UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:

IE TMI INVESTIGATION INTERVIEW

of George A. Kunder
Superintendent of Technical
Support, Unit 2

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NRC PERSONNEL:

Dorwin R. Hunter
William H. Foster

FOSTER: The following interview is being conducted of Mr. George A. Kunder. Mr. Kunder is the Superintendent of Technical Support, Unit 2, at the Three Mile Island Nuclear Power Facility. The present time is 2:16 p.m. Today's date is May 23, 1979. The place of the interview is trailer 203 located immediately outside the south gate of the TMI site. Individuals present for the interview are Dorwin R. Hunter. Mr. Hunter is the Inspection Specialist with the Office of Inspection and Enforcement Performance Appraisal Branch. My name is William H. Foster, I'm a Senior Inspector and Auditor with NRC's Office of Inspector and Auditor. I will be monitoring the interview. Mr. Kunder was interviewed two previous, on two previous occasions, as part of this investigation. At this point I am going to turn the interview over to Mr. Hunter.

HUNTER: Okay George...Hunter speaking...just to get started again and get a few more questions answered I'll go through the list of questions and they may or may not...the are not necessarily in any specific order. The first subject that I would like to discuss with you is concerning any periodic review that you participate in relative to trip occurrences, major trip occurrences or, and how you become informed of plant operation or any abnormal plant operation. Can you give me a feeling for the training, periodic review, that you have, or the way you become aware of these occurrences or trends and also include in that the ... how the trends, or the how you pick up any concerns, related to plant design and operations for future improvement?

KUNDER: Do you mean through the training program or just through my responsibility as the Superintendent of Tech Support?

HUNTER: One

KUNDER: Training?

HUNTER: Yes through the Superintendent of Tech Support what you see, how you pick that up, where it's reviewed and then you can talk if you'd like to separately about a training program and how you use that here if you would?

KUNDER: Well just about any significant event that occurs in the plant would be brought to my attention either through our daily review of plant operations... through the what we call the plan of the day meeting which is normally held in the mornings of each week day and that meeting is held with the Station Superintendent, myself, the Shift Supervisor on duty at the time, the Maintenance Supervisor, a representative from the Health Physics Department, and various other members of the staff and it may also include someone from B&W, or Westinghouse who represent the NSS and the turbine vendor, and at that meeting we bring up plant problems and resolution to those plant problems or tasks to whichever person is responsible. If it's a maintenance item it gets passed to the Maintenance Supervisor, if it's a plant problem that requires some investigation then perhaps correction from an engineering standpoint I would take that item as a task and typically

I assign it in turn to one of my engineers depending on discipline that the item is applicable to. Now that's sort of a broad, I guess, approach to the answer.

____: I think you had more specifically asked about transients or trips.

HUNTER: Okay let's take ...and one more question concerning that particular... in your daily meeting and your staff meetings, plant problems, would you characterize these ... as being more like routine problems during routine plant operations or would it sometimes include significant problems?

KUNDER: It's really both...whatever problem ...

HUNTER: Okay

KUNDER: We're experiencing that has an impact on plant operation.

HUNTER: Alright ...let's take a problem... let's take an instance such as a demineralizer problem ... demineralizer problem or a feed pump problem some significant problem that causes a runback or a turbine trip...how would you pick those up...how would you characterize the handling of that type of event?

KUNDER: Well if it's...if the problem is identifiable at that moment as a maintenance item, in other words let's say a valve failed, a work request

is written and the item is discussed and everyone generally agrees on the fact that it needs repair and the Maintenance Supervisor schedules that valve for repair. If it's a problem whose symptoms are known but the precise problem isn't known, which is, occasionally occurs, an example of that might be lets say the valves in the polishers went closed but we are really not sure why they closed. The symptoms are there the valves won't close, but was it due to the loss of air, was it due to a malfunction in the control circuitry or blown fuses, or whatever things can occur that, to make that to make that problem appear. Then, it might be referred to someone in my group if the engineers in my group are the people who have cognizance over that area. It might even be referred to one of the operations engineers if one of those engineers had specific cognizance. For instance, on the polishers two of the operations engineers have a great deal of experience in operating the polishers and they might be the first fellows to be assigned to try and identify specifically what the problem is, and then if it requires an engineering solution, such as a change modification or something like that, it would then be referred to my group for resolution. It might be a joint investigation if it's a, if it's felt that it might have something to do with an electrical problem, the electrical engineer who works for me would be tasked to assist the operations engineer for instance to resolve the thing. Really it depends on the nature of the problem and what our perception of the cause and resolution of that problem is as to who is assigned the responsibility for correction.

HUNTER: George ... if in fact a particular problem requires a design change or modification, is that handled locally or is it handled through Met Ed, GPU or how is the normal facility change handled?

KUNDER: Well they can be handled either way and the determining factor is generally the size or the degree of the change that is required. Typically, major changes, and in particular all changes whose impact could effect nuclear safety, or if it is a change to a system that is defined as a nuclear safety related system, or is a covered under the quality control program, all change mods of that nature would be approved by the Reading Engineering Group. Even if it's a very simple change, that approval is required by the Reading Group. If it's a non-nuclear safety related item, if it's a non QC, and the change is minor, we generally design the...or make the design change, here on site. We do the engineering work associated with the whole package. If the design change is a very complicated one and involves an engineering manpower commitment greater than what we can support here at the site, with my engineering group, we would typically task that kind of a change to either the Architect-Engineer like Burns and Roe or perhaps go back to the Reading Design... or the Engineering Group in Reading and task that group to do the design change. So in, in part, the rational is determined by the a nature of the change in terms of its nuclear safety or quality control significance, that is whether it's a major or minor change mod and also whether or not the manpower required to make that change is within the scope that I can handle with my people.

HUNTER: Okay George lets go one step further now. The plant here had had some major trips, major occurrences, and significant problems associated with major trips and occurrences, and looking back at the trips and occurrences...are these trips ...would you characterize the review of these being done at that plant of the day meeting, specifically like reviewing the trip package or reviewing the trip...the completed trip package and the engineering evaluations required to specifically identify the cause of the trip. Would that be picked up in a meeting of that type?

KUNDER: Well if it ... it could be ... I guess we have ... we have other functional groups within the organization that would tend to review and concern themselves with the specific recommendations and, you know, any design changes that result from the review of a trip or like a safety injection kind of an experience such as we have had in the past. That group might be PORC...I think in the past ...again I wasn't...I've been in Unit 2 since December and I suspect that the design changes that were required were reviewed by the PORC and also by the GPU Management involved with the startup of the plant. As an example, the April 23rd trip involving the failure of the main steam safety valves to reseat properly, I recall reading the PORC minutes and the PORC had specifically reviewed that incident in great detail, as well as, the GPU Engineering Group in Parsippany. The PORC's responsibility was to review the incident from a safety standpoint. Many of the findings that came out of the investigation of that incident were reviewed by the Plant Operations Review Committee and the Committee made certain recommendations in writing to Gary Miller. I recall that PORC

recommended not to start the plant up for instance until the safety valves were resolved, that is the problem with the reseat pressures and there may have been a few other things...I just can't recall but that was handled by the Plant Operations Review Committee in that instance and I don't think at that time we had, had been holding the plant of the day meetings as we now hold them during normal opera tions. Rat[illegible] at that time, perhaps, the Startup and Test Meetings that were held in the morning...which were essentially the same sort of thing...would have reviewed the changes that had to be made.

HUNTER: Okay George. As I understand it you're the Chairman of PORC?

KUNDER: That's correct.

HUNTER: Can you...when did you become the Chairman of PORC Committee?

KUNDER: I became Chairman of the PORC when I assumed my role of Unit 2 Superintendent of Tech Support back in the first of December.

HUNTER: Okay 12/1/78.

KUNDER: 1978, that's right.

HUNTER: Okay the PORC is the Plant Operating and Review Committee for the lady who is typing the tape, okay.

KUNDER: Plant Operations Review Committee.

