UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:

IE TMI INVESTIGATION INTERVIEW

of Met Ed Training Staff

Richard Zechman
Training Supervisor

Nelson Brown
Nuclear and Technical Training

Denny Boltz
Nuclear and Technical Training

Marshall Beers
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NRC Investigation Site
TMI Nuclear Power Plant
Middletown, Pennsylvania

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NRC PERSONNEL:

Bob Marsh
Don Kirkpatrick

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MARSH: The date is May 8, 1979, time is 5:17 p.m. We are located at Three Mile Island in Trailer 203, and I am Bob Marsh. I am an investigator with the US Nuclear Regulatory Commission assigned to Region III, Chicago, Illinois. The purpose of today's meeting is to conduct an interview of representatives from the Met Ed Training Staff, and at this time I would like each of the individuals in the room going from my left around the table to identify themselves, spell their last name, and indicate their position so we can start.

ZECHMAN: My name is Richard Zechman and the Training Supervisor of the Met Ed Company.

BROWN: My name is Nelson Brown, I am administrator of Nuclear and Technical Training.

BOLTZ: My name is Denny Boltz, Administrator of Nuclear and Technical Training.

KIRKPATRICK: I am Don Kirkpatrick, I am a nuclear engineer with USNRC, IE Headquarters.

BEERS: I am Marshall Beers, Group Supervisor of Nuclear and Technical Training.

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MARSH: Fine, thank you, before we start Mr. Boltz, may I get you to sit up on the end of the table on this side, and we will turn that end mike this direction if we may, and that may give us a little better pickup. I think that will give us a little better pickup on the tape. Okay, Don, I think you've got a few words you want to say regarding the scope. Before we do that I just want to put one other thing on the record. Prior to starting the tape we had a few words regarding this two page memo, which I have provided each individual in the room. Pause for a second for the airplane. This two page memo lays down the purpose for this investigation, a little bit about its scope and the authority under which it's being conducted. At the conclusion of this two page memo are three questions which I would like each individual to respond to. I'll read the questions and then if you would, give me your last name and your response to the questions so we also have it on the tape. Question No. 1 reads, "Do you understand the above, making reference to the two page memo?"

ZECHMAN: Yes.

BROWN: Yes.

BOLTZ: Yes.

BEERS: Yes.

MARSH: The second question reads, "Do we have your permission to tape this interview?"

ZECHMAN: Yes.

BROWN: Yes.

BOLTZ: Yes.

BEERS: Yes.

MARSH: And the third question reads, "Do you want a copy of the tape?"

ZECHMAN: Yes.

BROWN: No.

BOLTZ: No.

BEERS: No.

MARSH: Fine, at the conclusion of this interview I will then duplicate a copy of the tape, and you can have it today before you leave. There is a fourth question, which is not called out specifically at the end of that two page letter, but is covered in the body of it. This addresses your rights to have, if you so choose, a representative from the company or your union present right now. Could I get a response of your desires on that.

ZECHMAN: No.

BROWN: No.

BOLTZ: No.

BEERS: No.

MARSH: Okay, thank you. One other point on that, if at any time during the course of this interview, you feel that you do want to have someone present, do not hesitate to raise your hand and make the statement, we'll take a break and we'll get someone here. Likewise, if you want to take a break, you get tired or that, just call out and we'll break the tape, and give you a few minutes for a break. Don Kirkpatrick, at this point I am going to turn it over to you for your statement. And I think I will terminate this air conditioner and see if we cut down on this background noise.

KIRKPATRICK: We have already discussed the overall training program with you gentlemen and since there is a great deal of documentation that we have ready access to that gives this training program in detail, I see no point in taping it here at this time. Instead, what this session is intended to do is to answer specific questions regarding the training that is relative to the incidents that occurred during the events on March 28. In addition to that, I have some questions regarding the emergency response training that I will address after this. The first question regards auxiliary feedwater operation. Does the emergency training for loss of feedwater address the verification of auxiliary feedwater flows?

BROWN: Are we supposed to answer now, or are we suppose to wait 'til you have gone through your scope, or are done with the scope?

KIRKPATRICK: I am done, so go ahead.

BROWN: Yea. There is the procedural guidance for the verification of emergency feedwater. It is covered, and says that on the loss of feedwater, normal feedwater, that the emergency feedwater pumps will start. That is, one steam-driven emergency feedwater pump, and two motor-driven emergency feedwater pumps, and the emergency control valves, nomenclature EF standing for Emergency Feedwater, 11A and B, will automatically control the steam generator level. In the loss of both main feedwater pumps, they will control at 30 inches. This is addressed in the emergency procedure. Additionally this is documented, we document it by training on that in emergency procedure review, plus we teach it in-house, we talk about operating characteristics, and it is reviewed at the simulator, when we go over loss of feedwater.

BOLTZ: It is also covered in our in-house ICS course as well, ICS meaning Integrated Control System.

KIRKPATRICK: What made the auxiliary feedwater flow indication exist in the control room.

BOLTZ: There is no flow indication for emergency feedwater in the control room. The procedures on loss of feedwater, which is what these fellows were going through, ask you to verify the pumps are operating correctly. What the operator is supposed to look at is the RPMs of the turbine-driven feed pump, and the discharge structure. There is no flow indication there. He has to wait until he gets down to 30 inches on the steam generator levels, to see that the levels are held up by the initiation of emergency feedwater flow. So, in fact, until they hit 30 inches steaming down following a trip, there will be no emergency feedwater flow. Yea, the pumps will be on reset.

KIRKPATRICK: Are the operators trained to look for steam generator level rise or indication?

BOLTZ: They are trained to look at the steam valve. Okay, the level decrease in the steam generators, which appears following the trip. They are trained to verify that it does level out 30 inches on a startup range level entrance.

KIRKPATRICK: I see.

BEERS: On a normal reactor or turbine trip, it would take about three minutes for the steam generators to steam down to the 30 inch level. I believe in this incident here the time to steam down to 30 inch was approximately one third that time, as near as we can determine from heresay when we talked to other people.

KIRKPATRICK: The next question pertains to the electromatic release valve operation. As you know, we believe the relief valve came open during the event and stayed open for a long time afterwards. Are the operators trained to verify closure of the electromatic release valve following events which can be expected to result in its operation.

BROWN: Yes, they are, and with this loss of main feedwater and then not having auxiliary emergency feedwater immediately there, the pressure would have stayed up for some time period, and it would have--they wouldn't have looked at it right away. And once it, the pressure, would decrease below the point at which this electromatic relief valve was suppose to reclose, which is 2205, then everything they really had to look at that's concrete on that night and really concrete, is the indication on the console, which is only an indication of the demand signal to the actuator, not the actual valve position. And that's what they would have to look at for that. For additional information they would have to look at to verify it wou[illegible] be closed would be discharge line temperature. If they waited for, to try and see it on the alarm printer, the alarm printer is relatively slow, and following a reactor trip or turbine trip, the computer tends to get backed up and alarms that would happen in the first five minutes tend not to get printed out for 20 or 30 as a rule of thumb, sometimes longer, sometime less. And they could request that information, but that takes time and the first couple minutes of an accident you really don't have time to go play with the computer and request information. At this rate, the operator can look at the RC drain tank level pressure and temperature but unfortunately in Unit 2 that is not easily accessible. It's on a back panel out of sight of the normal controls.

KIRKPATRICK: You mention the fact that the operator can look at the temperature for electromatic relief valve operation. I understand that one of the reasons for the reactor coolant drain tank or one of the purposes of the reactor coolant drain tank is to handle leakage from the electromatic relief valve during normal operations. Now, if the electromatic relief valve were leaking, would the temperatures that you would expect to get be similar to what you might expect following the relief valve opening.

