UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:

IE TMI INVESTIGATION INTERVIEW

of

Mr. John H. Flint
Physics Tests Coordinator, Unit 2

Trailer #203
NRC Investigation Site
TMI Nuclear Power Plant
Middletown, Pennsylvania

April 23, 1979
(Date of Interview)

June 19, 1979
(Date Transcript Typed)

58 and 59
(Tape Number(s))

7908090532

NRC PERSONNEL:

James S. Creswell, Reactor Inspector

Donald C. Kirkpatrick, Nuclear Engineer

891 023

SHACKLETON: The time is now 6:08 p.m., April 23, 1979. This is an interview of Mr. John H. Flint. Mr. Flint is presently assigned as the Physics Tests Coordinator, Unit 2, at the Three Mile Island Nuclear Power Plant operated by the Metropolitan Edison Company. This interview is being conducted in Trailer 203 just outside the south gate at the Three Mile Island Nuclear Power Plant. Present to conduct this interview are: Mr. James S. Creswell. Mr. Creswell is a reactor inspector for Region III of the U.S. Nuclear Regulatory Commission. Also present is Mr. Donald C. Kirkpatrick. Mr. Kirkpatrick is a nuclear engineer assigned to Inspection and Enforcement headquarters of the U.S. Nuclear Regulatory Commission in Washington, D.C. Also present at the request of Mr. Flint is Mr. William H. Behrle. Mr. Behrle is project engineer for the Metropolitan Edison Company.

SHACKLETON: Prior to starting this taped interview, I presented to Mr. Flint a two-page document prepared by the U.S. Nuclear Regulatory Commission which explains the purpose, the scope and the rights of the individual regarding giving a signed statement and explaining this investigation. At this time, Mr. Flint signed the three questions "yes" that I'm going to repeat here for the record.

SHACKLETON: Mr. Flint did you understand both pages of the document?

FLINT: Yes, I did.

SHACKLETON: And do we have your permission to tape this interview?

FLINT: Yes, you do.

SHACKLETON: And, would you like a copy of this tape or a transcript?

FLINT: I would prefer a transcript.

SHACKLETON: All right, sir. Mr. Flint, for those persons who are listening to this tape, would you please give us some background information on yourself as to your credentials and being involved in your present job assignment.

FLINT: I am presently an engineer with Babcock and Wilcox Company. My prior experience includes approximately 5 years in the United States Naval Nuclear Power Program. I have 6½ years as a Senior Reactor Operator licensed on three reactors with the General Atomic Company and have been with Babcock and Wilcox almost seven years. During the period of time I've been with Babcock and Wilcox I was a physics test engineer on the startup Oconee units 1 and 2 for Duke Power Company in South Carolina; Three Mile Island Unit 1 at Metropolitan Edison Company, was approximately 1 year in the preoperational and initial criticality testing at the Toledo Edison Company, Toledo, Ohio; and was assigned as

a physics test coordinator Unit 2, Three Mile Island, for GPU Service Corporation, was in charge of the physics program startup operational testing and prior to this transient was in process of writing st tup report for Unit 2.

SHACKLETON: Thank you. And now gentlemen, we will begin our questioning, and for the purposes of those listening to the tape, Mr. Flint was present on March 28, 1979, some hours after the problem at Three Mile Island was identified. Mr. Flint, could you give the listening audience the best details that you can recall as to your actions and activities on that day?

FLINT: At approximately 0830 on the 20th of March, I arrived at the North gate to the Island only to be stopped due to security personnel restricting anyone from coming on the Island. It took me approximately 20 minutes to a half hour to have the security guards call in and contact the control room to find out if my services were required. At approximately 0900 I was granted permission to go on the Island; immediately went to the Unit 2 turbine area where we have the entrance for Unit 2 and went directly to the control room. On entering the control room, I noticed that the normal alarms were lit and that the typers were printing out as normally occurs following a turbine/reactor trip. Ah, I also noticed that the Emergency Team for radiation type emergency was in attendance in the control room at this time. I talked with the Control Room personnel and this is primarily with Bill Zewe,

the Shift Supervisor, Ed Fredricks, the Control Room Operator, and Lee Rogers, Babcock and Wilcox Site Representative, and learned that the conditions were abnormal for this type of a transient. In talking with these personnel and looking at the console indications and the computer printouts, I noted that the hot leg temperatures for the primary system were in excess of 620°F, cold leg temperatures were significantly lower than this, which would be unusual in this condition, pressure was low in the reactor coolant system, all control rods were on the bottom. Indications for the source and intermediate range appeared to be normal, for this period of time following a shutdown condition. I did notice, however, that there were several blips on the recorde for source/intermediate range and in conversation with Ed Fredricks he informed me that they thought at the time that they were going critical and that they had added additional boron to the system. At this time, I informed them that in all probability this was not the case, that there had been a change in leakage flux path from the reactor core to the detectors and it was not in fact the case the reactor going critical again. Looking at the recorder that prints out the steam generator and reactor coolant temperatures on wide range which runs from approximately 0 to 800°F, there were 2 temperatures that were printing up scale on the hot leg temperatures; one approximately 770 degress, the other approximately 800 degrees. Now these thermocouples are not normally used in this range so I was not certain that they would give an accurate temperature, only indications of approximate ranges. Ivan Porter, Metropolitan Edison I&C engineer, showed me a setup where he had set up a bridge and