HUNTER: And have you had any significant trips since 12/1/78 besides the one on the 28th?

KUNDER: We had the trip on the 2nd of December and we also had a ... incident... let me think ... that was ... in January of '79 as I recall around the 15th of January. I believe we were coming up from an outage and it was the atmospheric, I refer to it as the atmospheric dump valve bellows failure incident. And that involved at that time I believe it was a reactor trip and what occurred at that point was a transient which was not so much related to the primary but I think we had we had ruptured the bellow, discharge bellows, for atmospheric dump valves. The PORC did get involved in both those events.

HUNTER: What was the major problem concerning...as a result of the January event where the bellows ruptured on the atmospheric dump valves? The problem may also George ... the plant impact of that event?

KUNDER: The problem that occurred...let me think...let me get my memory in gear here...do you any happen to have any reference material on that one?

HUNTER. No not here.

KUNDER: Okay.

HUNTER: We were in the process of putting the plant on line...we were at approximately 15% power, as I recall, and we had been in the process of testing the turbine stop valve trip circuitry and...what occurred was a loss of vacuum ... the loss of vacuum to this date, although certain certain causes have been postulated, has never been confirmed. The loss of vacuum lead to the switchover in steam dumping from the bypass valves control to the atmospheric dump valves controlling. When that occurred, the discharge extension bellows to the atmospheric dump valves, which are labeled MSV-3 A and B, both ruptured. At the time we didn't know that it was the bellows. The impact was to fill the M-20 area with steam...it caused the grounding of the transformers to the pressurizer heater busses...those two batch 2-43 and 2-44 and it made the M-20 area totally inaccessible to personnel. Further, since we didn't have vacuum we weren't able to discharge steam to the condenser and after finally diagnosing that the steam... we felt, we knew we had a s m break, and we weren't sure where it was ...after diagnosing that it was from the discharge of the bello we found ourselves in the position where we had the inability to cool the plant down through the normal means because if you would open the atmospheric dump valves you'd fill the whole area with steam and we were of course trying to avoid that. The steam was...this is an area where we have the turbine driven emergency feedwater pumps... so we didn't want to risk loosing the, you know, the steam...we didn't want to risk losing the steam driven pump but it was so full of steam in that area that I don't think we even of had the use of

that. We had the use of the motor driven feed pumps and as I recall we did use those for feeding the steam generators.

HUNTER: Was steam George during that event communicated to near the control room?

KUNDER: It was communicated over into the service building area...we were concerned that there was potential for steam coming into the control building and we did station people to make sure doors were kept closed and that the sump pumps in the service building or the control building ... let me think on that ... the sump pumps in the service building area ... in the vicinity of the air compressors ... and I was concerned, or people in charge were concerned about the potential for the water backing up and coming into the control building through doors, so I did have people stationed down there just to make sure that if water did get through we could dam it up and prevent any problems there.

HUNTER: Hunter ...

KUNDER: That was mainly from the ...

KUNDER/HUNTER: Condensing of steam.

HUNTER: Hunter speaking...there was a...do you recall any major design changes or major modifications to the plant recommended as a result of

steam entering the M-20 area...entering the emergency feed pump room and the control area or...are the motor driven feed pumps also in that control area?

KUNDER: They're located in the service building area on the other side of the wall that separates the service building area from the M-20 area and one design change that was made obviously was to redesign the bellows so that wouldn't occur again and there was a long term commitment made at that time to design the bellows of the atmospheric dump valves as well as the main steam relief valves to be a self-aspirating type so that if we did get any leakage it still would not impact the area with a steam release. There was also a commitment that was still under design review and it related to a change that was going to be put in place during the first refueling outage and that related to the new feedwater isolation system that was going in place. We were going to install two fast acting feedwater isolation valves in the m. . feedwater lines going into containment. As part of that project the area was slated to be sealed in such a manner that for feedwater line break in the M-20 area we would not impact on an area outside of that M-20 area.

HUNTER: That was in

KUNDER: That would have involved a, you know, major sealing project and since that program is under way, it was expected that it would cover both concerns, okay, you are really trying to protect, you know, the other side

from the effects of the steam and so forth, that could be generated in the M-20 area. Whether it came from the steam line break or from the feedwater line.

HUNTER: The steam line feed to the aux feed pump rupturing ... that type of break?

KUNDER: Yes. I don't know what the design criteria would be and what size the steam line break or feed line break were included in the studies, but those studies are still in progress.

HUNTER: Alright. You indicated I believe during the time frame when you were dumping steam to the condenser through the normal method that the vacuum was lost and that the automatic switch then occurred to the atmospheric dump switch in fact caused the problem. You indicated that a low vacuum occured but you didn't have at this time any resolution to that problem.

KUNDER: Well yes we had a number of...a number of causes pinpointed but due to the fact that instrumentation wasn't conclusive enough as to the exact cause we were never able to confirm precisely what caused the incident.

HUNTER: Do you have a special task or any special engineering review scheduled to determine the cause of the low vacuum?

KUNDER: Well that, that effort was was underway and as a matter of fact the GPU Service Corporation was specifically charged to review the incident and try and determine the cause.

HUNTER: Hunter speaking...on the morning of 3/28 you also lost vacuum ...

KUNDER: Oh yes.

HUNTER: Through the main condenser and shifted to the atmospheric dumps.

KUNDER: That's right.

HUNTER: Would the loss of vacuum on 3/28 and the previous loss of vacuums be related?

KUNDER: I don't think so. The...althcugh I can't prove the cause of the loss of vacuum on the 15th, the cause on the 28th was due to the fact that Unit 1 was shutdown, was in hot standby condition, and they were taking steam from Unit 2 to supply their turbine seals and steam to drive their feedwater pumps and also the sealing steam in Unit 2 was ofcourse being self derived from the main steam system in Unit 2. When Unit 2 tripped that day we basically cut off the supply of steam and they had difficulty in getting the auxiliary boilers in service in Unit 1 and as a result of that inability to start the boilers we were unable to maintain adequate sealing steam pressure and we finally lost our seals and turbine which permitted air to go past the shaft. We lost vacuum in that fashion.

FOSTER: Excuse me, James S. Creswell, Reactor Inspector, Region III, has intervened here.

HUNTER: Hunter speaking. Are you aware or were you aware that morning of the 28th the that the hot water flooding ... that you had a hot water flooding incident going on?

KUNDER: I was aware that hotwell was flooded...it was reported to me. I can't remember if I looked at the hotwell level gage or not.

HUNTER: Hunter speaking. Was it subsequent to that hotwell flooding in the early morning problem...did you...was it reported to you what the problem was with the hotwell...the reason that it was flooding, do you recall?

KUNDER: No...well I guess the reason...it wasn't specifically reported the reason that it was flooding but ... apparently the level indication caused the control circuits to think that that the level was low and the automatic make-up valves were making up to the hot level of the condensate storage tanks, but I did not...I did not check any of the instrumentation and would have had to leave the control room to do so. Bill Zewe was ... had been involved in that job...as I said that's where he was when I came into the control room.

HUNTER: Alright we touched a moment on trending of problems and...a little earlier...do you have a formal trend system in your engineering group or a formal trending system on equipment for major problems in the plant that the PORC uses to track equipment failures, operational problems those type of events?

KUNDER: Yes we do. I guess the degree of formality may vary but we have one tracking system which we call the PORC Action Item List. That system typically treats items that result from either timely inspections or action items resulting from bulletins and circulars and in many cases items that result from PORC reviews of incidents or situations and the PORC recommends certain actions be taken to either prevent recurrence or correct the problem...or what have you...and that system is a fairly formalized program where the item is identified, individuals specifically tasked to perform the task and that system is reviewed periodically to make sure that the items are done. It also has a formal system for advancing the due date if * due dates can't be met for one reason or another. There is a review of the request for an extension to the task.

HUNTER: Okay.

FOSTER: We are going to break to change the tape. The time is 2:46 p.m.