BOLTZ: I would say, yes, that's true. From my understanding, the electromatic relief valve was leaking at the time, prior to the incident, because the fellows had to makeup somewhere over a thousand gallons each shift to hold the makeup tank level within the operating band, so that at the start of the incident here, they would have had higher than what you would call normal relief valve discharge temperatures.

BEERS: Under these conditions, it is difficult to determine what is a high temperature on the downstream side of the electromatic relief. Even if the code reliefs were leaking, it would be possible that you would get some transition of feed back up the pipe that the electromatic relief valve discharges into, and make that pipe also appear hot.

KIRKPATRICK: Okay, thank you. You also mentioned the reactor coolant drain tank pressurize. Does the operator training include actions that have to be taken if there is a pressure increase in the reactor coolant drain tank.

BROWN: Under normal conditions, yes. Additional things go into the RC drain tank, the relief valve discharge, valve packing lead offs go into there, and for an example, and these valve packing technically could also cause level and pressure in this tank to increase and with those conditions it's relatively slow and the operator does have time to respond, which could be turning on additional coolers for that tank, turning on sooner, could be lowering levels slightly, still keeping the sparging line covered, and putting in cold demineralized water to help bring the pressure and temperature back down, but those are relatively long time operation.

BOLTZ: They do have a response to alarm procedure for drain tank pressure, high alarm, which is received in the control room as well as high and low level.

BEERS: You might indicate where that alarm is, so

BOLTZ: Again, it is out of sight from the console. It is back where the level and pressure indicators are for the drain tank.

KIRKPATRICK: If the operator did observe abnormal indications of pressure and level in the drain tank, would he be able to distinguish what source it came from, based on his training.

BOLTZ: Based on his training he would be able to, but not necessarily instantaneously. It's...you've got so many sources of water at high temperature that can come in to this tank, that it could take some time to actually get down to the actual source by process of elimination.

KIRKPATRICK: Thank you. During the incident, the reactor coolant pressure decreased rapidly to the saturation level and apparently stayed there for a good while. Does operator training address the significance of the saturation pressure?

BOLTZ: I would say, yes, it does in the basic thermodynamics that we teach the AOs, and what we pick up in our CRO training program, under heat transfer characteristics.

KIRKPATRICK: Should the operator...assuming he had knowledge that saturation pressure existed, would that mean to him that the possibility of steaming voiding in the primary system other than the pressurizer.

BOLTZ: Yes. I am sure that the way it is put out by the training department, that it would have meant that. A good example of the way this is covered, we have a variable low pressure trip for the reactor, based on the actual value of the coolant outlook temperature from the vessel. As the output temperature increases, the low pressure trip, set point is automatically increased, and it is put out to everybody the reasons behind all the reactor trips including this one here, and they can all tell you it's DNBR consideration, a minimum value of 1.3.

MARSH: DNBR?

BOLTZ: Departure from Nucleate Boiling Ratio, DNBR.

KIRKPATRICK: Would you expect, based on operator's training in emergency procedures, that they would indeed check for this condition, assuming that the pressure was lower than they expected.

BROWN: With the conditions that happened from heresay that I can put together, I would say not immediately. Primarily, the electromatic was open. They knew it was open because the pressure was up, and then they didn't have any feedwater in there so the whole system got very hot as well. When they did establish the emergency feedwater, the emergency feedwater comes in at something less than 90 degrees or thereabouts, 90 to 100 degrees, which is very cold compared to the reactor coolant system, which with a lot of heat removal capability, which is going to cause the system to shrink and depressurize. Additionally, because of the rapid depressurization where they had the steam generators very hot, because they didn't have that feedwater, emergency feedwater, the actuation of the high pressure injection, the safeguards actuation system, also puts cold water into the system. So coming from the boiling water storage tank, that is again about 90 degrees, a lot of heat removal, so those two methods of heat removal plus the pressurizer spray valve sticking open, that's where your electromatic relief valve sticking open would cause that pressure to go down rather far and stay down for a little while 'til they could recover from that. So I think that would help--a little bit of Monday morning quarterback, I guess--but that would help to explain why you wouldn't take action immediately, because you did have a number of sources in there that were causing a large amount of heat removal.

BOLTZ: I would like to add one point to that. In the incident that occurred here on March 28 the temperatures and pressures that we're talking about that would concurrent with each other, this is the first time in my knowledge that a B&W plant has had a reactor trip and had elevated core outlet temperatures like we've seened through the complete loss of cooling water on the secondary side. So, if you're saying, would he have verified for a steam bubble in the core with this pressure, normally he would not because normally he would not be experiencing these cooling temperatures that he saw. He would not have to worry about a steam bubble.

KIRKPATRICK: Would you expect to find a set of steam tables in the control room.

BOLTZ: We have no requirement to have steam tables in the control room, and I haven't gotten upstairs to verify whether there are some there or not since we talked about this previously. Myself, as a Unit 1 shift foreman previously, we had tables in the shift foreman's desk, but not readily available to an operator at the console, and there was no requirement to have them there.

KIRKPATRICK: I believe he has no instrument to tell him that he's...

BOLTZ: Below saturation pressure?

KIRKPATRICK: Right.

BOLTZ: That's true.

BROWN: As far as relationship of hot leg, or core exit temperatures and saturation temperature, the only place that it is addressed where they could have somewhat access to it, limited access, is in the station blackout procedure when the discussion goes into natural circulation coolant, but the situations at hand, they were not in a station blackout, they didn't lose all the power so they wouldn't have been keyed to look in there, and there was enough other things going on that personally I don't feel they would have thought about looking in there to see, you know, where they were in relationship to those temperatures.

KIRKPATRICK: What are the operators trained to do in case of low reactor pressure, lower than normal reactor pressures?

BOLTZ: What they are trained to do, and you'll find procedures, what I am referring to, is pressurizer system failure, 2202-1.5 where they cover cases of a leaking electromatic relief valve, one which is stuck open, pressurizer spray valve which is stuck open, and they are taught that ways of bringing pressure back, it would be like isolating letdown, throwing the pressurizer heaters to manual to get them to full output early rather than waiting for the pressure to decrease to the automatic setpoint, and possibly increasing pressurizer level.

BEERS: All right, in the normal reactor trip procedure, they give various actions of turning on an extra make-up pump, opening a high pressure injection valve to try and bring the level up and the secondary part of that would bring the pressure back up.

KIRKPATRICK: All right. Now, if you had the high pressurizer level, what would his procedure require him to do.

BOLTZ: We have administrative requirements and tech spec requirements on maximum pressurizer level. Technical specifications say that pressurizer levels shall not go above 385 inches, okay, while the reactor is critical. Obviously we weren't critical in this incident. We had just shut down, but this is a loss of coolant consideration for the peak containment pressure following a LOCA, for the maximum RCS inventory that would flash to steam. So, we had that limit there. In addition, the plant operating procedures, we have the B&W limits precautions, a statement that says, "Thou shall not go solid at any time in the pressurizer, except for hydrostatic testing." And the consideration is over pressurization of the reactor coolant system, and the possibility of exceeding the safety limit of 2750 pounds in the coolant system by going solid and going against the discharge in the make-up pumps.

KIRKPATRICK: What did that discharge do?

BOLTZ: It depends on the flow out of the pump. Deadhead on the pumps is going to be somewhere around 2900 pounds.

KIRKPATRICK: Well, now, if the operator had any indication of high pressurizer level and at the same time he had an indication of low pressurizer pressure, based on his training and experience, what would you expect that he...which action would he take?

BOLTZ: Based on the training and the materials, and the operating philosophies, that is presented to Met Ed, to the training department by B&W, he would have reacted to the high pressurizer level, again trying to avoid going solid and overpressurization of the system, the action not going against low pressure. Like I say, they were shut down. Normally when you are shutdown, you don't have to worry about DNBR considerations or anything like that. The core is shut down ahead of time, so normal procedures, if you want to call a trip normal, he would respond directly to the high pressurizer level, like I say, a normally coolant temperature or lower.