was reading out a temperature in the back of the control room that was converting instances was above the normal Rosemont Calibration scale, came out to be approximately 725°F, which tended to back up the indications we'd seen on the other recorder. Talked to various personnel in the Control Room, Gary Miller, the rest of the Operations personnel such as George Kunder, informed me of sequence of events that led up to this position. At this time I again talked with Ed Fredricks and both he and I were convinced that we had in fact a solid steam bubble in both loops of the hot legs. At the time, I attempted to initiate the filling of the steam generator to induce natural circulation or at least remove enough heat to collapse steam bubbles sufficient to run a reactor coolant pump. At this time I had been informed that they had tried to bump the pumps earlier and that they had seen little or no flow indication and had therefore secured the pumps. At that time, to the best of my knowledge, natural circulation had not been started they were just in the process of filling the generators. Shortly after this, they tried to attempt to pressurize the system and collapse the bubbles by using pressure. I had at that time informed them that they could not do it this way in all probability because of the high temperatures, the pressure would exceed the allowable pressure we could go to in the RCS and that the Code safetys would lift long before we got there. However, the attempt was made in the in the possibility that thermocouples were not indicating properly and that just was a chance that it may in fact collapse the bubble. It did not work, and they then brought the pressure back down. During this period of time they were dumping steam out of

the atmospheric dumps, this was approximately 1100 to 1230. This was the mode that they were using to get rid of decay heat. They had lost the auxiliary boilers from Unit 1, (not have condenser vacuum, this was the reason they were using this mode); the "B" generator was bottled up at this time because there had been a reported primary to secondary leak. They had taken another set of samples and confirmed the fact that there was activity in the "B" generator. About this time, Gary Miller was preparing to go with George Kunder and Jack Herbein to see the Governor. We received a call that indicated that the Governor did not want us dumping radioactive steam out. He was under the impression that's what we were dumping, although we had an individual on top of the turbine building monitoring, we had people around the site; we had no contamination with dumping. However, the governor wanted the atmospheric dump valve shut and it was shut at approximately 12:30. At this period of time they were essentially removing decayed heat by either opening the block valve for the electromatic relief valve, which is RCV2, and dumping down into the reactor building, or dumping down into the condensor on the bypass valves. In this range of time, heard a double thump, and at the time we had been in and out of respirators. I assumed that the sound I heard was just a ventilation cycling at this time. There appears to be a correlation with this and the reported hydrogen detonation in the building at that time. Shortly afterwards we received our alarms for high building pressure, ECCS, building spray, and so forth. But, as I say, at that time, I just thought the noise was associated with the building dampers. Spent several hours

feeding with the high pressure injection pumps. Finally succeeded in bringing the hot leg temperature on the "A" side down on scale. At this point in time, the operator attempted to switch the inlet piping that was sending the high pressure injection in to try to collapse the (ah) "B" side also. At that time he lost the "A" side, went back up off scale above 620°. It was requested that we once again attempt to collapse the bubble. We took the pressure back to approximately 2300 pounds; held it there for approximately 1 hour (I again explain, I did not believe we could collapse it because of the temperatures we were at). It did not work and we were unable to collapse it this way. There was then some concern about whether or not we actually had the core covered. We felt that we did, but elected to reduce pressure in an attempt to bring the core flood tanks on. Through the injection nozzles of the core flood tanks, and coming right into the downcomer, it was felt that if the core was not covered that there should be a significant level and pressure change in there when they actuated. Pressure was slowly brought down, core flood tanks actuated, level came down slowly, we did not see any significant changes during this portion of time to indicate that we were, in fact, not covering the core. There was no noticeable change in the count rate for the source range instrumentation, which would also indicate that we had not significantly changed anything in there. We found that we were steaming again in going down on the bypass valve and so forth, had filled the steam generators up, removed enough heat that the "A" loop temperature came back on scale, the cold

leg temperatures started coming up and we felt that we had collapsed the bubble to some degree in the "A" side. During this portion of time we were periodically printing out the RTD's of the incore themocouples and following the temperatures in the core. When we first started dumping them out many of them had question marks, which indicated they were above their normal scale of 700° not printing out "bad" which would indicate that they had failed. Over the next few hours these thermocouples gradually came back on scale we were recovered more and more of them and towards late afternoon I believe we had most of them indicating on scale. We then elected to run a reactor coolant pump. We chose the "A" loop since we have spray on this side and this would be therefore, the best side to get a pump on if possible. Additionally since the "B" side was bottled up, we had a better chance of dropping heat across the "A" side. In order to be prudent, we only bumped the "1A" pump for approximately 10 seconds. We tried the "2A" pump, it did not start so we went to the "1A". During the approximately 10 to 11 seconds we ran the "1A" pump, reactor coolant pump, we had good flow indications and a normal indication of pump current. We did not therefore, have any reasons to believe that seals had failed, all the seal pressures and leakages were normal and so forth We then waited approximately 15 minutes. This is a normal mode since can draw a large amount of surge current on it we do not want to start the pump any more often than we have to. Since we felt that we had moved water, the temper-

atures appeared to be good, we did not feel that we had a two-phased blowdown there. We then turned on the "1A" pump again, approximately 15 to 18 minutes later, and left it on. The temperatures did in fact come down on the "A" side and later slowly started coming down on the "B" side. Late in the evening, approximately 2200 to 2218, in that range, we had the temperatures down and we did reestablish a bubble in the pressurizer. I believe that pretty well covers a general overview of what I observed that day and what I participated in.

