PRESENTATION TO THE UTILITY DESIGN AND REVIEW BOARD

DESIGN TO ACHIEVE AND MAINTAIN COLD SHUTDOWN

WEDNESDAY, APRIL 29, 1981

HELD AT: BECHTEL POWER CORPORATION OFFICE

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MR. COOK: It's my understanding that everyone who should be here or wanted to be here is here and that being the case, I think we will convene this session and get the proceedings underway. My name is James Cook. I am the Vice President for Projects Engineering and Construction for Consumers Power Company.

I'd like to welcome you all to the First Design Review Board Meeting for the Midland Project, the subject of which is to review the Midland Project design on cold shutdown. I think it's appropriate, before we begin into the details of the design review, to have a few introductory and welcoming remarks. I think the first thing I would note is that we do have a recorder with us this morning and we will be making a transcript of this proceeding. Therefore, I would ask everyone of this large group that's going to participate, when you speak, please identify yourself to assist the recorder in making the best transcript possible.

The second item of introduction, I would like to introduce the Design Review Board, welcome our colleagues from the Nuclear Regulatory Commission and ask them to introduce themselves, and then I will also ask Ed Hughes, who is the chief spokesman for the group presenting the design to the Board, to introduce those that will be talking during the course of the day.

I have just introduced myself. I am serving as the company's chief representative on the Midland Project as the Chairman of this Review Board. Serving with me today and around the U-shaped table, starting at that end, I see Dick Loos, who is the Bechtel Chief Nuclear Engineer; next to him, Eugene Van Hoof, who is Consumers Power Director of Nuclear Fuel but is a long-time participant in the Midland Project and prior to that in the Navy Nuclear Program. Next to Gene we have Jerry Slade, who is the Plant Superintendent of the Midland Nuclear Plant and is currently at work on the site on the myriad of activities required to prepare the plant staff for operation of the plant when it is completed.

Next to Jerry is Ron Bauman, who is serving as the Design Production Manager on the Nuclear Project directly involved in the Consumers Power Engineering effort for the Midland Nuclear Plant and one of the veterans of the design of the Midland Project. Next to Ron is John Garrick, Principal of Pickard, Lowe and Garrick, one of the leading consulting firms in the nuclear industry, who is working as a consultant to the Midland Project and one of his principal duties is working with our engineers to develop a probabilistic risk assessment for the Midland design.

Next to John is Jim Taylor, Manager of Licensing for Babcock and Wilcox, the supplier of NSSS for the Midland plant. Next is Lou Gibson, who is one of the principals in our Safety and Licensing Engineering Operation for the Midland Project. On my right is Terry Sullivan, the Manager of the Safety and Licensing Department for the Midland Project, and if I look over my list, that is all of the Design Review Board Members who are present. We are missing one other member who, due to an unfortunate accident and incapacitation because of an injured foot, can't be with us this morning. That is Russ Dewitt, who is Vice President of Nuclear Operations for Consumers Power Company. He sends his regrets to the Board and hopes that any further participation on this issue he'll be able to directly contribute. That is the constitution of the Board.

Darl, as the NRC Project Manager for the Midland Projects, I would like to ask you, please, to introduce your colleagues with us today.

MR. HOOD: Thank you, Jim. My name is Darl Hood. I am the Project Manager assigned to the Midland Project for the Nuclear Regulatory Staff and I have four members from the Nuclear Regulatory Commission present today and I'd like to ask each of them in turn to introduce themselves and name the branch organization of which they're a part.

MR. SULLIVAN: My name is Ted Sullivan and I'm with the Auxiliary Systems Branch.

MR. ANAND: My name is Raj Anand and I'm with the Chemical Engineering Branch.

MR. JENSEN: My name is Walter Jensen and I'm with the Reactor Systems Branch.

MR. MAZETIS: My name is Gerry Mazetis and I'm with Reactor Systems.

MR. COOK: Thank you. I would now like to ask Ed Hughes, Assistant Project Engineer on the Midland Project Team at Bechtel, to please introduce the participants in his group that will present the design to us today.

MR. HUGHES: All right. Thank you, Jim. I'm going to go through a little brief introduction and then get on with the introduction of my people here. As I believe you're all aware, the purpose of this presentation is to provide a means for expediting the licensing review of the Midland Project by reducing the number of NRC questions produced during the docket review; in addition, to demonstrate a critical evaluation on the present design by this Review Board. One of the ground rules for this presentation is that, it being transcripted as Jim said, we ask that anybody who is asking questions or responding to questions, please identify yourself first and if you're referring to figures or tables, to give the numbers of the figures or tables.