KIRKPATRICK: All right. The initial pressurizer level rise appears to be caused by relief valve venting and lowering the pressurizer pressure below the saturation pressure in the core. Now it seems that flashing in the core may have raised the pressure from the main part of the primary system above the pressurizer pressure, thereby forcing water up into the pressurizer from the partially voided system. Has the possibility of this ever occurred? Of this set of conditions that I described, ever occurring and brought to the attention of the operators?

BOLTZ: Never.

BROWN: The only thing that is ever discussed and it was discussed in the reactor trip procedure, is that following a reactor trip if you do not maintain your pressurizer level, you can get a pressurizer steam bubble into the hot leg which is one of the main reasons why they told them, "Start one make-up pump, start the second make-up pump,"--well, you already have one running--"start the second make-up pump," which is one of your first actions, and when you start you end up having three make-up pumps running following a reactor trip to maintain pressurizer level, so that you don't get that pressurizer steam bubble down into the hot leg. That's so in case voiding occurs in that leg, it will be swepted out by the pump.

KIRKPATRICK: That's right?

BROWN: I am not sure I understand that question.

BEERS: You want to maintain the pressurizer level, some level in the pressurizer so that this can never occur--to get voids in the hot legs.

KIRKPATRICK: You say that the procedure...

BEERS: Not a voids, but the steam bubble getting into the hot legs. The reason it can happen, is because you are going from your normal average temperature of 582 down to an average temperature of 555 following a reactor trip and the amount of shrink in the system, you have to start additional make-up pump and get more water in there to compensate for that shrink because of the change in density. So that's what we key them to--it is very important to get another make-up pump on early to keep the pressurizer level, so that that doesn't happen.

KIRKPATRICK: The question I ask, I misunderstood your answer, I was referring to the primary coolant pump.

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BOLTZ: The big consideration on the minimum pressurizer level, and the actions given in the reactor trip emergency procedure, is that the reactor is shut down, and you have to have a means of positive identification of coolant system water inventory to make sure the core is covered. It never addresses the steam bubble formation in that core. When you are shut down, it assumes you have cooling. The core is shut down, there is heat generated, but you've got positive identification that the core is covered if you have pressurizer level indication.

KIRKPATRICK: But in general the possibility of voiding in the primary system, has that been addressed in TMI or B&W training?

BEERS: Void coefficients were addressed to some degree in Unit 1, but it was never much of a consideration. It was never a consideration under these conditions.

BOLTZ: The only procedure that I know of on either unit that addresses boiling in the hot legs, the core exit, is the, for Unit 2, station blackout with loss of both diesel generators, where you're cooling the plant down by natural circulation, no cooling pumps running, and your doing it with the steam-driven emergency feed pump. In this procedure, they give a table which states saturation temperature for a given reactor coolant system pressure and a maximum T_{hot}, they allow you to control in the cooling system, and I quote "To prevent hot leg boiling," and primary shrinkage assuming an initial T_{out} of 582. It has two parts in this thing. It says

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you can go down so far with no make-up pumps running and maintain your minimum pressurizer level inventory, ensuring that you know the core is covered, and it also says - this is your saturation temperature for this given pressure, okay? Don't take T_{hot} any higher than within 30 degrees below this T-set. It is the only procedure I know of that addresses hot leg boiling. Again it is for a cooldown, on a steam-driven pump, during blackout conditions, and no

MARSH: Can you reference the document you are citing from?

BOLTZ: Yea, the procedure number is 2202-2.5, Revision 6, dated 9/22/78; the table is on page 6.

KIRKPATRICK: Thank you. The B&W analysis of loss of feedwater transient, Davis-Besey, indicates that this first voiding would occur in the primary system in the case of the loss of offsite power transient. Has this possibility ever been discussed with the operators?

BROWN: No. We do review all of the licensee event reports that come from the computer printout from the NRC. I forget the division it is coming from. And I have a copy in front of me of the December 9, 1977 LER output on PWR events that were processed by this publication of communications for the NRC during November for power reactors. And this particular information is on page 39. This computer sheet was handed out to the operators to review. It was not picked out. I personally review these to go over them in training when it is my turn to go over then. And the information that was in here was not enough to say that was something important to go over. There was not any information published by the NRC in the current events or operating history information, which comes out with the detailed information, nor was there anything prefaced on this by B&W, prior to March 28. The information that has three columns in it or four columns, it has a cause code, cause subcode, facility component, component subcode, system discoverer or manufacturer, that's one column, the next column is docket number/LER number, which is licensee event report/ control number. Then the next column is event date, report date, report type, and the last section is reactor status, event description, cause description, with percent power. All right, this particular event where Davis-Besey had boiling in their core as well, which last week we got the information from Davis-Besey, by phone call. They sent us a copy of their licensee event report, which is 50 pages long. It has in here under the first section: cause code, other non-applicable, Davis-Besey 1, implementation and controls, other instrumentation system required for safety, operational vent, Consolidated Controls Corporation, then under the docket it gives the Davis-Besey docket number, the LER number and the event report date was 9/24/77, report date was 10/7/77, and it was a two-week report. The reactor status event description says routine shutdown operations, they were initially at 9 percent power. Half trip of steam and feedwater rupture control system caused rise in reactor coolant system temperature and pressure. Caused pressurizer power relief valve to open, and valve failed to close causing reduction in RCS pressure, LCOs, limiting conditions for operation, were exceeded for 5

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tech specs, and they give the numbers of them. Now, they are under standard tech specs as is Unit 2, and personally I didn't take the time to look up all those references. If there was something that was a little more important, I figured it would be referenced. And then the cause description at the bottom it says - after condition from SFRCS--I am not sure what that definition stands for--safety features, reactor coolant system I guess, I am not sure--channel 2 which caused valve, and they give a feedwater valve number FWSP7A, to quote "Cause of this half trip has not been positively determined although extensive investigation has revealed loose connections at terminal boards (possible cause)". The information there was not significant--why do I want to go over with an operator that they had an LER on a loose terminal board that caused a half actuation, although the 50 page report on the second page of the summary, then says, and I quote, "The depressurization of the primary system resulted in steam formation in the primary system, but the evaluation has shown there was no appreciable boiling in the core." And that is the first time in any report that I have ever seen where B&W, or any place else, other than a boiling water reactor, discussed boiling in the core.

KIRKPATRICK: I thank you. Are you normally provided with this type of information by B&W?

ZECHMAN: Normally we are. Normally if information of that...if that information was very important, normally we receive two places: 1) through communications of the engineering departments between B&W and Met Ed; and

2) immediately it appears on the simulator trainer during recall or something of this sort; and 3) if it is important, we also find it on operator licensing exa..s. If its a major problem, it becomes a favorite exam question, and casually an operator will be passed on his oral. And we have not seen any, I don't think any questions that anybody related to us indicated any discussions of this sort either from B&W, NRC or NRC licensing exam.

BROWN: Also, if it is something that is important, that could be generic in all of the B&W plants, the B&W has a user's meeting and they also have a user's memo system where if something important comes out between meetings that they identify to all the operating plants, "Hey, this is something you ought to look at." And there was nothing in there either, to our knowledge. Nothing came out of that that got down to the training department to train the operators.

BOLTZ: In addition all the plants have tech specs. I know this for a fact, all the plants do, which requires immediate notification of the NRC on any item which is found not to be reviewed by the safety analysis, any transient the plant has gone through that is not being considered in the safety analysis or any problem which may look to be a generic problem in all similar facilities. And like I say and like Skip says, this thing at Davis-Besey was never treated that way, even though it is turning out to be that one.

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KIRKPATRICK: Do you think it would be helpful if NRC promptly disseminated this information to other licensees?

