questions? Do you have any additional questions?

MR. ALLISON: A couple.

BY MR. ALLISON:

Q Did you have NRC people working with your technical support group?

A Not in the sense of being integrated in the technical support group, no, we did not. However, we had a continuing and close interaction between the on-site NRC

JIDAR

Staff and the technical support group. For example, when technical -- when technically complicated questions arose, like the one I mentioned to two or three times, criteria for whether or not we had natural circulation, we had meetings with NRC representatives here, not in a presenter/reviewer type of meeting, but in a technical discussion type of meeting, what do all of us think?

So in that sense, there was a closer technical coupling at the lower levels in the organization than would be typical for an NRC review process. We didn't wait until we had all of our plans developed and then present them to the NRC.

Q For the record, I would like to develop what that means. If I understand you, the NRC people were demonstrating a different attitude than is -- than you were, too, than is normal in our normal business relations with each other?

A Certainly during the first two or three weeks of the accident, I think there was a relationship here between the different participants, including NRC, that was quite different than any relationship that I have ever seen in the past.

Q Tell me if I'm wrong, normally if you come to the NRC with an idea, we would generally tell you something like "There is something wrong with it," or "I am not sure that

JlDAR

it is right," right? "Go off and do some more work, and prove that that's okay."

Is that what you kind of characterize as normal NRC attitude?

A Yes.

Q Here the people -- again, correct me if I'm wrong -- shifted gears and tried to figure out how to solve the problem?

A Very definitely that was true. And in many cases the NRC, in fact, gave themselves action items to work along with us in trying to evolve a plan of action or something of that type.

And, also, I think the NRC Senior Staff made a really honest and I think generally successful attempt to judge, in their own mind, what should be the balance between, on the one hand, digging into every possible technical detail, and, on the other hand, getting on with the job that may be really needed to get on with.

And I feel, in my year's interaction with the NRC, that the period following the accident was the only time I have ever been repeatedly criticized by the NRC for not getting on with my job.

Q That's another general thing that the NRC seems interested in understanding something, whether it makes any sense or not, in your opinion?

A And let's stop arguing about it, and do it in some cases. So I think many people have said -- and I certainly would reiterate it -- that the contributions of the NRC Staff were very, very positive during this period of time.

And I think they shifted gears into what I think was a very appropriate mode quickly, and really on their own initiative, rather than us going and saying, "Hey, you ought to go work differently."

I think they recognized it even sooner than we did.

Q But you don't recall that people were actually along and working alongside of your people in the various groups?

A My memory was that that did not occur.

Q Do you remember who initiated the action to get the extra diesel generators on site, and when that happened?

A I don't know who initiated that action for sure. I think it may have been the on-site shift, technical support organization that was more or less headed up by Gary Broughton.

And I believe that probably happened along about Friday or Saturday, but I'm not certain.

Q You think it probably happened then before you came on?

A Yes, my memory is that was already underway at the time I first heard of it.

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Q Do you remember if the diesels were in place when you came down?

A No, I don't remember.

Q Do you remember about how many people were working in Fred Stern's task management and scheduling group?

A I don't believe it was very many. I believe there were initially maybe three or four people, maybe as many as half a dozen later on.

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Q. Last question. Can you explain to me what these NRC interface points mean on the organization chart?

One under technical support labeled "licensing," has an arrow with an NRC interface to it, and one in the plant operations organization, "Shift operations," has another arrow with NRC interface. There is another one reporting to Dick Wilson.

A. Right. The NRC interface into licensing was the interface that I might describe as the traditional NRC interface. If there were tech spec modifications or if there were NRC bulletins that we had to respond to or the reporting requirements for this accident itself, that's what that interface was.

Q. Can I interrupt for a second? Was that a significant part of this effort, making reports on tech spec changes and formal orders and things like that?

A. In terms of the total percentage of effort, very definitely not. There was ongoing effort and there were one or a few people assigned to that, but it was a very small part of the total effort.

Q. Just a few people at most, would you say?

A. Yes, and I doubt that there were a few people. I would suspect that there were one or two of them. As a matter of fact, the NRC interface into the shift operations was the people who were assigned in the plant who were both reviewing

the status of the plan and the actions being taken and who were also doing very operationally oriented operations, such as approving changes to procedures or approving new emergency procedures, this type of thing. And that interface is shown there, where it was a procedure that was prepared by the GPU technical support organization.