In the format of this presentation, we are going to go through setting the stage of the past and the present design and then getting into conformance to regulatory positions and deal with accident analyses and demonstrate the capability for cold shutdown. Now, as part of our presentation, John Gunning, whose licensing presentation on the history of the plant and will also get into accident analysis, and John is sitting over here. Mike Gerding will address the control systems **aspects** of the accident analysis. Tom Ballweg and Mike Pratt will address the -- cover Section IV, which is the cold -- again, the cold shutdown design of the systems. Bob Schomaker from B & W will address the accident analyses or Chapter 15 events.

Now, as part of the ground rules for this, we do request that as we go through this agenda -- John, will you put the agenda up -- that you hold your questions until the end of part four, at which time we will have set the stage of what the preceding design and the present design is. Thereafter, questions as you see fit.

We have two people who will be recording any open actions and at the end of this presentation and question section, we will resolve and summarize a list of the open items.

Now, just for history, for anyone who isn't fully familiar, Midland is a project that started over twelve years ago. A construction permit was issued in December of '72. The FSAR was submitted in February of '77 and we've had two rounds of questions. Essentially NRC review terminated after the Three Mile Island occurrence and since that time we've had extensive efforts underway on the project and with both B & W and Consumers to take the Midland design and conduct an internal review based on the lessons learned.

There has been both an independent three company nuclear safety task force for which a number of recommendations for design enhancements or improvements were determined and extensive on project efforts using the industry-wide efforts of the Three Mile Island analyses. Now, we have updated the FSAR in October 1980 to include the responses to the various Three Mile Island issues and events and any issues identified prior to Three Mile Island.

Now, a major topic, the one for discussion today, is the topic of cold shutdown and this is discussed in the Midland FSAR text and the responses to the various NRC requests.

At this time we'll start the presentation. John Gunning, Bechtel engineer, will present the history and the preceding design, parts two and three.

MR. COOK: Ed, excuse me. I just wanted you to take care of the introductions.

MR HUGHES: All right.

MR. COOK: I had a couple of other remarks to make before we got into the detail presentations.

Ed has done a little bit of the introductory remarks that I wanted to put on the record and put before the group before we went forward, so I will not repeat some of the remarks that I had planned that are similar to what he had just discussed. I do think it's worth, though, to mention for all of the group here and for the record that we are proceeding with this Design Review Board basically as an experiment in a mechanism to improve and to augment the licensing process. This idea was suggested to Consumers Power Company during a meeting last summer with Harold Denton and other NRC staff management concerning the status of the Midland review and ways which we might explore to try to expedite that review in light of the constraints faced by the NRC Commission and its staff and also the problems being experienced by the applicant in trying to, you know, execute the job.

I think Mr. Denton made that suggestion for a number of reasons which he stated, but one of which I thought should be discussed at this juncture. I think it was his opinion as stated to us at that meeting that he had a concern that all utility applicants could profitably utilize this procedure to become more involved with their individual design. I think one of the difficulties we have had in constituting this Review Board was to find people who could be sufficiently removed from the work that is being presented to us here today to, you know, constitute an independent look at that design. And I don't think that, because of the nature of the involvement of everybody in this room in the Midland Project, that we have been totally successful in being able to fulfill that particular philosophical attribute of a Design Review Board.

Be that as it may, I think we can definitely proceed with this activity and make it beneficial, but my general comment for the record was that although it has been an evolutionary process because of the long duration of this job, it is my firm opinion, and I think the opinion of all of those who are part of this job with me, including the Chief Engineer of my company, happens to be the President, and the Chief Executive Officer, that all of us are deeply involved in the completion of this project and I think, although we will not burden the record with the detailed discussion of how that has occurred over the years, it is there for those who are interested to pursue and to demonstrate to their own satisfaction that we at Consumers Power are fully involved in the job and will be in that role for the duration of the plant design and construction and for the, obviously, the operation of the plant as it proceeds through its operating lifetime.

With regard to the format of this meeting, we discussed the idea of constituting a

Design Review Board, you know, with the staff after the suggestion that we might find it useful. It was made to us by Mr. Denton. The culmination of that discussion was transmitted to the staff in my letter to Mr. Denton of January 21, 1981, and that letter sets out basically the protocol, you know, for the operation of this Review Board and I might just touch on one or two points in that protocol as we start the meeting.