BOLTZ: Yes I do, but I am not sure even the NRC understood the gravity of what happened at Davis-Besey, because it never came to us in NRC examinations or any kind of communications with NRC.

BROWN: The communications division at NRC, I don't know how large it is, like I said, this is a computer sheet that I have read off earlier that was on page 39. Some of these reports, they go in to the components and causes, plus they also go into things that are classified as operator error, which could be a maintenance man or janitor or a licensed operator. Sometimes it says, just plain operator error, and they don't--or personnel error--and they don't really identify whether it was an operator or maintenance man or what. But we get these reports monthly in a computerized form, and they run somewhere in the order of close to 60 pages every month computerized with three events per page, that's how many were processed due to communication. Now for that to get put out in even more detail, they would have to see...they would pick off just this one here with this loose terminal board that I quoted before, and use additional summary statements that would require somebody to fully review every licensee event report, for in-communication, to see here if it is a generic item or if it is of major importance item. And that to me, when they are processing that many reports every year, and you run them to standard tech specs with Unit 2 as far as the number of things would have to be reported, under standard tech specs,

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I called a couple of plants that were under standard tech specs before, and they were running about a 100 to 110, give or take a few, licensee event reports per year and there are 70 reactors and some reactors run 30 some run 110, some might go 150 events per year. That's quite a lot of number of events, and this computer printout gives you the prompt notification, which is the two week written followup, it gives the 30 day written followup, plus any revisions that may come in which may be six months, nine months, or even longer until a revision or a followup report is generated to give all the specific details. It is optimistic to say, yea, the NRC or somebody ought to jump on it, but that volume of information, and this one I have quoted before, this LER from Davis-Besey, which was 50 pages in length. A hundred of those a month times 50 pages, the guy's going to go crazy reading that.

MARSH: Do you feel some type of prioritizing would be in order for that. Some type of a code or more definitive code or more information in the code as to the importance of the event, the LER.

BROWN: The identification numbers do prioritize it--whether, where it was on, whether it is a safety system or not, but some of the accidents on the safety system that are reported are like this, the one I quoted where there was a loose terminal board is what started the whole thing off. That is not in itself, isn't anything to be overly excited about. That happens at different times everywhere, a little electrical connector decides to work itself loose.

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KIRKPATRICK: ...do you feel that maybe that prioritization that they have now should be refined even further.

BROWN: The volume is what really indicates that the initial cause doesn't look like much, but the final results of what really would dictate in the summary. And that may not be available for six months until all the investigation, analyses, and everything are done. One of the things that, I forget which one it is right now, one of the standard tech specs says that if certain parameters are exceeded, they've got to go through a whole reanalysis of 5 or 6 different events, to be verified that everything is still okay with that in mind, and 'til those things are done it can take quite a while.

BEERS: Perhaps there needs to be some method of going back and looking at some of these reports--the final report. You have to have an initial report and a final report on these events. Perhaps on this Davis-Besey incident, when the initial report was put in, maybe they didn't realize the gravity of it at that time, and then it never was picked up again on the final report. I don't know whether there was any method in the communications division of NRC to pick up this type of thing.

BROWN: The coding systems for identifying an LER is in itself defined in a Reg Guide, and for example this one that I read off there its identification number was 77-016/01T-0. That meant it was 1977, it was the 16th report, it was a 01--means it was a prompt report--defined under the conditions of a required prompt report, if my memory serves me correct. There is ten items there, the T signifies that it was 10 over 14 day written report and the zero means that that's the revision that it was. That's an awful lot of numbers to remember when you are trying to sort through these and say, now gee, where did this come from and what was it? This coding system after the 77-016 which is the year and the event number, to break down the code it goes anywhere from zero 1 through 99 that uses P, T, L, W and X and then you can have any number of revisions on the bottom of it. It gets to be quite lengthy as you are trying to break it down, and it still doesn't really, it goes into a lot more for licensee event reports on environmental incident and for overexposures and that type of thing.

KIRKPATRICK: I would like to get on with a different subject now. I noted during the incident that the operators were very quick to bypass the ECCS after it was initiated, even though they may not have found it necessary to reduce flow until sometime later. Are the operators trained to do this?

MARSH: Before you begin to answer I am going to break for a second and reverse this tape. Time being 6:02 and I am reading 710 on the meter.

MARSH: The time is still 6:03 and we have resumed. Don, you just read the question, still on your mind to go ahead and answer it.

BOLTZ: Yes. The reason the operators, they are in fact trained to bypass SFAS actuation following depressurization of the coolant system to do a number of things. Unit 2 has automatic opening of the sodium hydroxide tank outlet valves into the high pressure injection system which injects caustic into reactor coolant system. It's happened in the past and the only way to get these valves to reclose following opening up, which follows the actuation of the safety features actuation system, SFAS, is to bypass the actuation to allow closure by the operator. And he would be doing this even though he would not need to, at the time, throttle back on high pressure injection flow. I might add that if the pressurizer level is high following SFAS actuation, the procedures tell him to maintain 220 inches in the pressurizer. If it is higher than that, he's going to have to bypass the actuation to throttle the high pressure injection valves.

BEERS: We feel this is a design problem in that this same hydroxide is injected into the reactor coolant system at this time it is really the design, it is really for LOCA considerations and not necessarily at the time of a reactor coolant, or a reactor trip.

KIRKPATRICK: Another question along this same line, can you tell me what the pump, make-up pump limitations, flow limitations are.

BOLTZ: Yes, the make-up flow limitations on TMI 1 and TMI 2, that's 550 gallons per minute per pump and we have high pressure injection flow alarms to each of the four high pressure injection legs. Individually they come on at 275 gallons a minute increasing.

KIRKPATRICK: As the pressure decreases significantly below the low pressure trip setpoint that initiates ______, what would happen to the flow.

BOLTZ: Coolant system pressure decreases following initiation of high pressure injection. If you start out with, what, say, 250 gallons a minute through each of the four high pressure injection valves, as the coolant system pressure decreases the high pressure injection flow will increase, and it is required operator actions by the emergency procedures to bypass the actuation signal and throttle down on the high pressure injection flows to prevent run out of the make-up pumps.

KIRKPATRICK: Okay, thank you. One of the things that happened during the event was apparently--the core was, as the core was voiding, a nuclear instrumentation showed an increase. Does the training program include the behavior of nuclear instrumentation during the density changes in the core,...changes of density of the coolant in the core.

BOLTZ: Yes, the training that the operators get does address this. There are several areas where it is stressed not only for nuclear instrumentation purposes but for reactivity changes in the core. What we are addressing is leakage neutrons from the core. It has never been specifically addressed that if you get a steam bubble in the core you would see an increase in nuclear instrumentation. We have never addressed a steam bubble in the core. But, yes, they would be aware of the effects on nuc instrumentation.

ZECHMAN: We hit two areas with respect to those detectors in this light. One is the density changes of water in the event of neutron leakage which the detector see, and two, the movement of control rods in the areas of the detectors and their effects on the instrumentation.

BOLTZ: I might add that one of the things which is commonly done by a control room operator on the console is, when we are doing a heat balance check on the out-of-core detectors and of course I am talking power range detectors, if they are out of specification, meaning they are out away from the heat balance by more than 1.0 percent full power, one of the things that we can do is to slightly adjust the reactor coolant system T^F higher or lower to get the indicated reactor power from the out-of-core detectors back within 1 percent of the heat valves and this done very calmly. I am not saying we adjust T^F by two or three degrees or anything like that but many times even a half degree T^F change will bring the instrumentation back within specifications and the fellows know this, and they know that what they're doing is affecting the core density and the leakage neutrons that the out-of-core detectors are seeing.

KIRKPATRICK: Are changes in the pump behavior which are caused by reduced water quality addressed during training.