FOSTER: We are going to continue with the interview of Mr. Kunder. The time is still 2:46 p.m.

KUNDER: Okay another system that is utilized to track a correction of problems... particularly problems that impact plant operations is the use of this plant of the day meeting agenda it's a, happens to be a, computer listing of the day-to-day problem areas that we use to track completion of the items. For the most part those items involve repairs to equipment, for instance, if it...a secondary services river water pump fails to the bearing, whatever, that item will go on the POD listing will typically indicate purchase order numbers for the parts that we need and we assign responsibility for repair of that to the Maintenance Department and... it's a list that ... that is reviewed during the normal POD meetings. For longer term kinds of items, we generated a weekly POD list, which is a generally longer list, longer list of items, that was reviewed on a weekly basis. These are items that just typically do not get corrected on the short term and they typically don't have any kind of an immediate impact on the plant. They are things that ought to be corrected for the long term or if they are not corrected plant reliability will eventually be impaired.

HUNTER: Okay, ... one more question ... speaking about transients and what, and watching what's happening the plant, we discussed review of transients being presented to the PORC by engineering after it's completed. Do you have a mechanism that would present to the PORC or the plant staff on a formal basis an event such as the Davis-Besse blowdown transient that occurred in the latter part...in early 1977 for instance, and have you in fact seen that particular transient?

KUNDER: No unfortunately I didn't. As a matter of fact I guess the first time I recall hearing about the fact that Davis-Besse had a transient that was virtually identical to the one we just went through was I think it was about two weeks or so after we experienced this... the accident. There is a mechanism that exists for reporting to the PORC any and all kinds of industry events. First of all the way the processes work is we either get notified of industry experience through I&E Circulars, Bulletins, Information Notices, and those are formally handled. They are reviewed by the PORC and action is taken. Those go directly to the PORC because I'm on the mailing list for those things. The other way would be if some event reported to the Superintendent either through a memorandum or through reports that are sent to TMI or any other means of distribution to the site, and the Superintendent and myself really are keyed to review these documents and if they do pertain to TMI or could have an impact on our operations, or there is some generic or potential generic issue involved with the nature of the documentation it would be sent over to my group and ... for PORC review. In fact generally when we make distribution of these things we typically ...it's a mechanical item...or an electrical item ...we typically copy the lead cognizant engineer and send copies to maybe the operations people and a copy for PORC with a request to review in PORC or what have you, and that's in keeping with the responsibility that the Superintendent has for reviewing safety-related items and requesting PORC review of those items, and they would come over to myself. I would get them through Mark Bezilla who is the PORC Secretary and he schedules it for review. The frequency of our reviews in PORC has been and continues to be just about a daily kind of a meeting schedule. So

in Unit 2 we've not experienced any kind of backlog in reviewing material. We get the procedures in or this kind of documentation and it's reviewed relatively quickly within one or two days.

FOSTER: Mr. Creswell and Mr. Hunter are conferring.

HUNTER: Okay George...

FOSTER: Mr. Creswell is now leaving the intervie..

HUNTER: Okay George...if you receive IE Bulletins or Circulars these are entered into a formal system. Are there any other formal reports or formal items that are entered into your system such as industry reports that type of...Westinghouse for instance or B&W type generic reports that would routinely enter into that system?

KUNDER: I wouldn't say that they would routinely enter into that system.

HUNTER: Ah George... do you have a personal contact say or Joe Logan, yourself or the plant staff, do you have personal contacts with Oconee or Davis-Besse or SMUD, any other B&W type plants that you fellows use routinely?

KUNDER: I don't have any personal contacts. There have been occasions that I needed information from those plants and I called and generally asked for their Supervisor of Operations or that sort of thing. There is

more frequent communications I think between the Superintendents of those plants by virtue of the fact that they participate in the B&W users group which is I believe generally made up of the Superintendents of all the B&W plants, and I've come to know people like Jack Evans through his visits to site here at TMI and I know that the Superintendents they know one another and I believe that they communicate among themselves a lot more than I personally do or the people in my staff do with other people in B&W plants.

HUNTER: Okay. I'd like to ask some more specific questions concerning the event of 3/28 George. Looking at the morning of 3/28 and looking specifically at the operation of the reactor coolant drain tank and the systems when you came to the site and you had established plant status, did you discuss the reactor coolant drain tank with Bill Zewe ... the fact that the rupture disc was ruptured and also the...and the late rupture of the rupture disc, in other words, a few minutes into the event. Do you recall that?

KUNDER: No. I know I wouldn't have discussed the rupture disc in terms of its timing, but I did discuss the fact that...or I had learned of the fact that the rupture disc blew from Ken Bryant either that or perhaps Scheimann, but Ken was in the control room at the time and when he indicated that the rupture disc had blown, you know, he told me that...or I learned that pressure was up in the building and as I may have indicated before I did find the pressure recorder in the one console and noted that it was about two pounds or 2.2 pounds. So since that made sense I, you know, mentally concurred with the fact that the rupture disc blew. I had seen a similar...a

similar thing occur in Unit 1 during the Startup and Test Program and I can't remember even when that occurred anymore. It was years ago and resulted from a excess amount of steam going into the drain tank and the rupture disc blew and I...so I, you know, blowing of a rupture disc after an extended release made sense to me. I mean it's something I could identify with.

HUNTER: Okay Hunter speaking...earlier in the startup or late in the preop program the reactor coolant drain tank was upgraded or modified to increase the heat capacity on Unit 2. Were you aware of that?

KUNDER: Yes.

HUNTER: Was this required to ... because of an under-design by Burns and Roe or was it required because of leakage into the tank...do you recall?

KUNDER: Yes my experience in Unit 1 a few years back was if the safety valves leaked by, the Unit 1 drain tank was not sized for even a small amount of leakage. A very small amount of leakage would raise the temperature in the drain tank and render it partially incapable of adequately quenching steam relief following a transient because, the cooling system and the tank size just was not big enough and the temperature of the water in the tank would tend to be elevated and it was back in those days following the Unit 1 experience that I was personally involved in recommending to the Unit 2 design group...and I can't remember individuals anymore...but I do

recall I made a trip to Burns and Roe to discuss with them the design criteria. So the Unit 2 design at that point was changed...I can't even remember if they even...what kind of cooling capacity they had at the time but it was very similar to or even less than Unit 1 if I recall correctly. So the design was upgraded to basically provide a larger tank and a larger recirculation and cooling capacity so that you could accept a certain amount of leakage from the reactor coolant system and guarantee that your temperatures in the water would remain near ambient conditions to adequately quench steam relief into the tank.

HUNTER: The reactor coolant drain tank even with the pressurizer code release or power operated relief valve or all of them weeping appeared to be working... the tank temperatures stayed down even though the exhaust temperatures on the valves themselves were running 180-200° and actually moved around, up and down probably between 130 on up to about 200, slightly above 200, so it seemed to be working. One thing that I wanted to ask is looking at Unit 1 power operated relief valves and Unit 2 power operated relief valves, Unit 2 power operated relief valves and code safeties had been leaking for like three months to some degree for a number of months. Do you have the same problem in Unit 1?

KUNDER: No.

HUNTER: Can you explain the difference between the two units?

KUNDER: I'm not quite sure I can explain why Unit 2's systems leak...I haven't had an opportunity to inspect the valves, of course, but Unit 1's early difficulties with leaking safety valves we believe in retrospect, erode because the valve setpoints were set with the body of the valves in cold condition. And that allowed the setpoint to drift downward in a conservative direction for the low pressure standpoint, but the drift was great enough that the valves began weeping at pressures just slightly higher than operating conditions. As the valves began to weep the began to get cut and before long you have an aggravating leakage through the valve seats and it got to the point where you basically had to shut the plant down to correct it before you got into trouble with the drain tank, because we just weren't sized to handle any kind of leakage. And the leak rate that I'm talking about is anywhere from one gallon a minute which is as long as it is identifiable it's perfectly acceptable under, you know, under the tech specs which says you are allowed up to ten gallon a minute leakage from the RCS as long as it is identified. We just physically couldn't handle that so it forced a shutdown. The correction to that problem which did in fact work very well was to set the code safety valves with the temperature of the valve at or near the normal operating temperatures and that worked very well. We have not experienced any significant leakage in Unit 1 whatsoever since that... it was roughly that...first cycle as I recall.