I think the most important thing to touch on was the fact that we are pleased to have with us today and participating in the discussions, although not directly, members of the Design Review Board, the NRC staff members, you know, who are here. We welcome their presence and we encourage their comments and discussion, and we sincerely hope that their participation and our detailed preparation of material for this design review will be beneficial to the staff in developing the detailed review that they need to do to complete their review of the Midland FSAR. And as Ed alluded to, we will caucus at the end of this meeting. We will ask for staff, you know, comments on the materials that they have heard and we will also develop a specific list of things that we will follow up on as part of the design review process in completing the particular review of cold shutdown here today.

I think one other thing in terms of introduction that we should touch on as we go by, I am pleased that the staff was able to visit the Midland plant site yesterday and that we also have another meeting on another topic, although there is some interaction between the two topics, scheduled for tomorrow. However, in terms of trying to conduct a specific review on cold shutdown, I will ask all of us to try to focus our remarks today on the specific scope of inquiry on cold shutdown, mainly because we have a great deal of information to cover and if we start to range into other topics that are too far afield, I'm concerned that we will be unable to complete our total agenda today.

Obviously we will try to address, some time in the course of our activities, either in this week or in future days, all of the concerns that any of the staff members here today may have, but I will try to keep us focused specifically on cold shutdown today in order that we may try to get through our total presentation and question period.

There have been advance materials sent to both the staff members and all of the Review Board Members discussing the materials to be presented today. In addition, there is, I am told, considerable detailed engineering documentation regarding all of the subject under discussion **today here** in the room with us, so if you do not see enough detailed information, either board members or staff members, to satisfy your questions, we can make that available to you on short notice during the proceedings here today.

Now, I believe that's everything I wanted to introduce as part of the introductions. Ed, I'd like to turn it back to you, please, to start the presentations.

MR. HUGHES: Thank you, Jim. For the first presentation, John Gunning, Bechtel engineer, will present part two, the history, and part three, the preceding design for Midland plant.

MR. GUNNING: Thank you, Ed. Achieving a safe shutdown condition has always been a consideration of plant design. However, the design requirements for what is considered to be a safe shutdown condition have evolved over the years. Emphasis has traditionally been placed on the reactor condition following a loss-of-coolant accident or LOCA. This accident requires the use of emergency core cooling system equipment. This presentation will not address the LOCA to a great extent. However, equipment may be used that's also used for emergency core cooling.

For non-LOCA events, then, the reactor coolant system integrity is maintained. Achieving a safe shutdown condition while the reactor coolant system integrity is maintained will be the primary focus of this presentation. Following this type of event, the stable condition to be maintained has been hot standby. Hot standby is a condition, safe, stable condition that can be maintained for a period of time without offsite power. Subsequently emphasis was placed on insuring that **all** necessary equipment to achieve this condition is safety grade.

More recently, a similar emphasis was placed on insuring that systems necessary to go to cold shutdown are safety grade. This emphasis, then, on grade of equipment that is used in achieving cold shutdown has evolved from the change in the safe shutdown condition from being hot standby to one that is cold shutdown.

Since we'll be using the terms hot standby and cold shutdown extensively throughout this presentation, I'll find it useful to define these terms at the beginning. Slide III-1, this slide III-1 is a figure that correlates with this presentation the various shutdown conditions with reactor temperature. Hot standby is a condition from reactor trip down **to** the reactor coolant system temperature when the decay heat removal system can be initiated.

After a reactor trip, the temperature is at the high end of this range and will stay above the hot zero power temperature. Hot shutdown, then, is from the decay heat removal cut-in temperature and down to a reactor coolant temperature of 200° Fahrenheit and cold shutdown condition is from 200° Fahrenheit and below.

Associated with this is the reactivity where the reactor is at least one percent Delta k/k subcritical. The event useful for evaluating the plant shutdown capability is the safe shutdown earthquake coincident with loss of offsite power. Other events will be addressed in Section V.

From a historical perspective, after Three Mile Island occurred, a nuclear safety task force was formed and recommendations issued. Most of the design upgrades concerning cold shutdown that have been incorporated into the Midland design have evolved from this effort of the nuclear safety task force.

In conclusion to the section on history, present Midland design basis is that hot standby is a safe shutdown condition. This design basis is appropriate because hot standby is a safe, stable condition that can be maintained for an extended period of time with a minimal amount of operator action. Therefore, it provides additional time to further evaluate the condition of the reactor. In addition, it frequently is preferable to maintain the reactor in this hot, stable condition for extended periods of time rather than subjecting the plant to an immediate cool-down transient.