BOLTZ: Yes, you must be talking cavitation of pumps.

KIRKPATRICK: Right.

BOLTZ: MPSH, cavitation, things like that, pump run out. Yes, basic fundamentals under fluid flow and things, are covered all the way down starting in the AOC program that the fellows are initiated in. Auxiliary Operators, its the lowest, what do you want to call it, rank of auxiliary operator in the plant.

KIRKPATRICK: And as the operator observed some of the alarms that were occurring during this event such as increased pump speed and increased vibration, what would his training require him to do.

BOLTZ: We have procedures which cover abnormal operation on reactor coolant pumps and motors. Do I have those procedures here? I should. Reactor coolant pump operation procedure 2103-1.4, and reactor coolant pump and motor malfunctions, I don't have, let's see, the procedure, here it is, 2203-1.4 address abnormal conditions, which require securing a reactor coolant pump and they include high vibration, high amperage, low RC flow, those conditions under the manual action required, they say reduce power, trip reactor and secure the affected RCP, so under high vibration conditions, which we're sure that they had, they did have decreasing reactor coolant system flow indicatio, which I have seen through some conversations with operators that were there, and I know they had low motor current. I did mean high motor current rate originally. So here's one procedure specifically which says you must trip the reactor coolant pump. This was covered in operator training, both in CRO training and requal training for the licensed operators.

MARSH: Regarding both this procedure and the one you cited from earlier and the others that you referenced, is this correct that these are the current versions of those particular procedures and the ones that were in effect on March 28?

BOLTZ: The 2203-1.4 procedure, abnormal procedure, reactor coolant pump and motor emergencies, is--that I'm holding here--is revision 3 dated 5/4/78. The pages that were changed on this revision on this revision are pages 2, 3, and 3.1, the conditions requiring tripping the coolant pump under the low amps, the high vibration and the low coolant system flow are on page number 8.

MARSH: So that indeed then is the most current version and it does reflect information that was in effect on March 28, those portions that you cited.

BOLTZ: Yes, that's true, and page 8 here is revision 0 dated 5/17/77.

ZECHMAN: And you are using a control...you got a control copy in front of you?

BOLTZ: This is a control copy for the training department.

KIRKPATRICK: Does the training emphasize or include discussion of any of the hazards that the operator might, because of the primary system, if he did not trip the pump in case of high vibration.

BOLTZ: If you did not trip a pump due to high vibration. Yes, the operator knows and it is addressed during CRO(?) training programs that he could run into seal failure problems of the pump itself. Cavitation could cause dropping the impeller, and the steam formation right there, and one of the big things that we pushed in our training program is the idea of a seal failure. You want to try to avoid it under all circumstances, because it puts the unit into a loss of coolant situation. I might add from my own personal viewpoints, is--that paper said, you know, you can give your own recommendations--that if the coolant pumps had been left on line instead of being secured like they were, if they would have cavitated those pumps very much longer, they would have gotten seal failure, which would have put them into a loss of coolant situation which is unisolable. And I feel at this time we would be recirculating the Reactor Building sump inventory through the low pressure injection lines and the dose rates in the Auxiliary Building would be tremendous, and any leakage out of those pumps right now is going to give one heck of a gas release, so we would have offsite teams tracking a plume yet today.

KIRKPATRICK: One of the things that occurred during the event was that the outlet temperatures went offscale and comparison with the pressure at the time indicates that these were in a superheat range. Did the operator training ever address significance of such a thing and the fact that, ah...

BROWN: We discussed the regions of heat transfer, as to whether it's conduction, nucleate boiling, film boiling, bulk boiling, or superheat. As far as the temperatures were--really referred to the pressure--yes, and no. We deal our discussions primarily with the steam generators. We're talking about those different mechanisms of heat transfer and getting the good quality of steam out of the steam generator, and don't really address it in the reactor coolant system because--Well, the only thing we talked about is that the reactor is operating in the nucleate boiling region, and the fact the nucleate boiling region can be broken down into two parts: the subcooled and the saturated, and that the regular operators in the subcooled nucleate boiling region, where in the nucleate boiling region small bubbles are formed, small voids are formed, but they move into the coolant and collapse quickly and in the subcooled nucleate boilding region those bubbles of heat transfer are at a minimum, even though you are in a good region of heat transfer. But as far as talking about those temperatures that be T set, those range of those instruments that they would be looking at on the console only go up to 620 degrees, and I don't know exactly what the pressure was at the time that you were referencing it, 1300 degrees. Yeah, you are definitely over set T. But, there's a few numbers that are in their mind, like for example, they know that for a pressure of 1010 that the set T is around 545.

KIRKPATRICK: That's because that's the steam generator.

BROWN: And that's to do with the steam generator and we talked about that for a reactor trip, and the steam bypass valves are to maintain that steam header pressure at 1010, so that we have a cooling mechanism to go to maintain the steam generator 545, while the reactor coolant system will lag a little bit and be around 555, which will limit the amount of shrink following a reactor trip. And that is gone over quite extensively. Whether they can carry it over or not during that transient situation, I don't know. I'm sure the--personnally I would sit there and say, "Oh, gee, look at that temperature, that's T set." You know, there's 14,000 alarms going off and you're trying to figure out where to go, I'm not sure if I could put that together myself. Maybe I could, and I'm cuttin' myself down, but that's something I'm not sure I would go with, but yes, heat transfer, superheat and certain T set's are gone over, even in the pressurizer operation. They have to record every shift of the pressurizer temperature, and they know that for 2155 T set is 650 or thereabouts, close to it, and that's the indication that they are looking for to show that they have saturated conditions in the pressurizer.

BOLTZ: One thing I would like to add to that is during the CRO training and in fact during the requalification training, when an RPS force is given we do address the effects of departure from nucleate boiling on cladding temperatures. There is a graph that we put out that show's what happens when the core does depart from nucleate boiling, going back and forth to the film boiling region and the film collapsing and cycling the temperatures of the cladding up and down. But, it is never discussed, that I know of, in terms of reactor coolant system pressure and an actual steam bubble being formed in the core, uncovering the core. Just the effects on heat transfer and the effects on elevated cladding temperatures, is all that has been addressed.

BROWN: The only time that any B&W lecture or anything else we ever talked about goes into the safety features emergency core cooling system, is on the maximum hypothetical accident, the worse LOCA, is that the assumptions are that the only system that works is your low pressure injection system, and if the core does get uncovered then the recovering is no problem.

BOLTZ: That's right. We also have right in our tech specs, the final acceptance criteria of 2200 degrees it is right now, for peak cladding temperature following a loss of coolant accident.

BROWN: The analysis was done to show that it was safe at 2300, but the final acceptance criteria for the emergency core coolant system limited that to 2200.

BOLTZ: But again, I do want to stress that the final acceptance criteria as it was presented to us by the B&W people and as we present it to the operators is stressed on cladding temperature and its effects on heat transfer and cladding damage, not on coolant system response. We are talking accident conditions when we talk final acceptance criteria, and we are talking loss of coolant, which dictates coolant system pressurizer level really being low and possibly out of sight because there is a hole in the coolant system.

KIRKPATRICK: PAll right, thank you. That's all the questions I have regarding the primary system behavior. Do you have any more comments that you would like to give at this time before I get into the emergency plan questions?

BROWN: There's something I would like to have in here. And that is that the whole event that started this thing was due to the loss of main feedwater. And what caused this whole thing, I feel it could have been avoided with some good designing. The main feedwater pumps did trip on low section pressure as designed. They were cleaning out some--trying to clean up the condensate polishing demineralizers--and a line clogged which got water back into an air line which caused the outlet valves on the condensate polishers to go closed. Therefore, there was significant reduction in the water suction to the main feedwater pumps, causing them to trip. There is a bypass valve on these condensate polishers, but it's manual and that doesn't do anybody a damn bit of good. And that to me is--that started the whole thing, and we were talking about some of the locations of, where is the indication at? Where's the control at? In the control room, is the availability for the operator to see it? There's a lot of design things there that, as far as I know, were identified on problem reports to the contractor, Burns and Roe, the engineer contractor and startup testing, which I believe was done by UE&C, United Engineers and Constructioners and to GPU. This was by the operators. Some of the things were taken care of; other things weren't.