HUNTER: Did you... can you relate the leakage to in Unit 1 code safeties code relief and power operated relief valves with five gallons a minute to any specific problem at this time?

KUNDER: Unit 2 leakage?

HUNTER: Yes Unit 2.

KUNDER: Well since the...we knew that the relief line temperatures were elevated just like they were in Unit 1...it was my conclusion that the safety valves were leaking by. It did not pose any operational problem nor did it pose any impact that we could determine on safety. Since the...it appeared the valves were still functional and I never had any experience where the valves did not operate properly and the drain tank conditions were maintained insofar as level and temperature and pressure in a safe mode.

HUNTER: Okay George... five gallons a minute relates to approximately two thousand gallons a water a shift. I can assume that, you know, you guys... that you were again as PORC Chairman and engineer and technical, superintendent technical, you were aware that they were moving around two thousand gallons of water a shift. Can you give me a feeling of PORC or any discussions you had in the plan of the day meetings concerning moving that amount of water or any problems that moving that amount of water created for the plant, the plant operators?

KUNDER: Well I can't recall any specific conversations I don't think we specifically reviewed that in the PORC per se. It was discussed from time to time in the POD and there was a review of the leakage rates performed at

least informally to track the amount of leakage and track really the increase in the leakage with time because it was apparent that, you know, that the leakage would not decrease and that at some point in time we felt that it would become a limiting condition for plant operations. The fact that we were handling two thousand gallons of water I don't believe was...I don't think it posed any particular operational problem because it was water that was returnable to the reactor coolant system.

HUNTER: Okay...looking at the problems associated with the power operated relief valve loop or safeties leaking...apparently the operators were having trouble...having problems or were involved in continuously operating the spray valve and the heaters in manual to reduce the concentration in the pressurizer...the boron concentration in the pressurizer which was resulting from the power operated relief valves or relief valves leaking. Was this discussed in the plan of the day or the PORC meeting?

KUNDER: I don't recall discussing that in the PORC. I suspect it might it have been discussed in the POD but I can't recall specifically. Our experience in Unit 1 was the same, as a matter of fact, I think I recall that, you know, it's in Unit 1 we had received a ... specific recommendations on the duration and frequency of operating the spray valves.

____: At any rate the sprays...you had to spray periodically in order to assure a certain turnover water in the pressurizer so that any steaming that was occurring and leaking through the safety valves would not tend to over-concentrate the boron in the pressurizer.

HUNTER: Hunter speaking...did steaming through the pressurizer safety valves...the pressurizer relief valves was that reviewed specifically in the PORC or the plan of the day meeting as related to what that condition could would ultimately result in or could result in?

KUNDER: I don't think it was reviewed in PORC, at least I don't recall having done so nor do I recall seeing anything like that in our minutes. In the POD I know it was discussed because I think I made mention of the fact that, you know, we want to keep an eye on the leakage and try and project when it will become a limiting kind of condition. I don't think from the standpoint of the valve integrity it concerned me in the least because we've experienced that similar kind of leakage in Unit 1 with no effect whatsoever on the operability of the valves. It merely represented a leak through the seat and that would not impair the function of the valve itself. But beyond that, you know, I think our approach at the, at that time, and this would have been I guess the February and March time period when the leakage was obvious and was identified as leakage ... thought primarily would be the leakage through the steam valves. I know that total leakage in the system was I think four or five gpm and we had presumed that it was pretty much all through the steam valve because well, not only presumed, it was all recovered in the drain tank. It was...

HUNTER: By recovering in the drain tank George it would be from the reactor coolant leak off system or the power operated relief valve leak for units...

KUNDER: Yes it's possible it could have been a valve stem leak off or perhaps excessive leakage from the pump seal, I mean, it could be leakage from the pump seal. Right now I'm not familiar enough with the leak off system of the Unit 2 RC pumps to know what's really excessive, but the combination of all the leakages into the drain tank added up to within I guess less than a half a gpm of the leakage that we were experiencing. In other words of the total leakage we were experiencing less than half a gpm was unidentified or apparently leaking into containment somewhere or into the auxiliary building through the make-up purification system and the other remainder of the leakage was recovered in the drain tank.

HUNTER: _____ I want to get you to look at a couple of procedures here George, one is...the procedure is the...this is the performance sheet for 2301 3D1, and 2301 3D1 is the leak rate calculation in the reactor inventory calculation. One thing that's on the 3D1 is a Temporary Change Notice 279 070 I believe the number is

KUNDER: Um hum

HUNTER: And the Temporary Change Notice is to more accurately account for reactor coolant leakage collected in the drain tank. Were you aware of this Temporary Change personally?

KUNDER: Yes.

HUNTER: That it had been issued?

KUNDER: Um hum

HUNTER: Okay. Is this Temporary Change issued because specifically because of the leakage into the reactor coolant drain tank?

KUNDER: It was initiated because the leak rate calculation was giving us unidentified leakage values that were greater than the one gpm allowed and...or it was getting very close to the one gpm allowed on some of the calculations that were performed by the computer. This is one of the items that we discussed at the POD as a matter of fact. I had specifically asked Tom Mork to review the calculation because when you observe the make-up tank leak rate and when you did a long term calculation of the drain tank leak rate by looking at the level increase, the Shift Supervisors were finding that indeed the unidentified leak rate was much less than one gpm. When he, when Tom Mork looked at the calculation he found...let me think...he found that the ...as I recall... that the drain tank volume was not corrected back to the specific volume of the coolant at the temperature the RCS was operating at and since other the other tanks in the system such as the make-up tank and the pressurizer and so forth, since they were corrected to, back to a standard specific volume this would introduce an error in the calculation. So this design change was intended to change the correction for specific volume to what it should be so that the whole calculation would be consistent and due to the extra leakage that we had going into the

drain tank, this minor error tended to be more sensitive to fluctuations in, you know, the level and so forth.

HUNTER: Okay...would the TCN, George, include Attachment 1A for review by the PORC for instance? The 3D1 includes the grade sheet, the calculations...?

KUNDER: Okay could I have a copy of the procedure revision?

HUNTER: And here's the...I have the copy of the 3D1 procedure, specifically.

KUNDER: Okay. That was the TCN.

FOSTER: At this point...

KUNDER: Was this TCN...let me ask a question...is this TCN complete ...it says see attached, so there should be an attachment...

HUNTER: That would be it.

KUNDER: Okay that's it. Yes it would include the whole thing.

FOSTER: We are going to break for a change of tape now. The time is 3:15 p.m.

KUNDER: Okay.

FOSTER: We are going to continue with the interview with Mr. Kunder the time is 3:20 pm.

HUNTER: Okay George, we had been discussing previously the 3D1 the reactor coolant system inventory and noted that the TCN for that was issued, the Temporary Change Notice, and it did include a appendix for a manual calculation to correct the density of the water in the reactor coolant drain tank for the affect of temperature decreased from 650 something degrees down to the ambient temperature in the tank to give a accurate indication of control leakage into the reactor coolant drain tank versus the apparent inaccurate calculation done by the computer since it did not include the density compensation calculation. And we ended up noting that this was reviewed by the PORC and signed by a member of the PORC, Chairman Mr. Warren. It was being used the morning of 3/28/79. The leak rate was in fact calculated according to the procedures as we have it. The leak rate was less... the unidentified leak rate was less than a gallon a minute. Okay you commented... would you again comment on the PORC review of that particular TCN. The TCN was reviewed based on its technical adequacy to provide the correction to the leak rate.