The current Midland design provides for the ability to achieve and maintain, by safety grade means, the hot standby condition following an SSE or safe shutdown earthquake coincident with loss of off-site [illegible]. Although it's not a design basis, present

Midland design incorporates the ability to take into cold shutdown condition using only safety grade equipment, assuming only onsite or offsite power is available and considering a single failure.

In addition, the present Midland plant design can achieve and maintain cold shutdown following a tornado by using equipment that's protected from the effects of the tornado. This is conclusion of Section II.

Progressing now to the preceding design, it's appropriate to briefly review the Midland nuclear steam supply system. I'm sure some of you got a chance to see the hardware of that on your plant review yesterday. Slide III-2 is a pictorial review of the Midland reactor coolant system. It's a B & W nuclear steam supply system. Could you focus that perhaps a little? The reactor vessel, the two steam generators, the pressurizer, four reactor coolant pumps, two hot legs and four cold legs. This is figure III-2 or slide III-2.

Slide III-3 is a schematic from the same system. It shows the two steam generators, the two hot legs, four cold legs, four reactor coolant pumps, and slide III-4 is a view of the steam generator. Thank you.

The remainder of this presentation will provide an explanation of the preceding design and is intended to facilitate an understanding of the design upgrades that have been made. It's been previously stated the Midland design basis has been the ability to achieve hot standby using safety grade systems. It's previously shown, in figure III-1, hot standby is a range but normally after a reactor trip, the reactor coolant temperature will stay at the upper end of this range. This condition can be maintained using safety grade equipment with sufficient time to re-establish offsite power and then use safety grade and non-safety grade systems to maintain hot standby and to proceed to cold shutdown.

In order to insure this stable condition is maintained, certain essential functions must be performed. These essential functions are reactivity control/inventory control grouped together as one, pressure control and heat rejection. These functions are performed by particular systems and consequently necessary systems will be addressed on the appropriate function that the system performs.

Slide III-5 will address reactivity control/inventory control. Control rods: Control rods are **designed** to bring the reactor to at least one percent Delta k/k subcritical **upon** reactor **scram.** Allowance in the design is made for the highest worth control rod assembly sticking out of the core as well as for the temperature effects from hot full power, 579, **to** hot zero power, 532.

Boration of the reactor, boration concentration in the reactor coolant system is normally increased by using a makeup system, makeup pump, to inject boric acid from the chemical addition system.

In the event chemical addition system is unavailable, boric acid from the safety grade borated water storage tank may be injected into the reactor coolant system. Regarding inventory control, the makeup system normally controls the reactor coolant system inventory. Obviously we **here** see the obvious interrelationship between inventory and boration control.

Portions of the makeup system are safety grade and used for high pressure injection to assure adequate core cooling and appropriate boron concentrations. Makeup water is again available from the safety grade borated water storage tank.

Pressure control, slide III-6: III-6, pressurizer safety valves, this is a pressurized steam generator, reactor vessel, the reactor coolant pumps and the safety valves. Pressurizer safety valve prevent over-pressurization. In the event of loss of offsite power, the thermal inertia of the pressurizer maintains the reactor coolant system pressure sufficiently until the pressurizer heaters can be re-energized.

Slide III-7, heat rejection, the hot standby condition: Heat removal is accomplished using the steam generators, the main steam isolation valves and main feedwater isolation valves, main feedwater not being shown, main steam isolation valves. These valves may be closed to limit secondary side heat removal. In addition, the main steam isolation valves and main feedwater isolation valves close automatically on low steam pressure or after receiving an emergency core cooling actuation system. These valves limit secondary side heat removal if required. Auxiliary feedwater enters here. A motor driven and a turbine driven auxiliary feedwater pump are supplied with cross connects on the discharge so that either pump can feed either or both steam generators.

Normal auxiliary feedwater is from condensate storage tank. However, emergency backup is provided by the safety grade service water system.

Main steam relief valves: Heat removal rates to maintain the hot standby condition can be maintained by cycling the main steam relief valves. Steam removal without cycling these relief valves could be performed by opening the non-safety grade modulating atmospheric dump valve. This valve has since been relocated and will be discussed in the present design section

The one other concern in heat removal addressed is natural circulation. This is to insure that if heat removal was being removed from the secondary side, that adequate core cooling is also being maintained. Midland plant can provide adequate core cooling without operation of the reactor coolant pumps. Characteristics of this natural circulation cooling have been calculated by Babcock and Wilcox with conservative values for their resistance and form loss factors.