KIRKPATRICK: I discussed this area with you before. You listed a series of differences between Unit 1 and Unit 2 that you believe would have led to... had they existed on Unit 2, as they do on Unit 1, may have mitigated this problem.

BROWN: One of the lists

KIRKPATRICK: Make notes

BROWN: I'll try, I don't know if I can remember all or not. One of the things is the electromatic relief valve. In Unit 2, there is a status light on the console that was added after they had lost a power supply one time; and the only thing that this light does in Unit 2 is give you an indication of what kind of command signal is being sent to the solenoid valve for this electromatic relief valve. In Unit 1, it's a limit switch on the valve that will tell you whether that valve is open or closed. Additionally, in Unit 1 all the operator has to do is, standing there at the console, controlling the primary system, is turn around and he has indication of RC drain tank pressure and temperature, and he can see whether the heat exchanger is on trying to get the temperature back down. In Unit 2 he can't do that. Those are two things right there that I can think of, plus this bypass valve, which I just mentioned.

681 081

BEERS: Right. Why don't you go ahead and explain how the bypass valve works in Unit 1?

BROWN: Well, in Unit 1 if you get a high differential pressure across the polishers in Unit 1, which is called Powdex in Unit 1, this bypass valve goes open so that you can pump straight from the hot well to the condensate pump, to the condensate booster pump, right to the feedwater pumps, without cleaning up the water. They sacrifice water quality, as far as chemistry is concerned, to ensure that you do have water in the main feed pumps, and in Unit 1, the main feed pumps don't trip because they have that bypass around their polishers.

BOLTZ: I might add that Unit 1 has the same feedwater pumps that Unit 2 does. Unit 1 does not have low pressure trips on those feed pumps.

KIRKPATRICK: You mentioned the existence of the block valves on Unit 2. Feedwater block valves. Auxiliary feedwater block valves.

BOLTZ: In Unit 1, it comes off the discharge of the pump, it goes through the control valves, which are called EFV30A and B, straight into the steam generator through the Aux Feed nozzles. In Unit 2, it comes out off the discharge of the pump and it goes through the control valves which are EFV11A and B, and then it goes into a header motor operated where this one valve was closed, this EFV12A and B. They were closed, and then through two normally closed valves and their numbers are EFV32A and B, and 33A and

B, and they are a bypass around this block valve that in event this 12 valve doesn't work they can go through those. And in Unit 1, they don't have that, so there is no problem about worrying if it is locked open, or if it was tested properly, or if the limit switches were okay. It's just a straight shot off the control valve and you either have it or you don't.

KIRKPATRICK: Do you know why the procedure for surveillance testing requires closing those 12 valves, _____ valves, if they are not needed on Unit 1.

BOLTZ: You mean on Unit 2.

KIRKPATRICK: Yeah. The Unit 2 procedure requires closure of these valves. Since they don't exist on Unit 1 presumably they are not needed there.

BOLTZ: I don't know why they do. In fact, not all of the surveillance procedures that we have on the Unit 2 emergency feedwater system, which ends up with the emergency feedwater pumps running on recirculation--not all the surveillance procedures require those valves to be closed, only one. It happens to be the one that was performed a few days before the incident.

BEERS: There are two possibilities of why they must be closed on Unit 2 and not on Unit 1. The first possibility is that Unit 2 is on standard tech specs and requires many more operability checks, all of these emergency feed systems, than is required by Unit 1. Secondly, perhaps the flow control valves, the EMV11A and B in Unit 2 leaked through, and to preclude water being injected into the generator, the block valve was in in line with the control valves.

BOLTZ: The way Unit 1 gets around that is they close the discharge valve on the emergency feed pumps, which is downstream of the discharge check valve and Unit 2 has the same set up. In fact, motor operated discharge valves, Unit 1's are manual which have to be closed locally by the operator, but the low flow recirculation valve for pump protection is before the pump discharge check valve, just as in Unit 1. So they could have operated the same way.

BROWN: There is one other difference between Unit 1 and Unit 2, is that some of the discussion with the operators, they were having a lot of problems with their make-up pumps, getting them on and letting them stay on, and the interlocks require a four second time delay for the Unit 2 make-up pumps to start, 'cause when you hit the the control switch you have to hold it until it goes through its logic to get the oil pumps on before we'll say okay pumps start. In Unit 1, it doesn't have that time delay. You hit the control switch, the oil pumps are already on, and it goes right away. That's one other difference between Unit 1 and Unit 2 on those.

BOLTZ: One other thing we mentioned the other day is for unit differences, and it becomes quite important in the March 28 incident, and that is the design feature in Unit 1 on the way we empty the RB sump. We have two containment isolation valves that we have to open, it's gravity flow into the Auxiliary Building sump in Unit 1. There's a low level interlock, which automatically closes one of the valves to maintain a water seal, so that there is no gas release from the containment to the Auxiliary Building should the line go dry with the sump. There are no automatic sump pumps or valves or anything like this, like Unit 2 has. And maybe if they would have had the same thing, all this water in the Unit 2 Auxiliary Building just wouldn't be there today.

KIRKPATRICK: All right.

BOLTZ: I might add one thing, is these two containment isolation valves on the Unit 1 RB sump, and I am sure this is true of all the Units, only close on a four pound safety feature actuation, not a low RC pressure deal.

KIRKPATRICK: Okay. I'll go to the eme[illegible]cy plan questions. Do you have an established training program for individuals who are assigned duties and responsibilities by the TMI emergency plan.

ZECHMAN: Yes, sir. We have a procedure titled "Station Health Physics Procedure" 1670.9, Volume 1, "Emergency Plans and Procedures, Emergency Training and Emergency Exercise," which I have available for you here today.

KIRKPATRICK: All right, this does briefly describe the nature of the training, briefs of the...well for the various categories of personnel who would be involved in an emergency, is that right.

ZECHMAN: Yes sir, it does.

KIRKPATRICK: All right, thank you. Does the training outline...let's see does this training program...is this training program, excuse me, outlined in the form of schedules and lesson plans?

ZECHMAN: The training program outlines--the procedure, I should say, outlines the training required for each of the assignments to the onsite emergency personnel. It identifies in the procedure that lesson plans will be available for each program. In other words, the lesson plans are not included in the procedure but the procedure states what shall be taught.

KIRKPATRICK: All right.

MARSH: Have these lesson plans been developed?

ZECHMAN: Yes, sir.

MARSH: And they are available.

ZECHMAN: And they are available.

KIRKPATRICK: Is it training, classroom, or hands-on in nature, or both?

ZECHMAN: It is a combination of both because along with the training we followup with a drill, the actual drill participation by the participants.

KIRKPATRICK: All right. During--you're at the end of the training sessions, are there tests or other checks of individual's proficiency.

ZECHMAN: In certain areas there is, yes sir. Depends on the job assigned, for example, we don't for training offsite fire companies or civil defense people as part of this program, we don't give them tests.

KIRKPATRICK: But for, let's see, well, for personnel in these categories like emergency directors, accident assessment personnel, radiological monitoring teams, fire brigade team, onsite fire brigade team, repair party team, first aid rescue team, operations personnel and division support personnel. Would they have the proficiency tests?

BROWN: Some of them would.

BEERS: Part of them do, and part of them don't.