CRESWELL: OK John, thank you. I'd like to go back to the previous day. Ah, John having looked at the security logs, I note that that you were in from the time period of 1445 hours to 1555 hours. Could you briefly describe what you did during that time period?

FLINT: Since that time period would be the time period that I normally go up to the Control Room, talk to the Control Room Operators, find out if conditions were normal, which I did at least once a day. We had the Reactimeter, which is B&W's name for a data logging system, data acquisition system, 24-channel capability. Its on an automatic 3-second logging frequency, at least once a day change the magnetic tape in it. This is the period of time when I went in and I always try to stop at the Control Room before I go in to change the tape.

CRESWELL: So you did change a tape out?

FLINT: That is correct.

CRESWELL: And a tape would last for how long?

FLINT: Tape on a 3-second logging frequency will last for approximately 26 hours.

CRESWELL: OK. Were there any particular points that you were monitoring at that time?

FLINT: Do you have any problem there?

BEHRLE: No.

FLINT: Ah, OK. During a normal mode in which we might experience a transient of some type, we normally monitor reactor coolant system pressure, the hot leg on the primary side, the cold legs on the primary side, pressurizer level, the spray valve position, steam generator operate and startup levels, steam generator pressures, turbine header pressure, makeup tank level, drain tank pressure.

CRESWELL: That's reactor coolant drain tank pressure?

FLINT: Reactor coolant drain tank pressure. Feedwater flows on the "A" and "B" loop on the secondary side, feedwater temperature; pretty much the parameters that we normally would look at.

CRESWELL: Ah, the reactor coolant drain tank pressure - why was it of interest?

FLINT: If for some reason you had lifted the safety valve, you can get an inference from the changes in the drain tank pressure. This is sort of a backup system to incur on a transient to see how long you had blown down.

CRESWELL: OK. Have you had some previous experience that indicated that you needed to monitor that particular parameter?

FLINT: I don't know as I'd use the term "needed to". It's more that we felt its a nice parameter to have. There had been one or two ocassions down at Oconee where we had a rupture disk go on the tank and therefore we were trying to follow what was the occurring during the transient and as I say, it is a backup in case one of the other systems didn't tell me the information, this was another way of gaining it. Sort of like on the steam generator, you're normally on the operate level, but we monitor both the startup and the operate for overlapping redundancy, if you will.

CRESWELL: OK, So you were the one that selected the data points that would be put in the Reactimeter?

FLINT: That is correct.

CRESWELL: Oh. So, I think you mentioned that you arrived at the gate. What, the north gate or the south?

FLINT: North Gate.

CRESWELL: North Gate. About 7:30 a.m.?

FLINT: Approximately 0830.

CRESWELL: 0830. I'm sorry. Ah, and you were there for what - about 30 minutes?

FLINT: 20 to 30 minutes. I'd say closer to 30 minutes.

CRESWELL: Ah, could you expand on that time period. Did you initially walk up to the guard, or could you develop that time period for us?

FLINT: No. The first several minutes, I just sat there debating whether to go up to the observation center, which is the normal collection point for this type of, an isolation of the site, most people

will go up there. However, I noticed that Unit 1 had not come up and I knew that that morning was scheduled to come back up line; and about that period of time before I decided to go up to the observation center, personnel started coming down. Most of them appeared to be instrumentation technicians to go on the Island. I therefore felt that there was no reason why at least some people could not go on and therefore at that time approached the security personnel. Took a few minutes to convince him that he should contact the Control Room and find out if my assistance was required.

CRESWELL: OK. What did you observe while you were waiting there that 25-30 minute period?

FLINT: Primarily that both units were down and, that traffic was being sent up to the observation center, there were several security personnel in the area. There were only (I believe) 2 or 3 cars there when I was there. It was just a normal atmosphere, just possibly overrunning a security drill except for the fact that I noticed that the cooling, there was nothing coming out of the cooling towers on Unit 2.

CRESWELL: OK. And you noticed the same on Unit 1 and that's how you derived that Unit 1 wasn't back on line.

FLINT: That is correct.

CRESWELL: OK. Ah, did someone call you at home to come in or is the normal time for you to come in?

FLINT: This is approximately the normal time I would have come in in the morning. I received no phone call at home. But I have a very selective phone system. I can call out at any time but only approximately 40% of the messages come in. I spent about a year fighting with the phone company on this but no success yet.