KUNDER: Okay. I stated in the past that I didn't recall the PORC having reviewed the specific implications of the leaking safety valves. The fact that the PORC reviewed this change to the RCS inventory, which was really

prompted by the fact that the leakage from the safety valves was making the leak rate calculation more sensitive to the degree of leakage, that the PORC, I suspect, although I wasn't in the this particular I didn't chair this particular PORC... I suspect they addressed specifically the technical change of the procedure itself... the calculational method, rather than getting into the you know, implications of the safety valve leakage or any of the other leakage going into the drain tank per say.

HUNTER: The leakage on the morning of 3/28, the time on the computer printout indicates 1:28, being reactor coolant system leakage indicates total identified leakage of 6.93. That's a corrected number with the calculation having corrected net unidentified leakage of .01. George, have you or the PORC or were you aware of any training or plotting or tracking of the leak rates being done in engineering or by the plant staff to monitor the increase in leakage on the safety valves?

KUNDER: Well, although I can't recall anyone having a chart displayed in any of the offices. We were trending, starting to trend the... at least the leakage. I suspect that someone does have that and I will probably go to someone like the operations engineer to determine if he was keeping a record or keeping a graph of this. Although off hand, as I said right here, I just don't know.

HUNTER: Okay. I would like to comment that the acceptance criteria on the TCN indicates that the total leak rate would indicate... should be less

that 30 gallons a minute. The total identified leak rate must be less than 10 gallons a minute. Net unidentified must be less than 1 gallon a minute. Can you comment on the less than 30 gallons a minute? What the total leak rate means?

KUNDER: Well the total leak rate is, that's a Tech Spec value.

HUNTER: Of 30 gallons a minute?

KUNDER: That is right.

HUNTER: And then the total identified leak rate of less than 10 gallons a minute?

KUNDER: That's a Tech Spec Value as well.

HUNTER: Okay. And then the less than 1 gallon a minute is unidentified as a Tech Spec?

KUNDER: And that's also a Tech Spec that's right.

HUNTER: Okay.

KUNDER: I might add that, although I don't know that it really relates to this incident, the drain tank itself I think was designed for something

well in excess of the 10 GPM okay. I think that was just to make sure that when we did have any significant leakage that the drain tank temperature would indeed be ambient, and not some elevated temperature.

HUNTER: Okay George. Let me go back and change your thought train if you would and let's talk a minute about the operation of the reactor coolant pumps the morning of the 28th. Fairly early in the event, the reactor coolant pump flow started to vary, the amps on the motor started to vary and even we were getting some vibration alarms and some other alarms that indicated that the pumps were not operating normally. The pumps should operate without any alarms, if you really want to look at from that direction. Can you relate again your thoughts when you came in after 4 that morning and got your plant status, and ended up looking at the reactor coolant pumps. What type questions did you have in your own mind and what did that really mean to you?

KUNDER: Well, first of all I was not aware that we were getting vibration alarms and secondly, I was not watching the amps and didn't realize that the amps were varying. When the Shift Supervisor and the other people... I guess was the operators and we both found that the group around the console looked at the parameters and I had thought they were keying mainly in the pressure and temperature of the RCS relative to the NPSH curve on the pump that the decision was made to shut down two of the pumps because in the condition we were in, at that time, we were at or below NPSH curve for reliable pump operation. I can't remember if there was any formal decision

made or who even consulted with me precisely, but I know they went ahead and shutdown the pumps. I'm pretty sure I looked at the curve after the first two pumps were secured and prior to the second two pumps being secured. I think I mentioned at the last interview that there was an operating procedure on a desk and it was opened to the page showing the heat up and cooldown curves. On that same curve we have a number of curves, and two of which is the ones relating to the pump NPSH. For the benefit of the typist's that's Net Positive Suction Head. I've seen that typed many different ways I guess. The first curve, which is the upper one, I recall is the one for four pump operation and I believe the lower curve is for two pump operation or single pump operation. I can't remember now any more. And I'm pretty sure I looked at the console recorder and the temperature. I can't remember now if it was Tc or Th but I... the temperature and pressure correlated in that when I picked a point in the curve it was very close to the line, the upper line. And in my own mind I concurred with the move to shutdown the pump. So it is either through mentioning to the guys or through passive concurrence that I agreed with that. From that point on I do recall looking at the flow indicator. The A loop flow indicator which normally reads about 86% or so on the indicator was down around 70 or 60%. I can't remember the other activities I was involved with at the moment. I know I had been on the phone or I had previously been on the phone or I was involved in a call with Gary Miller. I recall coming back to look at that indicator and it was dropping off. Again I didn't look at the amps, I was unaware of any alarms because at that point in time I wasn't... I'm not sure I even would of known where to go to look at them. The flow was definitely dropping off

and had dropped off and as I recall to about 30%. Bill Zewe was there at the console with the other operators and I recall that they were getting concerned that, "Yes that was a clear indication we were getting cavitation in the pump". The pump just wasn't doing its job so they secured the other two pumps. My thought at that time was well, okay, now we're resigned to the fact we're going to be operating in natural circulation. So even at that point I believed that natural circulation was going to occur and I did not have the perception that we had indeed... you know we're in a LOCA situation.

HUNTER: On the same curve George, is there not a point for operation during natural circulation or any compression for pump operation... any compression for natural circulation, is that type of curve on that chart?

KUNDER: Yes.

HUNTER: Does that curve, the NPS curve, some of the operators call it, or the Net Positive Suction curve... heat up cool down curve....

Can you relate saturation, temperatures and pressures directly off of that curve or did you relate?

KUNDER: I did not relate at that point of time. At the... I think in a mental condition I was in, trying to hunt for what was going on I guess my inclination being an engineer, I would of gone to the steam tables and

that's where I would take the temperatures and pressures, go to the steam tables and see where I'm at rather than trying to deduce from curves as I hadn't really thought about that trying to derive that information from any of those curves.

HUNTER: Okay. The odd operation of the reactor coolant pumps then would be related to loss of Net Positive Suction here in cavitation. At that moment did you or Bill discuss why... or Ken Brian who was there also, did you all discuss why you have a odd operation of the reactor coolant pumps?

KUNDER: I don't think we did to any great degree, I think at that point things were happening so fast that I either had forgetten what we discussed or we didn't discuss it at all. By the way, you mentioned Ken Brian I don't recall Ken even being around at that point. He may have been there but I just... he doesn't come into my mind.

HUNTER: You didn't see him earlier but at that particular time he wasn't there?

KUNDER: Later on in the scenerio, I don't recall Ken being there. That doesn't mean that he's there though.

HUNTER: Let me again, changing the subject a little bit just to try and keep things flowing though without getting to far off. The operators and their procedures... the operators and their procedures, the plant operators

way of doing business, more not plant procedures that I don't want to confuse that particular type question. The operators are in practice of routinely securing... blocking and securing high pressure injection. In the past they have been in the habit and they still do because of the apparent severe transients that occur on Unit 1 and pressurizer level and pressure decreasing. Were you familiar with that practice?

KUNDER: Yes.

HUNTER: Is this a practice George, only on Unit 2 and not on Unit 1?

KUNDER: I guess it's been more a practice on Unit 2 because they have experienced more inadvertent safety injections than Unit 1 did. I think Unit 1 may have experienced a safety injection way back during the startup and test program. On a reactor trip however, even in Unit 1, it's written into our Reactor Trip Procedure, that due to the rapid drop in pressurizer level... in order to maintain that level above the elevation of the heaters, the operators are directed in the manual response to start a second makeup pump if needed and to open the B High Pressure Injection valve. That's the one that water is normally... that leg is the one that normally... the makeup water is normally flowing through and you would not incur a thermal shock to the High Pressure Injection nozzle as it enters the cold leg. So they're directed specifically to open MUV-16B if needed to keep the level above the 80 or 85 inch mark in the pressurizer and trying regaining pressurizer level and re-establish normal level and that action is prompted

because of the fact that on a reactor trip the temperature in the RCS drops and...