681 087

BROWN: All right. The accident assessment group that would be doing the calculations, yes, they are instructed, they go over all the offsite doses and calculations have to be gone into that, and there is a quiz that goes along with that. The operations personnel must pass a test on certain emergency procedures that are outlined in this 1670.9. There is a hands on type of training for the fire brigade, everybody has to go then physically wrap the hose in their hand and put a fire out or an extinguisher or both, and the first aid training is a Red Cross or multimedia course and, yes, there is a quiz with that. Some of the training there is, some there isn't.

KIRKPATRICK: All right.

_______: I might point out that like the procedures states, unless the plans are outlined, will be revised by the instructor for each program, and will include periodic examinations or assignments.

KIRKPATRICK: All right.

MARSH: You mentioned contingency planning with offsite local fire departments, this type of thing. Who bears the responsibility for that, under whose ...which one of you would be in charge of that or would bear reponsibility for that portion, or do all of you get involved?

BROWN: Yes, the training is conducted and it normally falls under the realm of radiation protection supervisor, Dick Dubiel, and supervisor of maintenance, Dan Shovlin, and safety supervisor--which I believe in charge of that now, is Earl Gee. And they work together with getting these people in here. Earl Gee, for example, he works a lot with the fire companies to get them in, either him or Jim Wheelan, from Met Ed Safety Department. We'll work with the fire companies so that they know which gate to come in, where the special hookups--that's for anything different from what's on their truck--is located and as far as who was in charge this past year, I don't know.

______: The procedure can be very specific. For example a training program facility _____ is the responsibility of the supervisor of Radiation Protection and Chemistry. The training program for the Bureau of Radiological Health is the Supervisor, Radiation Protection, or his designee. The training program for the State Police is the Supervisor of Radiation Protection and Chemistry. The training program for the local fire companies is the TMI representative and his designee, as Mr. Brown just explained.

MARSH: Do you people monitor the performance of these people to see that this training ______ had been carried out?

_______: We receive final documentation.

KIRKPATRICK: Okay, has this been exercised. Have they been doing this lately?

______: Yes, sir.

KIRKPATRICK: Do the offsite people participate in any of your drills? Have they responded or has this been exercised, so that, uh,...

BOLTZ: The way it works is we set up a training program and invited the local companies to respond.

KIRKPATRICK: Have they responded? .

BOLTZ: Some have, some have not. To be specific, I would have to go back to the records and tell you exactly who has this year and who has not. I don't have it with me.

BROWN: Some of the...most of them I think had. I am not sure f we have an attendance by name of who from these offsite organizations participated. And every year in the radiation emergency drill, they are notified to activate their own subsection of the plan and follow it through with the emergency plan. And this is sort of a little thing afterwards: about a week and a half after this March 28 incident here, I heard a big thing on the news from the, I think it was Lancaster County Civil Defense, that says, "We now have an emergency plan." What in the hell were they doing since 1974 when we were running these drills?

KIRKPATRICK: One of the questions that I have down here is, "Briefly describe the emergency drill program."

________: Sir, that is spelled out in detail in the procedure 1670.9 that I am turning over to you today.

KIRKPATRICK: All right, thank you. As of 3/28 has the 1978 training iteration for emergency planning been completed?

________: The training was provided for each of the organizations that are mentioned in the training procedure. There are a few who send, for example, the repair party. The repair party, two graduate people(?) have been trained with the responsibility to go to their people in their departments, and train them. In certain areas, that has not been completed as of this date. Operations training has been completed.

KIRKPATRICK: All right, thank you. If a drill identifies any area or an area requiring followup, in other words improvement, how is the area highlighted, evaluated or corrected?

________: All right, as a result of the drill critique, individual action items are listed on Enclosure 4 of this procedure. With action to be taken, then has the be...the action has to be resolved with resolution attached and signature and date signed.

KIRKPATRICK: Okay, and to your knowledge, on March 28, were there any outstanding items that had been identified during previous drills that have not been resolved.

_______: During previous drills or the last drill?

KIRKPATRICK: Well

_______: During the last drill, there are still outstanding items that have not been resolved.

KIRKPATRICK: All right. Would you be able to describe them right now or

_______: No sir, they are available.

KIRKPATRICK: All right, but outstanding items from drills previous to that have been completed, is that right?

______: Again, I would have to look at, into all those items and tell you, you know. I do not have them with me to identify that, and it has been over a year since that time so it is available to you at any time.

KIRKPATRICK: All right, thank you. That's all the questions that I have.

MARSH: I've got one or two more. With the offsite contingency training, that's a broad title for it, I assume the hospitals are also included?

_______: Yes sir. We have run a yearly emergency drill with the hospital.

MARSH: In some instances, your employees here, within different categories work on a swing shift type of basis, witn them rotating shift to shift to shift, with a set period at the end of that rotation assigned for training. Do you people monitor the use of that time? In other words, if I've got a week at the end that's supposed to be training, you are just dealing with supervisors to be sure that ultimately the training is accomplished, am I understanding you right?

BROWN: This is right. For licensed operators and people in operations the auxiliary A, B and C operators, on some of their weeks, which is called a training week, there is some classroom training. Other than that, there is some system training, which they can do on their own under the direction of the Foreman, who says, "Okay, you go trace this system out and go answer these questions." The licensed operators do attend the requalification program. The maintenance people such as electrical, mechanical, instrument, radchem techs, people that are on shift work of that nature, we at this time do not do any training for them. If there is any training they can sit in on, it's fire fighting, first aid. All right, they come to that, but we don't provide a weekly training schedule for those people.

BEERS: We do provide some training for these type of people that you addressing, but what Mr. Marsh is asking, do we track to ensure that they are trained. Am I correct?

MARSH: The specific one I am looking at that, although time is set aside, what prevents this time from being used by the supervisor as just another work week. And although it may be labeled as training, it is not dedicated the same. I am looking for a hand as to whether we can measure that or not.

________: We can. Let me be a little specific. Our department represented here today has the responsibility for the training, and operations training, general employee training, radiation emergency drill training. The line departments, line management, is responsible for their training programs, maintenance responsible for their training programs, radiation protection, that department is responsible for their training programs, and so forth. So we are getting in another area that we are not responsible for.

MARSH: Right, but at the end of that training they then respond to you?

________: That's right.

MARSH: Do you have track records on that?

_______: Yes sir, at the end of that training they supply to us the final documentation of their training that took place within their area.

MARSH: That answers my question. Okay, one other area I would like to put on this tape, and this is from a layman's point of view recognizing that the tape may be listened to by other investigative teams with limited technical knowledge. If I were a newly hired potential licensed operator, if I understand you right earlier, I would start as a Aux operator C and I start undergoing my training. Could you briefly describe what my course of training would be? How would I progress to the point where I became a licensed operator? Kind of put the whole training program of an operator into perspective, recognizing that it's detailed in the documents, but just for the sake of expediency here I would like you to repeat what's in it.