CRESWELL: OK. Getting back with TMI. Ah, You finally gained access. The guard, well what, the guard told you you could go in?

FLINT: He contacted the Unit 2 Control Room; I believe spoke to Gary Miller or George Kunder and they said to send me in.

CRESWELL: OK. So could you ah, briefly describe how you got up to the control room?

FLINT: Went down to the normal access we use to go into Unit 2, which is through the security access gate down the Unit 2 turbine building, went in through the turbine building, and up to the control tower.

CRESWELL: What did you notice walking from the security gate until you got to the control room?

FLINT: Essentially that the unit was either cooling down or in a relatively [illegible] mode. There was not the normal sounds that you hear from the steam piping and so forth when you're operating. At that time there were no safety valves lifting I just walked thru the lower levels so I couldn't tell whether or not the turbine was still rolling or anything of this nature. But it was obviously a case where the unit had been shut down for several hours.

CRESWELL: OK. Did you see any personnel on your way in?

FLINT: The only personnel were the two personnel that I met at the security station that passed me thru the gate and allowed me to go in.

CRESWELL: OK. What, ah, as I recollect walking down the hall there in the control room, there's some glass windows.

FLINT: There's a window outside of the Shift Supervisor's office.

CRESWELL: What did you see as you walked down the hall through the window?

FLINT: Saw a large number of people in the Control Room that were appeared to be in conference. And I could glance in, I could see the annunciators were on. It would appear to be a recovery from a trip.

CRESWELL: Do you recollect who was in the Shift Engineer's office when you passed it?

FLINT: I could not say for certain at this time.

CRESWELL: OK. So then you entered the Control Room. And what were your first impressions as you entered the Control Room?

FLINT: Well, except for the fact that there were some auxiliary operators and the radiation monitoring team or the emergency radiation team in there, it appeared to be, as you would expect after a turbine reactor trip, normal lines, normal annunciators lit, station personnel, such as Gary Miller, Joe Logan, George Kunder, Seelinger, were all in the Control Room. The operators were there. The only unusual portion was apppeared that the previous shift was on. Had essentially double shift in the Control Room. Plus some personnel that are normally up in Unit 1 were down there.

CRESWELL: OK. How many people would you estimate were in the Control Room at that time?

FLINT: Perhaps 25, 28.

CRESWELL: OK. Did you happen to notice the radiation alarms on the panel?

FLINT: I noticed that there were some radiation alarms on the panels. I did not walk over though to look at that time at the relative indication to find out how far up it was.

CRESWELL: Do you happen to remember approximately how many would have been?

FLINT: No, I was just doing a quick scan at that time. Looking at the computer output and getting a quick idea of what the conditions were and not specifics.

CRESWELL: I have here a set of photographs that I have obtained from the TMI Training staff. Color photographs of the Control Room. That I am showing John now and to give us some perspective about where he is in the control room and where some of the other people are. Could you briefly describe as you walk in the Control Room what the situation is?

FLINT: Entered on the left side of the Control Room through the normal access door. Looked at the back annunciator panels, primarily towards the reactor coolant portion of it the emergency cooling system, radiation alarms, went to the plant computer, which is on the left hand side, saw that the printouts appeared to be standard printouts at that time following a turbine reactor trip. Then, verified of course at the same

time that all the control rods were on the bottom (this is one of the first things I noticed entering the Control Room) and started talking with Lee Rogers, Ed Fredricks, Bill Zewe at this time.

CRESWELL: Could you briefly describe what you discussed with them or what their statements were to you?

FLINT: At the time I had asked them what had occurred. They told me that they had had a turbine reactor trip. That they had eventually saw an indication of loss of flow on the reactor coolant pumps and secured the pumps, had seen an unusual indication on the source in the immediate range, which I had verified by looking at the strip chart and when they told me that the pressure had been low earlier I went over and checked a few of the charts quickly and told them at that time, that my impression was not that the reactor started to go critical again, but that it was just a change in leakage path. I asked them about the alarms for the radiation. They said that they had a large number of alarms in the aux building, in the reactor building and that they had bottled up the "B" generator because they thought that they had a primary secondary leak on that side. Shortly after this period of time, Dick Dubiel had obtained an additional sample and verified that in fact that the "B" generator did have activity.

SHACKLETON: Gentlemen: Hold off just for a moment while we change the tape. We'll use the second tape. This is Owen C. Shackleton speaking. I've been present since the beginning of the interview acting as moderator and I am an investigator for Region V U.S. Nuclear Regulatory Commission.

The time is now 6:38 p.m., April 23, 1979.

SHACKLETON: The time is now 6:40 p.m., April 23, 1979, and this is a continuation of the interview of Mr. John H. Flint. Please continue gentlemen.

CRESWELL: John, we were just discussing what you had the discussion that you have had with the operator when you came in ah, into the control room. Now what time did you, ah, realize that there was ah, an abnormal situation?