HUNTER: Do you realize what you just said? I want to make sure okay because you just said I let you go normally and naturally okay. You said, and I want to touch bases with you because that's where we do the best business is what you said. I wasn't prompting you to say what you said. You said that they normally would in fact start the second makeup pump, it's in the procedure, they've been instructed to open the "B" valve in order to be getting pressurizer level.

KUNDER: I know what I said.

HUNTER: What about pressurizer pressure?

KUNDER: Well pressurizer pressure follow, quite frankly, in every event, every transient I've every seen and that has been specifically in Unit 1. As I indicated before I don't think I've seen any of the... I've not been in the Control Room and observed the transient in Unit 2 but in Unit 1 I have. And I have of course through my training in the Simulator had been through a number of these transients myself and have reacted in the same manner. In pressure, in every case has recovered to the normal range and so I think what you were referring and what I just said is correct and I think I feel somewhat programmed to keying on that level.

HUNTER: Okay. I just wanted to make sure that you quoted correctly.

KUNDER: And the pressure has never been a problem. Therefore, I guess it you know has alsways been okay. I don't think I've ever ignored it but, by the same token I have never experienced a low pressure situation.

HUNTER: George the setpoint on the high pressure injection system is 1600 lbs. in that approximately. The fellows blocked the engineered safety features which doesn't change anything for the tape blocking of the SI, I will infact read it the way I read it. Blocking of the SI should never be done except during normal cooldown. Securing high pressure injection should never be done, it would have to be in anextreme extreme emergency that you would want to change the high pressure injection mode and blocking electronically, electrically locking or resetting of blocking high pressure injection does not in fact change any valve position securing pumps or change the actual flow to the reactor. Upon seeing the pressurizer level recovering after a few minutes into this event, the operator then throttled the 16 valves of four high pressure injection valves back actually shuting to... cutting off one high pressure injection pump and then throttling the other two back to minimum flow if... a small amount of flow, basically equaling the letdown flow of injecting at best 100 gallons per minute and letting down somewhere between 74 to 140 gallons a minute with a, an apparent negative... with an apparent loss of inventory at that time. The practice of throttling back the high pressure injection is also, follows blocking of the safety injection system. Were you aware of the practice of

throttling high pressure injection valves in order to maintain pressurizer level?

KUNDER: No I never... let me try and find that. My concept, or my conceptualization, of throttling back on the high pressure injection valves has been traditionally in order to limit the flow rate through the high pressure injection lines to 250 GPM to prevent run out of the makeup pumps. That's specifically covered in our loss of Reactor Coolant Procedure. After safety injection of this nature, I'm aware of what you're saying, the fact that they throttled back to maintain pressurizer level and I can identify with that. They were concentrating on that and pretty much reacting to the way that we just talked about. That they were somewhat programmed through our experiences to key on level. I guess I'm aware that that would be done okay.

HUNTER: Okay.

KUNDER: I'm kind of answering from two sides you know, I don't operate on the panel but I am an operator and I've gone through the training down at the Simulator and I can emphasize with the fellows on the console particularly in Unit 1.

HUNTER: Particularly, excuse me, particularly in Unit 1 or Unit 2?

KUNDER: Unit 1, because in Unit 2 I don't have the feel.

HUNTER: Okay fine, that's good.

KUNDER: I'm not sure I can put that... how I can put that in words. But I think in Unit 1 I would have a better feeling for the console and then for the operation after transient. I guess it's a hard question to answer because I've never been through the inadvertent or the actuation of ES in the same fashion.

HUNTER: Allow me George to... allow me to draw on your training some and look at the high pressure injection as a system that's initiated on reactor coolant pressure and not pressurizer level. Does that mean anything to you personnally, the way you were trained that the fact the high pressure injection system was blocked and the reactor coolant pressure was not in fact above 1600 pounds?

KUNDER: Well my training again, I've experienced these things at the Simulator. We have a drop in pressure, ES comes and we recover pressure, okay. When the pressure is recovered and we don't want to over pressure and generally concurrent with that the pressure slackens up, but I don't think it in my eariler expriences with the Simulator we worried to much about the pressurizer. The pressure come up into the 1800, 1900 pound region and we did bypass ES in order to enable throttling back on the 16 vavles and restore pressure to its proper value. We would throttle back as

much as you had to in order to maintain inventory and pressure in the system.

HUNTER: Would like to make a point there George if I might. You indicated to bypass safety injection at that time.

KUNDER: That's right.

HUNTER: Not to block and bypass because you were above 1600 and you had the permission to bypass it electronically. The logic on high pressure injection is if you come up it will not automatically... will it automatically unblock?

KUNDER: In well... Unit 2 Simulator I can't remember now how that works. But, Unit 1 when you come up above 1600 pounds it automatically... the bystables automatically reset and if it were to drop again it would reinitiate.

HUNTER: But, in order to take manual control of the system you may in fact have to bypass the ...

KUNDER: Yeh, I don't recall yeh I don't really recall what pressure we blocked it at to be honest with you. We're recovering, we know we've got to get manual control we start doing the bypass operation at the Simulator and that's the only time I've ever actually have been in a position to do this.

Every component has to... the buttons have to be bypassed. So there's, oh roughly 50 or so components that have to be bypassed by the push buttom. So it is kind of a involved operation just to do the bypassing and then regain control of the components that you wish to throttle back.

HUNTER: Okay.

KUNDER: Such as the 16 valves. So, in relating to actual pressures that's not meaningful to me.

HUNTER: The point I wanted to make is that above 1600 the system is reinstated and logically then giving the operator the go ahead to bypass it without blocking it first. The block function in the procedures and in the descriptions was put there by the operator to prevent high pressure injection on a normal cooldown, not to pull himself out of a severe transient on a reactor system per say, okay.

KUNDER: It's an interesting.. if I can just add a comment. This interplay between the low pressure and pressurizer level and just what Criteria I uses to ascertain whether he has a break in the system. All the previous incidents of a leak in the system, which have been simulated at the Simulator, have always involved a drop in pressurizer level in addition to the loss of pressure. From my early experiences in the training program, you do key in pressurizer... the actual pressure in the system and you recover that and then you pretty much confirm in your mind that you don't have a leak or you

at least get a leak rate by observing the behavior of the pressurizer level.

HUNTER: Okay.

KUNDER: So it's kind of easy to progress to the point, I guess, where operations are experienced a number of transients induced safety injections and as long as the pressurizer level is high they apparently don't perceive that there's a limit.

HUNTER: I'd like to ask you a question around that George. If I indicated to you that pressure was the prime parameter for low pressure safety injection, would you in fact be able to indicate to me why you would not yourself being a licensed operator, a senior licensed operator, have keyed on pressure? Qas it due to the way you were trying to key on pressurizer level and sort of let pressure take care of itself? Or would it be due to some other mechanism that I'm not aware of?

KUNDER: I'm not sure I understand. I think I know what you are saying.

HUNTER: Okay. If I tell you, and I'm going to make an assumption and it is a good assumption I hope, that the reason they call that system a low pressure... a high pressure safety injection system is because it's to maintain pressure high, to maintain inventory and they call it a ES system and they key it on pressure.

KUNDER: Okay.

HUNTER: Not on pressurizer level. Knowing these facts now and that is fact, I'm not trying to... I'm just trying to build a question, so that I can get an answer based on your experience and maybe the way you were thinking that morning remember and why you didn't key in that area based on the fact that it is a pressure system, it is a pressure maintenance system, it is to maintain system pressure. Where did your training or what item got you off track so that all of a sudden it became a pressurizer level maintenance vehicle versus a pressurer maintenance vehicle.

FOSTER: George if you would could you answer that question on the next side of the tape?

KUNDER: Okay.

FOSTER: We're breaking now at 4:10.

FOSTER: Correction, Side , this tape is ended at 3:50 PM not 4:10 PM. We're gonna continue now with the interview of Mr. Kunder. The time is 3:55 PM. George would you provide an answer to the question Mr. Hunter asked ending side 1 of this tape?