ZECHMAN: Zechman - Okay, I can describe that program. The training program for CRO today begins really at the Aux operator level. I'll give you a feel for this. We have three classifications of Auxiliary operators, Auxiliary C, above him is Auxiliary B, above him is Auxiliary A operator. In order to get to be a control room operator, you have to be at the Auxiliary A level, and be the most senior qualified individual to bid in for CRO position when it is available. Now, to give you the kind of training that one goes through just to get to the A level: an Aux C, a person who meets the job specifications for an Auxiliary C operator will be identified as an Auxiliary C operator and come in to a one year training program, the beginning of which is approximately six to eight weeks of classroom training, 8 hours a day, 5 days a week on secondary systems. This is followed by a comprehensive written exam. Now, I point out that weekly exams are given during the progression of that program, a comprehension exam at the end of classroom portion. This individual, then, for the remaining part of one year is to be assigned to a shift under the direction of a shift foreman and other auxiliary operators on shift, and proceeds on-the-job training with those people. At the end of one year, he is then given an oral and final written examination on everything he has had for that period of one year. Successfully passing that program, he then automatically, what we call the mode, automatic motor progressions, moves up to the auxiliary B level. Should he fail two exams for the Aux C program, in other words he failed the original one, and then we give him a re-exam with the union present. If he fails that he returns to the job he previously held. If we had hired him from the street, he would be out of a job. If he came in from a utility group or with any other group within the company, he would go back to that position. Now assuming he successfully finishes the Auxiliary C training program of one year and qualifies as I said he moves up automatically to the Auxiliary B level--again, he goes into a classroom training program six to eight weeks, and now is indoctrinated on the primary systems. Same criteria applies, he takes weekly exams and on final written exam at the end of the classroom portion, then is assigned again to a shift under the direction of a shift foreman and an auxiliary operator crew, and goes onto an on-the-job training situation. Again, at the end of one year he is then given an oral and written examination on everything he has had to date, and it's comprehensive. It includes both secondary and primary. And

I might point out that the oral exam is given by his shift supervisor to assure that, the operation department, that they are satisfied with this gentleman they have positioned. Now once he completes that training program, he is automatically promoted to Auxiliary A operator position, as a fully qualified Auxiliary A operator. Now, as I said, if a control room operator position does open up, the Auxiliary A operators are allowed to bid through the union process for that position. After interviews, the most senior qualified Auxiliary A operator would get that bid. He immediately then goes into a nine month, what we call Category 4, control room operator training program. Perhaps, Marsh, this is your area, you would like to describe that program.

MARSH: Well, Brown, you did so well on the last interview that I'll let you do it again.

KIRKPATRICK: Brown, before you start I am going to interrupt you just a second, and put a new tape on if I may. Okay, the time is 6:47 meter reading 1377. I am going to terminate this tape.

MARSH: We are continuing now with the second cassette in a discussion with Met-Ed training personnel, and, Mr. Brown you were about to continue with the training procedures of the newly hired individuals destined to become an operator, who'd be going through.

BROWN: Okay. The training program for a control room operator, hereafter referred to as CRO, is nine months in duration. He is going to be on probation for this job for 90 days. So the program describes evolutions for the shift foreman to look at. How well does he handle himself in the control room? Remembering that the control room is a room without any windows, you don't know what time of day or what the weather is outside, completely confined, and it takes a special kind of a person to work in there. So they want to look to see how they react in there, how well they learn the basics of the layout of the console, and how they've worked with other people on their shift. The program itself has a listing of all the procedures in there; the administrative procedures, going over such things as document control, switching and tagging, radiation protection plan, and emergency. All the emergency and abnormal procedures are listed in there, and the normal operating procedures are listed. The program starts out with a review of the secondary plant with systems like circ water, river water, and some of the closed cooling systems, much like they had when they were an auxiliary C operator. The difference being, now that they're going to be looking at the specific interlocks of that system, the functions of that system again in more detail, and the places where that component may be controlled from--whether it is out on the plant or in the control room and what indications they have in the control room for that system. And the first portion also goes into the administrative procedures. During the whole course, during the 9 months, they have to get signed off on this procedure list. They have to talk with the--they either have to perform it, simulate it, or describe the events in that procedure to the satisfaction of their shift foreman, the shift supervisor, or another senior reactor operator--if they understand what's in that procedure. Now the program for the 9 months is broken down into six segments and they cover it in--we call it half of the cycle. After they go through half of this cycle, to the sixth segment, they get a written test on that information. The whole program is cumulative in nature. What they were responsible for on day 1 they are responsible for the end of the 9 month program. At the end of the first complete cycle, they then have to take another written examination and a comprehensive walkthrough, which will last somewhere between 4 and 8 hours on the material that they had studied. They then continue going through the cycles into the primary systems, chemical addition, safeguards actuation, reactor theory, control rod drive, intergrated control system, reactor coolant pumps, reactor coolant system construction components in there. And each time they're taking a written, two writtens and an oral examination, a walkthrough, on every one of these cycles and, again, its cumulative. So by the time they get to the end of their 9 month program they will have taken a minimum of 12 written examinations, and have 6 oral examinations. In addition, they also get a class depending on their experience and availability of those people, whether its one on one, or whether its one with five or six, one instructor to five or six people, they will have a class on the integrated control system, where we go into everything except the size of the resistors and stuff. They're very detailed, very exact, and a one week course on reactor theory as well. They also have to, for satisfactory completion or preparing for a license, have to go to the simulator and they have to pass a startup certification. So, once they finish the 9 month program with the training department, taking the 12 written and 6 oral examinations, in order to get the opportunity to get examined by the NRC, they also have to take a mock written exam following in the guidelines of the NRC exam, of the seven categories, and they have to get an additional oral examination by a senior reactor operator other than someone in the training department. So they will have 2 to 3 different people or more giving them examinations so that they can benefit from having the same question asked by different people in different ways. It's quite extensive. We also go into the non-nuclear instrumentation and the nuclear instrumentation in great detail.

ZECHMAN: We might point out that I have turned over, this is Dick Zechman speaking, turn over to Donald Kirkpatrick a complete package of the category 4 training program. And you might also point out that when they do receive the right to, for us to allow them to go for an NRC exam, the NRC then administers both a written exam, which lasts anywhere from 6 to 8 hours, followed by an oral exam, which lasts anywhere from 4 to 6 hours before they certify them as an SRO or CRO, ...

BROWN: There is one thing I'd like to bring out, this is Brown again, is that during the oral examinations, the emergency procedures, they have to simulate them in a timely fashion corresponding to whatever emergency procedure it is, at the console by saying "I'm gonna look at this switch," and pointing to it, "I'm going to look at this gauge," and pointing to it, and goes through step by step, and be interrupted, and say, and answer the question "Why?," during the examination.

KIRKPATRICK: This is Kirkpatrick, I have a package that was given to me by Mr. Zechman and it will be available as part of the investigation team documentations.

BROWN: One other thing I would like to address since we've described this program in detail and that is the fact that, as I understand it, the personnel who were actually on shift the day of the incident had had previous extensive experience and training, including, I believe in each individual's case, they've completed the naval nuclear power program. And because of this, they did not receive all the training you've described here. Could we briefly, since we have addressed this area, can you describe the training these four individuals had?

ZECHMAN: The individuals went through with the NRC titles a code licensing training program and it is described, the program is described in the FSAR for Unit 2, Chapter 13, training programs for supervisory CRO's and SRO personnel and I'm turning it over to you at this time.

KIRKPATRICK: Thank you.

ZECHMAN: I might point out that that document I turned to you is only a portion, that covers the major training programs of the in-depth and the number of minor training programs by minor I will even include something like first aid, although that only has a small number of hours associated with it. The training that each person has received is available from us

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and also is summarized on a computer printout and the number of hours for each training program for each individual. And that is available to you at any time.

KIRKPATRICK: All right. I'm still gathering that kind of documentation and I believe that--well, we will include for those specific individuals, we'll include this, these records as part of the investigation team records.

MARSH: Well, I appreciate very much your time in coming in to speak to us and since we've been asking you questions, before we terminate, I would like to offer each of you an opportunity, this is Marsh speaking, to put into the record, as I discussed while I was changing tapes, your thoughts on the incident and what we're benefitting from it. Any comments or recommendations will be solicited, if anyone has anything. I know we've discussed and commented during the course of the investigation, this has been going on as things have been coming up we covered stuff on a tape, but I didn't want to cut you short and terminate before we give you an opportunity if there is anything you want to bring up or discuss. Okay, if we're in shape, then I'm gonna terminate the tape at 6:58 reading approximately 105 on the meter, the second cassette. Once again, say thank you for your time. I recognize that you are busy people also, I appreciate your time in coming in. I cut the tape then at 6:59.