FLINT: I would say that I realized it pernaps, this is only an estimate, 20 minutes perhaps a half hour after I had come into the control room. By this time I had talked with several people and had learned of the securing of the pumps the unusual flow indication, the source and immediate range was coming up scale, had looked at the thermocouple readings that were reading, one was reading 770 the other one was reading up around 800°F indicated as I mentioned I didn't know whether

to exactly believe these because they normally don't operate in this range. I had also looked at the computer printout, called up a few of the incores I believe at that time, and felt that at that time that we did have a fairly serious problem.

CRESWELL: OK. Uh, you mentioned a flow problem. Could you elaborate on that a bit?

FLINT: The operators that ah, indicated that although the pumps were running, the indication on the current appeared to be going down, and the flow continued to exhibit a slow decrease in indicated flow. At this time their pressure was somewhere around a thousand pounds to the best of their knowledge. They stated that because of the pressure they had shut off the "B" loop pumps and then later shut off the "A" loop pumps in order not to fail the reactor coolant pump seals. This is a normal operating procedure.

CRESWELL: Do you feel that that was a reasonable thing for them to do?

FLINT: Here you are asking for an opinion from me and I would have to say that my answer would be probably different from their's as an engineer as opposed to a control room operator.

CRESWELL: OK.

FLINT: And I would say at that point and time, I would probably have continued to run the pumps.

CRESWELL: Based on what sort of judgement in your mind?

FLINT: As long as my seal cavity pressures and flow to the pumps was maintained and I did not see any unusual indications other than the dropping of the current, did not see any large oscillations indicating that I was flashing the reference legs to the Gentilly tubes and just that it was going down, I would feel that from my indicated temperatures and and my pressure, I was ah, had low quality water and was therefore pumping low quality water and that the pumps in fact, were still performing satisfactorily.

CRESWELL: OK. To what do you attribute the drop in current required by the reactor coolant pumps?

FLINT: If the pumps are, the pumps are designed as constant mass. Therefore, if they are pumping lower quality, they require less current in order to function and turn at a certain RPM, they are not working as hard.

CRESWELL: What if one were receiving vibration alarms?

FLINT: If the alarms were high enough to indicate that there was potential failure of the pump or the seals, then in that case, I would shut the pump down.

CRESWELL: OK. We recognize that you, as you prefaced your remarks, these are your opinions as an engineer.

FLINT: As an engineer not as an operator and of course, I'm talking ah, coming into the control room five hours approximately after it occurred.

CRESWELL: Right, right. OK. One of the other things that you discussed with them wa the isolation of the "B" steam generator. Could you go into some detail about what you discussed with them about that?

FLINT: They had mentioned at the time when I was talking with them, that they had isolated the "B" steam generator because they felt that there was a primary to secondary leak based on some activity, later and additionally when they thought they should be maintaining a constant level, they had seen a level change in the generator. As opposed to the "A" generator which it was not varying in level at that time. I asked if they had taken an additional sample to verify that, they said they were in a process of doing so, and shortly after that, as I mentioned earlier, Dick Dubiel presented the results of the sample which did indicate they had activity in the "B" generator.

CRESWELL: OK. Did you look at any data regarding levels, pressures whatever, any temperatures in the steam generator ah, to, to research that on your own?

FLINT: Essentially, all I did was go over and look at the existing level and the trend prior to that, they were on the strip chart recorders on the console.

CRESWELL: What did that indicate to you?

FLINT: I would say, at that time, just merely that in all probability the "B" generator was bottled. Cause I was just looking at it and had not been told that, and that they were, at that time, steaming off of the "A" generator. Ah, other than that, I, I really couldn't have drawn much of a conclusion.

CRESWELL: OK. What happens next? After you've discussed these items with the (ah) operators?

FLINT: Ah, that was the period of time that ah, they'd come to the conclusion that the reason they probably were not transferring heat across very well was the fact that they did not have the level high enough in the generators to induce natural circulation and that they had a steam bubble in the two loops and till they collapsed steam bubble they could not establish natural circulation.

CRESWELL: Where in the ah, physically located in the reactor coolant system do you feel the blockage was, flow blockage?

FLINT: At that time I felt it was at the top of the hot legs, which we refer to as the "J" legs where they come up and just before they go down into the top of the steam generators.

CRESWELL: When do you figure that that flow blockage occurred in those hot legs? At what point in time?

FLINT: Looking at the data that was available there, I would estimate that it had occurred shortly after or about the time that the two re- "A" loop reactor coolant pumps were secured.

CRESWELL: That's when all forced flow was lost in the system?

FLINT: That's when all four reactor coolant pumps were off at that time.

CRESWELL: OK. Ah, what happens next in time?

FLINT: Approximately in that period of time we are bringing the ah, generator level up on the "A" side to induce natural circulation. There was a period for approximately an hour when the pressure was increased to approximately 2000 pounds in an attempt to collapse that

bubble. We were also reading out the incore thermocouples and following the ah, setup that Ivan Porter had put up to look at the temperature over there on the special bridge, and, following the temperatures that were printing out on the recorder.

CRESWELL: OK. Ah, we have received from the licensee certain charts that were prepared there, ah, 20 of these charts if I remember correctly. And ah, its my understanding that these were plotted in the control room. Could you relate in time when this plotting went on?