KUNDER: Okay. Due to the break, I'm trying to retain as much of the continuity as I possibly can. If you were to ask me now why we key in on

pressure to actuate the high pressure injection systems, it's very clearly that you... a loss of coolant accident, in the classical design, involves the loss of pressure. Tt could be rapid, it could be slow, but none the less the pressure does decrease due to the fact that your losing inventory and flashing steam to containment. There's no question in my mind that the actuation that's based on pressure and if I was operating as an operator and pressure wasn't decreasing, knowing the setpoints for high pressure injection, 1500 pounds if it's Unit 1, Unit 2 1600 pounds, you know, I'd manually actuate it. I guess the problem I have in concepualizing this event in view of my training is that when I hit the Control Room it didn't appear that we were in kind of a loss of coolant situation in the classical sense. We did have a loss of coolant situation after it's progressed is... it involves a lot of inventory. And I guess at the time that I came to the Control Room and of course observed that the pressurizer level was high that the I guess it had to confuse me. To believe that inventory was not a problem and the pressure and temperature relationships that we had in the reactor coolant system was a result of the transient effect and I guess my line of thought departed from that classical concept of a loss of coolant accident.

HUNTER: Okay George.

KUNDER: Does that, I don't know, I like to try and focus I'd like to bring out exactly.

HUNTER: Okay no no problem. When you walked in and the pressurizer the reactor coolant system pressure was in 20 minutes or so 1300 1400 pounds above 150 pounds and the pressurizer level was at that time probably all... at that particular timeframe was probably full or almost full it was almost at the 400 inch mark. Was there any discussions concerning the fact that the bubble had just had collapsed in the pressurizer and there was no pressure maintenance... there was no mode to maintain pressure, that the pressurizer heaters were lost? Was there discussion in that area?

KUNDER: I can't remember any discussion in that area. I do recall that was the thought that I had been considering. Just what had happened to the bubble I just assumed that we pushed the bubble out of the pressurizer through over filling the whole system trying to solve the system and then we were trying to letdown and we didn't have an adequate bubble and pressure was lost.

HUNTER: Did you George at that time look at pressurizer temperature?

KUNDER: No.

HUNTER: Or ask someone what the pressurizer temperature was?

KUNDER: I don't think I did.

HUNTER: Okay. At that time could you relate pressurizer level and pressurizer pressure at all? Was there any relationship between those two parameters?

KUNDER: I don't remember even attempting to do that.

HUNTER: Let me take on a more general type of question. During your time frame, when you came in shortly after 4 that morning, were you kept fairly well informed so that you could make decisions or provide suggestions or and if you were how was this done? Or were you more in the lime light sort of sitting back looking?

KUNDER: I was I guess more sitting back and looking I regret that I don't think that I was much help to the operators. The manner in which I was becoming informed of the plant status was by asking questions of the operators, what they had done, what's their situation and they gave me a real quick briefing on some of the main parameters and what had occurred and I tried to go around and either find the instrumentation or ask other questions and try and get my understanding clearer as to what the plant status was.

HUNTER: Looking back George, excuse me go ahead.

KUNDER: I don't think I ever assumed any kind of a direction or directive role in the operations. I'm sure I gave suggestions and advice, I can't recall specifically any more unfortunately. The initial oh I'd said the

initial hour that I was there was I tried to understand what was going on, tried to be a help to them. I don't think I was very much help to them of course but I was also on the phone with Miller and I tried to brief them in conditions and sometimes you know I didn't have the full story even then. I had to go out into the Control Room and ask more questions. That sort of thing. Does that address your question?

HUNTER: Yes. Later on Joe Logan came in and also Mike Ross came in.

KUNDER: Right.

HUNTER: When Joe Logan came in did he end up with a problem of did he pick up do you recall picking up operations of the facility or picking up activity of turn-over the same as you had?

KUNDER: I guess he did. I'm having trouble remembering specifically what conversations I even had with Joe. I think I had briefed Joe on some of the things that I had known and we proceeded at that point.

HUNTER: What about Mike Ross?

KUNDER: Specifically I can't remember what we discussed anymore.

HUNTER: What about Mike Ross?

KUNDER: Mike, my recollection my discussion with Mike is pretty much the same as with Joe. I just can't remember specifics and I think they were in there. I know... I think Joe came in before Mike Ross came into the Control Room. And I thought that Joe was there prior to shuting down the last set of pumps. I seem to recall maybe Joe was up there with Bill but it's just not clear in my mind anymore.

HUNTER: One problem early, we touched base on a little earlier as a comment, but the reactor coolant buildings, the reactor buildings sump level was high. Not knowing how high it was, did you discuss that issue with Bill Zewe or any of the fellows?

KUNDER: I don't recall discussing sump pumps at all.

HUNTER: Okay. During the initial part of the event, the operators had trouble with the makeup pump, the 1A makeup pump. The typical problem that they had was in the excitement or the moment they didn't hold a switch long enough, the oil pressure didn't come up and it tripped back off. But they in fact had A pump tripped off even after running for 26 seconds or something. Were you aware of that problem?

KUNDER: No no. Not at that time.

HUNTER: A little later in the day, in the afternoon looking specifically, depressurizing to the core flood tank pressure... 30, 30, 28 to 30 temp/pres-

sure spike. Now this is the reactor coolant pressure but as you okay. As you came down, going in the reactor coolant system pressure, and we're looking at the wide range reactor coolant pressure chart, a copy of that particular parameter, the containment pressure spike occurred somewhere between right before 1400 that afternoon at 2 o'clock. Were you aware of that pressure spike occurring?

KUNDER: No

HUNTER: Were you... when did you become aware of a pressure spike occurring in the containment?

KUNDER: It was about somewhere around Friday that would of been the 30th.

HUNTER: Okay.

KUNDER: I think. I can't remember specifically but ...

HUNTER: How did you become aware of that?

KUNDER: I had been discussing the some of the parameter curves from the incident with either Gary Brotons group, the GPU Investigative Team group or it was in a meeting that I had with some of the other GPU Engineers.

HUNTER: Would you spell Gary's name?

KUNDER: B R O U G H T O N. I can't remember specifically who it was but it was ... I was either questioning the group on some of the things they had found or it was during the meeting that I had with a team of GPU Engineers who were specifically charged under Dick Wilson by Herman Dieckamp to begin the investigation of the incident. I may have been requesting that they start looking at the hydrogen generation problem in the building. My perception of the hydrogen generation problem after such an event is that it's a long term process you know At that point I guess I was concerned that we were getting an investigative group together with the very people that I think should be helping us secure the plant because at that point I didn't feel very comfortable at all with the status of the plant. I didn't until we finally went in natural circulation cooling just a few weeks ago. But at any rate it was at either one of those encounters that the mention was made that "Oh gee did you know that you had a hydrogen explosion already" or something to that effect and I said no I didn't and they showed me the spike. They said it'd occurred that day. Then in future conversations with Gary Miller he indicated that he remembers hearing something and he asked what was that. And that was... this occurred during the period of time that I was still in the Control Room because I don't ever recall leaving the Control Room since the morning. And it was just prior, according to Gary's recollection, to the time when he and I had to leave the site to go up and see the Governor. During that period of time I was... I may have been getting data together to take up to the Governor's Office.

HUNTER: Okay.

KUNDER: But I never heard that I was never aware that the spray pumps came on and or any of that really.

HUNTER: Okay. Did you have access to the Incore Thermocouple data at any time during the morning? Do you recall?

KUNDER: Well I had access through my Lead I&C Engineer, Ivan Porter, and I don't think I specifically asked for that information because at that time I was unaware that we had incore thermocouple information because Unit 1 does not have that information. The incore thermocouples exist but they're not hooked up.

HUNTER: You didn't see any incore thermocouple numbers coming back?