With this I conclude my section on the preceding design and I turn it to Mike Pratt who will now address the beginning of Midland present design capability.

MR. PRATT: Good morning. My name is Mike Pratt and I will address several important aspects of the present design capability for cold shutdown. First a few general comments; the Midland design provides for the ability to achieve and maintain hot standby following a safe shutdown earthquake with loss of offsite power. Although not a design basis, the Midland design incorporates the ability to be taken to the cold shutdown condition assuming only onsite or offsite power is available and considering a single failure.

Could I get the first overhead? This was touched upon briefly in John's discussion. Reactivity and inventory control, pressure control and heat rejection are the essential functions that must be considered. I will address reactivity/inventory and pressure control, the first two items, and Tom Ballweg will then address heat rejection.

Figure IV-1B shows the operational

temperature ranges for reactivity and inventory control systems. Shutdown functions and systems are shown on the left and the operability of those systems over a given temperature range is depicted by horizontal bands or whichever is appropriate for the given system in question. Specifically for reactivity and inventory control, control rod operation is shown, operability range of the emergency boration system is shown and operability ranges for reactor coolant makeup from the BWST and from the chemical addition system are shown.

There are three aspects of reactivity in inventory control; control rods, boration and RCS makeup. Control rods were discussed previously and no design changes have been made in this area for cold shutdown so I'll move onto the second item of boration. For normal shutdown reactivity control, the design of the Midland plant includes two sources of borated water: First, the borated water storage tank or BWST and, second, the chemical addition system or CAS. With let down available, either the BWST or the chemical addition system is capable of maintaining the reactor to one percent subcritical. This can be during hot shutdown or transition to cold shutdown at any time in core life for the most limiting normal fuel cycle. This is assuming xenon free conditions and the maximum worth rods stuck out of the core.

The use of only safety grade equipment to maintain the reactor subcritical at hot standby and the transition to a cold shutdown condition requires the use of the emergency boration system or EBS, and the overlay shows the addition of the emergency boration system providing a suction source to the makeup pump.

The EBS is a safety grade system designed to provide a six weight percent boric acid solution to the RCS by the makeup and purification system. The EBS in conjunction with the other contraction volume sources is designed to insure the ability to maintain a one percent subcritical margin during hot standby and during the transition to cold shutdown. Adequate shutdown margin is maintained during the transition to cold shutdown by using the borated water from the BWST or chemical addition system. The next overlay shows that suction source capability.

These sources provide adequate compensation for reactivity changes that result from the change in moderator temperature. Following any event which results in loss of letdown and a stuck rod, the six weight percent boric acid solution from the EBS storage tank can be transferred to the RCS via the makeup and purification system. One of the three makeup pumps is used to inject this solution into the RCS.

What I'll do now is go onto the third aspect of reactivity/inventory control, specifically inventory control. As the RCS cools, it is necessary to keep the volume of water in the RCS approximately constant. Therefore, additional water is injected via the makeup system. The safety grade source of makeup water is the BWST or borated water storage tank. This tank contains at least 300,000 gallons of 1.3 weight percent boric acid solution. In addition, three boric acid addition tanks per unit, which are part of the non-safety grade chemical addition system, are also available for makeup. These tanks can provide the required RCS contraction volume in conjunction with other available water sources. The boric acid addition tanks are tornado protected and can be made available following a tornado and a loss of offsite power.

emergency DHR system cut-in temperature and is intended for use only during emergency cold shutdown. The auxiliary spray system flow is provided by a makeup pump. Suction for the makeup pump is normally taken from the BWST. The boric acid addition tanks via the makeup tank serves as an alternative suction source. The spray line discharges to the auxiliary DHR pressurizer spray upstream of parallel motor-operated globe valves so we have the auxiliary spray connection being made at this point tying into the normal auxiliary spray line. And by the way, this is figure IV-3 of the controlled shutdown document.

The spray system requires local alignment prior to initiation but is remotely initiated and controlled from the control room. Once initiated, the spray will be operator-controlled to provide the desired depressurization rate that is determined by the cooldown rate and plant status.

The design enhancements for pressure control, which I touched on briefly a minute ago, are shown on figure IV-3. This includes the addition of the auxiliary spray capability from the makeup pump and also includes the addition of a second PORV block valve.

That concludes my discussion of reactivity and inventory control and Tom Ballweg will now discuss heat rejection.

MR. SULLIVAN: Mike, can we ask some questions on reactivity and inventory while you're still up there or do you want to wait?