FLINT: These charts were actually plotted down in the process control center in one of the ah, rooms there on the 29th and the 30th. A day and 2 days following the transient.

CRESWELL: OK. So no data was plotted in the, in the control room area?

FLINT: None of the 20 charts you're referring to were plotted in the control room.

CRESWELL: OK. Was there other data that you did plot in the control room?

FLINT: At that time, no, we were merely ah, trending data output on the computer, watching the strip chart recorders and occasionally bringing out ah, utility printer groups looking at various parameters in the system.

CRESWELL: OK. Would you classify your participation in the control room after you got there as mainly as an advisory capacity?

FLINT: That is correct. Since I do not have, ah a reactor operator's license, I can only suggest or recommend certain operations to the personnel there since they have the licenses ah, they can accept or ignore my advice.

CRESWELL: Ok. Could you briefly ah, describe those recommendations that you made and who you made 'em to?

FLINT: One recommendation was to fill the generators to cool down and collapse the bubble. When we got some indication that we had flow across there to run a reactor coolant pump for a short period of time to induce flow; to monitor the incore thermocouples to tell us what the core was doing; to, at that time they had already taken steps although I did not know it when I first mentioned about taking those samples to verify that we did in fact have activity on the "B" generator because if we could open up both generators, this would make it a little easier to cool the unit; ah, to maintain the pressure as much as possible and not go down any lower. At that time or shortly after I had gotten there, I learned that the electromatic relief valve had been opened for several hours and that they had finally shut the block valve to isolate it, and on occasion when I was there, they were using the block valve as a control valve during this portion of time. Ah,

CRESWELL: When you say control valve, that's to vary the flow out?

FLINT: Vary the flow out. They had ah, letdown flow during this time, normal letdown flow and they were also using that as they were putting the high pressure injection water in from the makeup pumps they were using that to control their level on their pressurizer.

CRESWELL: You had indications that they were doing this prior to the time that you were there?

FLINT: Ah, I had verbal indications that they were doing this prior to my being there.

CRESWELL: Now please go on with your recommendations that you made.

FLINT: Ah, when we finally got the levels up high enough in the generators that we could see, in fact, some pressure drop across it, recommend the running of the pump to try to remove heat, anyway. At this time, they were still working here to get the auxiliary boilers back so we could draw a vacuum down the condensor and steam it. We were in constant communication with Lynchburg, Virginia, with Babcock and Wilcox, there was an open line to them; ah, NRC personnel, approximately, I would say 10 to 11, but that's only a guess because time has no meaning when you're in this type of a situation. Had arrived in the

control room they had an open line and were talking with other NRC personnel on the incident and of course the Met-Ed people were conferring with outside personnel in their organization regarding this.

CRESWELL: Who did you make these recommendations to?

FLINT: Made them to Lee Rogers, George Kunder, and Gary Miller, who are the top people at the site and talked with, on occasion, Joe Logan.

CRESWELL: Did you spend most of the, your time with those people, that is Miller, er, Rogers and Kunder?

FLINT: No. Lee Rogers spent most of the time with them, I was primarily out in the control room with ah, Bill Zewe or Ed Fredricks, ah, or some of the other operators out there. I was more or less following what was occuring in the plant and occasionally going in and listening to the discussions.

CRESWELL: Ah, you mentioned, ah, that you were monitoring the incore thermocouples. Ah, did you have indications that ah, personnel in the control room had been monitoring that data before you got there?

FLINT: No, to the best of my knowledge they had not been.

CRESWELL: Did you recommend that they pay closer attention to that information?

FLINT: I recommended at the time that we look at what they were indicating to try to get some idea of what the core conditions might be. Periodically, after that I called up the indications to follow what was going on in the core.

CRESWELL: Did you have any indications that after you'd been there and studied the ah, plant history and the event, that the core had been uncovered before you got there?

FLINT: My early remark to them about the fact that it'd been in all probability change in the leakage path from the core was my feeling that at that time either there had been partial uncovering of the core, or that there had been enough void formation or low quality enough water there, that the ah, leakage path had changed enough that probably the core had been uncovered. There were at least 2 instances where this probably occurred.

CRESWELL: Does this plant contain ah, what is called, the device is called 'internal vent valves'?

FLINT: Yes. There are internal vent valves.

CRESWELL: To your knowledge did these devices play any part in the event?

FLINT: To the best of my knowledge, no.

CRESWELL: OK. Ah, what time did you leave that day?

FLINT: Approximately 2300.

CRESWELL: OK. That'd be 11:00 at night?

FLINT: Yes.

CRESWELL: Ah, so were you doing any other things besides, ah, looking at data, just having discussions with the operators, or discussions with Lee Rogers?

FLINT: No, that was primarily my function at the time.

CRESWELL: At the end of the day, what types of data had you looked at, beyond what you've already mentioned?

FLINT: I'd taken a quick scan through the alarm printer, ah, and also looked at the other recorders on the back of the console in a little more detail, had looked at the backup recorders, seen some of the

levels that were being indicated on the radiation monitors. Primarily that was it. I wasn't too interested in the secondary sides cause we were essentially shut down and weren't many parameters over there to look at.