We frequently were the ones also that interfaced with them there, and I think that is what the dotted line shown under Wilson is, because our normal route for approval of emergency procedures, if it wasn't the type that was going to involve the entire technical group, if it was to be approved by the technical support organization and then it would be approved by the plant operation group, and specifically by the PORV. And then it would be reviewed with the NRC people who were in the plant, and, at that point, if they had questions, typically it would be the technical support engineer, or, in some cases, myself, who would get to go with the NRC people and discuss what the technical issues were. And if they could get it approved, they would sign it off. If we ran up against a hard spot, which happened once or twice, then we might delegate it to the level of the technical working group and get the more senior NRC people involved in it.

Q So you described three interface points shown on the organization chart, and you led into another one, which is the meetings of the technical working group. The technical working

group is a committee that met of the managers of all these various organizations?

A. That's correct.

Q. Did you go to many of those meetings?

A. I went to most of them, yes, sir.

Q. And is it true that at those meetings Mr. Arnold was the person responsible for making decisions as to what to do?

A. That's a hard question. It is true that Mr. Arnold led the decision-making process, but the environment that existed -- and I suspect to some extent still exists -- was not such that really there was one person, but unilateral decision-making effort.

For example, Mr. Arnold clearly could not decide to do an operation that the NRC would not approve of.

Q. Right. The NRC had a veto --

A. Right, right.

Q. -- power, besides just sitting in and being another participant in that meeting, and providing opinions like the others did?

A. Right.

Q. There was a veto power and, I guess, responsibility, too.

A. Exactly. And so, in fact, the way it worked, it was that Arnold might be pushed for a particular decision, but I never saw a case where they had attempted to override people in

order to get that decision carried through. It was rather a case of he tried to understand -- if one of the other senior managers objected to it, what their objection was and what needed to be done in order to either get them to change their opinion or get them to change his opinion. So, in some sense, you can say that this operated as management by committee.

Q. Did you ever see even one of those meetings where the NRC exercised a veto kind of authority and said, "No, you just can't do that"?

A. Yes, very definitely. If you want a specific, the one that hops to mind is the plan that was developed to measure the water level in the containment building, which involved opening certain containment penetrations in order to get a pressure measurement. And that plan was developed, and then was held in abeyance, specifically and only by the NRC veto, until a certain set of prerequisites that Mr. Stello, S-t-e-l-l-o, wanted to see, had come to pass.

Q. Do you recall any other vetos offhand?

A. I think there were probably one or two others. I remember that one specifically because it extended over a period of time. I do not know of any case in which the NRC vetoed anything where there was general agreement, if there was an emergency in doing it. And, as a matter of fact, as I indicated earlier, sometimes the shoe was on the other foot.

And there were very specific cases where Mr. Stello or the

other senior representative would go in and bank on their own organization to be more responsive.

MR. ALLISON: That's all I have.

MR. SCHIERLING: Yes, I think if these are all the questions you have and Dennis, you have none --

THE WITNESS: I would like to make a couple of general comments.

MR. SCHIERLING: Yes, I was just about to ask you for any additional comments you would like to make.

THE WITNESS: I have two or three having to do with the operation of this organization.

One, I guess, it's generally recognized now -- I would like to reiterate that by far and away, the major problem that was faced by this organization was communications problem. And that was true even after everybody was physically close enough together that you would have thought those problems would have gone away. But in fact, they did not, and it was not at all unusual to spend an entire working shift or longer simply trying to find out what should have been a very simple piece of information to obtain.

It's hard for me to characterize all aspects of that problem, but one portion of it was the fact that during the first couple of weeks, when the situation was the most complicated, the majority of this organization was across the river, and then there was a support organization that was here on the island.

And in the control room ard in the communication chains that were set up from the island to across the river were just absolutely not capable of carrying the volume of information that needed to flow.

So in the sense of developing future emergency plans, that communication link or links between the off-site or support organization and the on-site support organization are something that -- well, it's just impossible to overemphasize the importance of that.

The second thing is, we were really severely hampered, much moreso than one would have thought in advance, by trivia concerning facilities. The simple fact that when we had new people come in from a nuclear vendor or from a utility or so forth, that there was no place that Dick Wilson or myself could sit down with those people and talk about what was going on and how they could fit in, without our physical presence interfering with all the other work that was going on.

It led to a situation that during the daytime, there was very little that was done during the first two weeks. And most of the productive work in the sense of making progress in planning and making progress in procedures, and so forth, was done in a time period that ran from about 10 o'clock in the evening to about 7:30 in the morning. And that was simply because the facilities were such that everyone was standing on everyone else during the daytime.