KUNDER: I think I did later in the morning but Ivan had gotten that information and he had... he may have mentioned it to me. I can't specifically recall. But he did mention... he had been giving temperature information directly to Gary. I probably became aware of the incore information later in the morning after we... it was pretty well known we had high temperatures in there and that we did damage to the fuel because of the release of radioactivity. I was not coordinating that part of the analysis of what had occurred. As I recall, Ivan spent a large part of his time looking at hot leg temperatures and the thermocouple temperatures and even

up to this past week, I believe he was able to find additional records of temperatures that were marked down on paper by the I and C foreman and turned over for review. I was not specifically keyed into that part.

HUNTER: Early in the morning George, Reactor Building Pressure was in fact... Reactor Building temperatures, they even had some fire alarms on the annunciator panel for high temperatures in the Reactor Building. Were you aware of those parameters?

KUNDER: I remember the high temperatures in the building. That was, I guess, during the period of time when we were, at pressure. We were at... between 2000 pounds pressure or above, and opening and closing RCV-2.

HUNTER: Okay.

KUNDER: That period of time. That's the period of time when containment pressure rose to 4 pounds.

HUNTER: What about earlier in the morning when containment pressure was in fact coming up and we knew what ...

KUNDER: Well pressure was up but I don't recall the fire alarms. I do seem to recall that I looked on the temperature recorder and it's on the back panel and I think I saw temperatures that were elevated. But, it seems to me that the time that I saw significantly elevated temperatures was during this period of time when we had the 4 pound building pressure.

HUNTER: Okay. In the earlier morning did you have information on the increase in radiation levels of... in the primary system of from Dubiel or any of the fellows that says, "Hey the letdown sample is hot", "the letdown sample lines are high", who was that specific?

KUNDER: I was the guy that answered the phone from.

HUNTER: Okay.

KUNDER: I answered Dick's call.

HUNTER: And what did he say?

KUNDER: He said that the radiation level on the sample lines just shot up to 600 mR per hour and that we got "big" problems and he got very excited.

HUNTER: What was your reaction to that then?

KUNDER: I felt that we were failing fuel and I yelled over to Joe Logan from the spot that I was standing talking on the phone, I said "Joe, Dick just tried to draw a sample in the letdown and the sample lines just shot up to 600 mR per hour". I seemed to recall saying, I don't want to use the same language, but we're failing fuel.

HUNTER: Okay.

KUNDER: It wasn't very much beyond that that we were getting alarms on... it seems like a matter of seconds that we were getting alarms...

HUNTER: Did the site emergency follow that very quickly?

KUNDER: Pretty quickly. I seem to recall that the I looked over to Bill and said you know we got a Site Emergency situation or words to that effect. I think Bill seems to recall the same sort of thing in my subsequent conversations with him.

HUNTER: You said, "We have a Site Emergency situation", based on what?

KUNDER: The radiation level in the... all I can see was the alarms started to come in. The fact that we had this high radiation on the sample line.

HUNTER: Okay.

KUNDER: I knew we were into something big and I didn't really quantify in terms of the specific criteria in the Emergency Plan but I knew, Hey we had a big problem. We had radiation coming up all over the place and we were in the shits. I'm pretty sure at that point we had already initiaited the high pressure injection. Again I was very concerned about the boron as I spoke to you previously. Mike was in the Control Room at that time, I know

because I remember him say that we got to do something. You know, we just had to do that. I couldn't quantify exactly what was happening, even to that point but I knew we had to initiate high pressure injection again.

HUNTER: Allright.

KUNDER: So we yelled to have that put that back on till we understood what was going on because that was the safest direction.

HUNTER: Do you recall seeing the high pressure injection put back on or was it just the word passed in the Control Room?

KUNDER: No the word was just passed. I was standing over behind the operators desk and I'm pretty sure, it was indicated before, that I didn't... I couldn't even tell if they had hit the button for high pressure injection or started the pump or just what but they supposedly ...

HUNTER: Were they there doing something that you could see?

KUNDER: There was a lot of guys standing there. So I didn't look at the panel specifically.

HUNTER: Let me ask you a question concerning the... in the area of stopping the first two pumps which it was the B pumps... the B pumps were stopped. Do you recall looking at or discussing the parameters in the B loop at that time, the steam generator level pressure, Tc, Th?

KUNDER: No.

HUNTER: Those parameters? Okay.

KUNDER: By the way one thing that I might clarify. I was trying awfully to hard to remember what exactly happened as we declared a Site Emergency but when I, I always felt that I recalled saying that we have a Site Emergency problem or situation and later on when Bill and I got to talking, he seemed to recall a similiar sort of thing That he thought I said Site Emergency and he said yes Site Emergency, from then on Bill pretty much implemented the Site Emergency in terms of getting the operator to make the announcement. I really departed from the panel at that point. Assuming that Joe, since he was the senior fellow was acting as the Site Emergency Director. I took on the role of getting communications initiated.

HUNTER: Okay. Were you aware of ventilation securing automatically or being secured manually or being found secured on that morning for the Auxiliary Building, Fuel Handling Dome?

KUNDER: No.

HUNTER: The Control Room Building?

KUNDER: No.

HUNTER: Would the limited... realizing your short your... just a few weeks of being introduced to Unit 2 in formal training or somewhat training or somewhat formal training... but would you be aware if the Control Building automatically isolates on high radiation? If it would?

KUNDER: No.

HUNTER: Do you have any idea of what the gaseous release paths were the first three days of the event the 28th through the 30th?

KUNDER: Well I'm not sure I thought about it those terms but I... the one gaseous release path for the short burp was up the B atmospheric dump valve. But we, I think that was very small cause we had specifically went up from the roof with monitors... someone went up there and checked and they didn't find anything of significance. The Auxiliary Building exhaust was a tremendous gaseous release path. We probably had some gas releases into the Control Building which eventually was drawn out because we did have xenon in there. We had to done gas masks, you know the full face respirators.

HUNTER: Where was that coming from George?

KUNDER: I don't specifically know. In retrospect I understand that the radiation level was down around the control access area in the Service Building was high presumably due to the xenon cloud but I was not familiar with what the ventilation flow paths were at that time.

HUNTER: What about the gas release paths within the Auxiliary Building itself? Were you aware of any gas release paths within the building itself like from the Bleed Tanks or the Makeup Tanks or any specific release path or was it... you're not aware of any paths at all?

KUNDER: The only way I would of been aware of it is if someone else, one of the operators, who was familiar with the Auxiliary Building said ah ha we have a leak out of this source or it's coming from this valve or something like that. But there was no... I could not have deduced on my own which paths were in existence at the time.

HUNTER: If thinking back, what would you... what did you attribute if you did at all attribute your gas releases to during the first three days?

KUNDER: Well it's imparent that the degasing of the reactor coolant system was a tremendous contributor and the leakage that... or the water that was pumped out of the Reactor Building into the Auxiliary Building from whichever flow path that came was degasing and was giving us quite a release of Xenon, Iodine. Tt was giving us a lot of activity. I don't think we differentiate precisely in which was Iodine which was Xenon but the cloud was apparently mostly Xenon because there was very little contamination. When we were outside and later in the day and the activity levels were high or the dose rates were high it was pretty much do to the Xenon cloud. The release paths that was very evident was in the Makeup Tank, in the Vent Header Lines between Makeup Tank and the Vent Header. I don't

think I was aware if we had any Vent Header problems where by we were lifting relief valves. But I know the Makeup Tank was degasing at such a rate that it was not venting off very well and I know that pressure was up close to 80 pounds and it could of been weeping out the relief valve but I don't think that anyone really for sure. Or postulate at all along has been that we have some leakage in one of the valves probably MUV-13 which is a vent valve in the Makeup Tank to the Vent Header.

HUNTER: Okay.

KUNDER: But we've never been able to get close enough to find it and correct it to this day.

HUNTER: Allright. I don't have any further questions George. I appreciate your time, sorry it took so long. I know you indicated you were glad to come in and we will... we may in fact be back in touch with you we don't know yet but I appreciate your time.

KUNDER: No problem, thank you.

RESNER: Okay thanks a lot George. We're going to conclude this interview at 4:20 PM.