CRESWELL: OK. It's my understanding that since the event ah, you have been involved in reviewing quite a bit of the data.

FLINT: That is correct.

CRESWELL: And at this time I would like to ask Don Kirkpatrick ah, ah, to address that particular aspect of what you've been doing.

KIRKPATRICK: Allright. First of all, I would like to go back to ah, I have a two, couple of questions on some of the comments you made earlier. Ah, you mentioned the fact that you tried to raise the pressure in the system in order to collapse the voids. What method were you using to try to arrange that?

FLINT: The makeup pumps or high pressure injection pumps.

KIRKPATRICK: In other words, you turned on more than one valve?

FLINT: Pump.

KIRKPATRICK: Pump.

FLINT: To bring it up. Or if, since we were using RCV2 as a block valve on the electromatic, you only, if that is shut, you only have letdown flow at that time essentially and a makeup pump can more than overcome this. So you can pressurize the sytem that way also, just with one pump.

KIRKPATRICK: I see. Ah, But there were, the pressure went up in spite of the fact that ah, the electromatic relief valve was open?

FLINT: In spite of the fact? Could you clarify that?

KIRKPATRICK: Well, I understood you to say that ah, the ah, high pressure injection pump raised the pressure without reducing the temperature. Is that right?

FLINT: We increased the pressure ah, the hot leg temperatures were offscale above 620°, we did change the cold leg temperatures some amount during this period of time.

KIRKPATRICK: I see. Well at the time that you were trying to raise the pressure, ah, I take it the block valve was closed?

FLINT: Yes, that is true. During a portion it was closed.

KIRKPATRICK: I see. Let's see. You said at one time earlier, that you had a question of whether the core was ah, uncovered, ah, can you comment on why according to the charts that the pressurizer level appeared to be high at this time?

FLINT: Well, I felt that the core was covered at this period of time. There were some individuals that had doubt as to whether it was and it seemed prudent to verify whether or not it was. Ah, the pressurizer level would be high if you had transferred your bubble from the pressurizer into the hot leg loops, or if you have a bubble and you continually cycle your hydromatic relief valve or your back block valve to it or if the Code Safetys left, obviously your level in the pressurizer is going to increase. You're going to bring the level up there if you collapse the bubble.

KIRKPATRICK: I see. Let's see referring to some of these prints.

CRESWELL: Excuse me, would you run that, run over that description again. Ah, if the bubble collapses the pressurizer level wil ncrease?

FLINT: The pressurizer level will increase if you're feeding through the high pressure injection pumps and you're feeding water in then the level would tend to go up. If you reduce pressure in the system and

you have steam bubbles up in the loop, they are going to tend to expand and act as a pressurizer ah, steam space up there. Ah, they would tend to force water up into the pressurizer and out through the electromagnetic relief valve.

KIRKPATRICK: That's under the assumption that the water level was above the inlet to the surge line to the pressurizer?

FLINT: Well, if, if it wasn't then you wouldn't have a level indication in the pressurizer. So you had to have water in there, which said there had to be above the surge line to get in there.

KIRKPATRICK: I see. Well, ah, you mentioned also earlier, that you felt that the change in the ah, flux indication was due to the fact that ah, there was increased leakage path, or a change in leakage path. Ah, could you comment more, er, or elaborate on what form this change in the leakage path was, or what you felt caused the change in leakage path?

FLINT: Well, after the fact that they told me the pressure, that they had come down to approximately 1000 pounds or so, the fact that the temperatures were still fairly high meant that you either had very low quality water and/or steam in there. And this of course, would reduce a normal density and increase your leakage flux out of the core.

CRESWELL: When, when do you feel significant fuel damage first occurred?

FLINT: This is only a supposition on my part, I'd like to stress that, and I feel that it did not occur until approximately a hundred minutes into the transient when it first started occurring.

CRESWELL: That's when all the pumps were off?

FLINT: All the pumps were off.

CRESWELL: Do you feel that that damaged could occur with low quality, let me put it this way, with a mixture of gas and liquid phase, water and gas in liquid phase in the core?

FLINT: If there was still flow through the core and considering we only had approximately 90 EFPD on the core and we shut down at that time, I would say no. I would say that the core would still be receiving adequate cooling, and that ah, no significant damage would occur to it.

CRESWELL: OK.

KIRKPATRICK: Now from your review of the data, ah, of these charts, ah, do you have any feeling for how much water was in the reactor, at what percentage of the primary system was filled at the time the pumps were shut down?

FLINT: I have no idea.

CRESWELL: Going to the first minute or two in the transient, ah, after the power operation release valve, or the EMOV failed the pressure did drop in the system. High pressure injection was initiated. And while pressure was dropping, the pressurizer level was increasing. Do you have an explanation for why that would occur?

FLINT: If you're charging into the system and you have a leakage path out, with the electromagnetic relief valve open there would be a tendency for the water level in the pressurizer to increase you have nothing you're compressing against, essentially, its just restricted back pressure there. So there would be, you would expect that the level in the pressurizer would go up.