The communication links with the outside world -- we had six telephones in one small end of one trailer. And so if I wanted to be talking with Babcock & Wilcox, someone could not be talking to Combustion Engineering, or be engaged in a shouting contest.

I mentioned earlier the problem with the telecopier. All of these kinds of of things, that if someone had asked me before the fact, I would not have put a whole lot of importance on it. Having lived through it, I put a very great importance on it.

BY MR. SCHIERLING:

Q Let me follow that up with a question.

Was it necessary as far as the response itself is concerned, was it necessary to have that physical separation between on-site here on the island and off-site at the observation center? Could not some of the work that was being done here on site also have been done off-site in one location?

A I think not because the on-site engineering support staff was working on a literally hour-by-hour basis, and supporting operations that were going on here, making plans for short-term modifications like added instrumentation or direct support for some of the tests that were going on. And so, physically, they needed to be located here in order to have closer interaction with the operating staff.

What might have been able to have been done is to move more of the technical operation that was across the river over here.

And eventually, in fact, that is what was done.

BY MR. ALLISON:

Q. On unit 1, when you are installing data links to Parcippany, are you not?

A. Yes.

Q. Are you putting those into other locations?

A. The data link is in the plans. We haven't mechanized it yet. The thought is that we would run a similar data link into the off-site emergency control center.

Q. I believe during the first few days a data link could have taken the place of about 100 communication channels in talking to people and trying to get information. Is that your opinion as well?

A. Very definitely. And not even just during the first few days, I think. I think that at least, ultimately, the type of data link that we would like to set up, and, I suspect, other people would like to set up, would be capable of really giving people off-site a very good understanding of the total situation of the plant.

Q. So, I guess my question is, would a data link have helped to alleviate the communication problems you mentioned?

A. Yes. It very definitely would have helped. It wouldn't have totally solved it, because a lot of communications today have to do with plans or desirable course of action or that type of thing, that the data link wouldn't address, but

it was true that a lot of our information the data link would address.

BY MR. SCHIERLING:

Q. Are there any other comments that you would like to make in any area that we either didn't cover in sufficient depth or didn't cover at all?

A. One we sort of hinted at, and I guess I would like to get it on the record specifically, is that certainly we should never again allow the situation to exist where this organization hasn't been thought out in advance.

The time to develop that organization is not when you need it, as we learned. And, developed carefully in the cold light of day, as we and many others are now doing, should be possible to have an organization that we can call into place and function more efficiently and more quickly than this one did.

BY MR. ALLISON:

Q. And would it have to be drilled beforehand in order to fall into place quickly?

A. I don't know that drill is the right word, but I certainly think that the people and their alternates that would be expected to assume key roles in the organization would need to get together and at least spend a little time talking about how the organization would function, and not just passing papers back and forth.

I'm not sure you would have to have monthly drills, but just

an understanding of who would do what, when, and how.

BY MR. SCHIERLING:

Q. Mr. Keaton, again referring to the organization chart here, we talked earlier about interfaces with the NRC. What are your thoughts about the NRC playing a more active role in this organization than is indicated here? To the extent that, as you know, it has been suggested that maybe the NRC could take over such a recovery organization. Do you have any comments on that?

A. Yes, I personally feel fairly strongly that that is the wrong way to go. Aside from problems in communications with the public, I felt that the function that the NRC played here and its relationship with this organization was one of the brighter spots that we went through, and I think that there are two reasons why it is better for the NRC to play an interactive role rather than management role in the case of an emergency response.

One is that I think it would be very difficult for NRC to have on standby people with detailed knowledge of every nuclear plant in the United States that would be necessary to come in and take over the management. And I think having somebody taking over the management that doesn't know the plant in detail could lead to a lot more problems than it would solve.

The second thing is that if the NRC came in and took it over, then who is going to be the independent watchdog that you

bounce the ideas off against? You lose that. Whereas if the normal management continues, then the NRC has the opportunity to fulfill an interactive and, if necessary, even combative role, in making sure that there is good review of all of the suggested items.

So I would personally have much regret seeing an emergency plan that involved takeover by the NRC.

MR. SCHIERLING: If there are no more questions, let me just close this interview with saying that while we could close right now, there is always the possibility that we might ask you for more information or have you comment on additional thoughts that we have.

With that in mind, I think we can close the interview for now.

end T-6 (Whereupon, at 1:45 p.m., the hearing was adjourned.)