CRESWELL: Due to what?

FLINT: The fact that ah, you no longer have a steam bubble there to hold it down, to cushion it. You're relieving everything out of the pressurizer.

CRESWELL: Well, doesn't the pressurizer level indicate the water level inside the pressurizer?

FLINT: That is correct.

CRESWELL: And it didn't actually go solid or go to 400 inches?

FLINT: It went to 400 inches

CRESWELL: It didn't actually do that though, until minutes into the transient.

FLINT: You initially see your level in your pressurizer dropping and you would ah, expect that this would in effect occur. You have tripped the reactor, you're cooling down, you're adding a minimum of additional heat, during this portion of time you're taking energy out of the steam generators and you have relieved some through the electromagnetic relief valve. You would therefore, expect some contraction and therefore the level to initially drop.

CRESWELL: OK, but how do you explain the pressurizer level increase after that period of time when the pressure is dropping in the reactor coolant system?

FLINT: There could be 2 mechanisms for this. One mechanism would be that if you're not removing as much heat and the water is starting to expand then obviously its gonna add some volume to the system, and if you're charging in with a high pressure injection pumps, you're also adding water to the system.

CRESWELL: So you'd describe two physical effects? Effects that could occur. Ah, one is that as pressure drops the water in the pressurizer expands?

FLINT: Well in the, in the reactor coolant system will expand simply by the energy it picks up from the core and the heat that it already has in it. If the pressure drops, the water is gonna tend to expand.

CRESWELL: Looking at the charts of "B" hot and "B" cold. It appears that the average temperature of the reactor coolant system remains fairly constant during this time.

FLINT: Right. "T" average time is fairly constant.

CRESWELL: So that the expanding, expansion effect of the reactor coolant system would not be a major contributor to?

FLINT: No. It would only be a small factor. Primary factor would be the fact that you have makeup pumps on and adding to the system.

CRESWELL: OK, But the additional effect that you feel could affect the increase in pressure level would be the expansion of water in the pressurizer?

FLINT: Well, when you initially ah, have a transient your heater banks shut off and then come back on. Depending on how much heat they are adding at the time the water in the pressurizer can expand from these also. I do not have ah, an indication of the energy that the heaters were putting in therefore, I cannot qualify how much was due to their input.

KIRKPATRICK: Have you considered the possibility that there may have been some voiding in the primary system that escaped flashing?

FLINT: At this period of time?

KIRKPATRICK: At this period of time?

FLINT: Yes. Ah, particularly at about 6 mintues there was that possibility. I felt, however, that since we take our pressure tap very high up on the hot leg and considering the temperatures are in a hot leg at a very high point, that if there were any flashing it would be minimal, and since the reactor coolant pumps were still circulating ah, you could get low quality water perhaps, but I did not feel that there would be any significant flashing at this time. And if it was it would only be at the very top of the hot leg.

CRESWELL: Do you feel that as the reactor coolant flow was dropping off, this was prior to the time of any reactor coolant pumps were tripped. Ah, that there was any significant cavitation in the ah,

reactor coolant pump suction? That would be the lowest pressure point in the system?

FLINT: Or the suction.

CRESWELL: Would that to your knowledge, be most likely point for flashing? The water there of course, is cooled more than it is on a hot leg, ah, and I feel that because we did not see more.....

SHACKLETON: This is a continuation of the interview of Mr. John H. Flint. The time is now 7:15 p.m., April 23, 1979. The first tape ended at 6:38 p.m. Jim, would you review again what the question was so that we can complete, if you can recall, where you got cut off. John, maybe you can recall, you were here yesterday.

FLINT: It was whether or not we had a single-phase or two-phase flow in the reactor coolant pump. As I mentioned, the fact that the recorder strip chart did not indicate more oscillation than what it did, would to me say that it was single-phase at that period of time or tend to indicate single-phase.

CRESWELL: I have one brief question. Have you seen these oscillations; have you experienced these oscillations before to see what they looked like?

FLINT: Yes, we normally see them whenever we do reactor coolant pump flow coast down tests. This is a standard test that you do preoperationally?

CRESWELL: You would do that at low enough pressure so that you can see cavitation?

FLINT: Its not a case of seeing cavitation, its a normal fact that the pump being discreet individual pumping mechanisms as it were, buckets turning down there, sends out the water, not in a continuous stream, but you do get these pressure pulsations. And you do see this oscillation.

CRESWELL: Due to cavitation?

FLINT: Ah, not to cavitation, its just that even when you're running at normal temperatures and pressures you can see these oscillations in the, in the flow.

CRESWELL: OK, John. That's fine. Owen, do you want to close out the interview?

SHACKLETON: Yes. Mr. Flint, would it be possible in the future time to conduct further interviews regarding what took place if we have additional questions?

FLINT: Yes. There'd be no problem.

SHACKLETON: We thank you very much for the time you've given to the Commission this evening and we'll bring this interview to a close. The time is now 7:17 p.m., April 23, 1979.