MR. HUGHES: Terry, I'd really prefer to finish with Tom, if that's all right, and then we'll go into questions on that, unless it's a matter of clarification for the upcoming --

MR. SULLIVAN: I can wait.

MR. BALLWEG: My name is Tom Ballweg. I will be talking here today about the heat rejection part of the cold shutdown. Thus far, Mike Pratt has discussed reactivity and inventory control systems and pressure control. In this portion, I will talk briefly about the specific Midland plant features and systems used for heat rejection and to maintain control of the reactor coolant system temperature. In the first transparency, our first transparency, which is figure IV-1C of your pack, basically covers the material that I will be talking about here today.

In heat rejection, the steam generator

is initially the primary path for release of energy. The necessary operational parts of the system are the main steam isolation valves and the main feedwater isolation valves to establish the pressure boundary on the steam generators. The auxiliary feedwater system is operational through the entire range of hot standby down to the hot shutdown condition. The main steam relief valves provide capability for heat rejection initially on hot shutdown -- or achieve, excuse me, hot standby and are operable by cycling above those temperatures. The power-operated atmospheric vent valves are used to reject heat from the normal hot standby condition on down to the hot shutdown condition. The decay heat removal system is used after the reactor coolant system has been cooled to either 325°, or in the case of an emergency cooldown, or to 280° normally.

Now I'll go into a little more in-depth discussion of the heat rejection using the steam generator. The next slide is figure IV-5. Basically to reject heat via steam generator, it is necessary to provide a source of feedwater, source of water, the auxiliary feedwater system and the steam vent path. The steam is vented either via the power-operated atmospheric vent valves or the safety valves or the modulating atmospheric dump valves. The features which are in red here are enhancements or modifications made specifically to handle or to facilitate the cold shut-down.

The main steam **relief** valves are spring-loaded valves and cycled to relieve steam enabling the reactor to be maintained in a hot standby condition. The power-operated atmospheric vent valves, there are actually two, although we're only showing one per steam line, provide a path so that steam can be relieved to maintain the reactor in a hot standby condition without cycling the main steam relief valves. Steam can also be relieved to cool the reactor to the temperature where the decay heat removal system can be cut in.

The power-operated atmospheric vent valves are safety grade, motor-operated control valves located, as shown on the figure, upstream of the main steam isolation valves.

POAV's are sized so that an inadvertent stuck open valve will not result in unacceptable consequences to the reactor core. The POAV's are sized to permit the reactor coolant system to be cooled to the emergency decay heat removal system cut-in temperature of 325° within thirty-six hours, assuming one operational POAV per steam generator. The 325° cut-in on the DHR system I'll talk about a little bit later.

Each POAV can be manually -- can be jog-controlled from a switch in the main control room or from a switch at the auxiliary shutdown control panel. The operator will position the POAV's until an acceptable temperature is maintained or an acceptable cooldown rate is established.

Steam **relief** can also be accomplished by dumping steam to the condenser or opening the modulating atmospheric dump valves. These valves are located downstream of the main steam isolation valves and would be used preferentially in a cooldown, in a normal cooldown over the POAV's. However, to insure that **cold** shutdown can be achieved using only onsite emergency power and safety grade systems, credit is only taken for the components upstream of the main steam isolation valves.

Figure IV-7 shows the discharge of the auxiliary feedwater system. The auxiliary feedwater is automatically supplied to the reactor coolant to the steam generators at a controlled rate by redundant one hundred percent capacity pumps. One of the pumps is a motor-driven pump. The other pump, the B pump, is a steam turbine-driven pump. Power and controls to both pumps are safety grade and Class 1E.

The next slide, which is figure IV-7, shows the suction side of the auxiliary feedwater system. The normal alignment of the auxiliary feedwater system is to the condensate storage tank and through two normally open motor-operated valves which allow suction to both main feedwater -- excuse me, both auxiliary feedwater pumps. Safety grade source of auxiliary feedwater is provided from a service water system independently for each auxiliary feedwater pump. Because of the concern for the quality of steam generator feedwater, automatic transfer to service water is provided only upon coincident AFW actuation signal and low auxiliary feed pump suction pressure.

Now I've completed the discussion that I will about the auxiliary feedwater system and the heat rejection using the steam generators. What I'll talk about now is the decay heat removal system.

After the decay, after the reactor coolant system pressure and reactor coolant system hot leg temperature have been reduced to approximately 300° and 280° Fahrenheit, or 325° Fahrenheit under emergency conditions, the DHR system operation can begin.

The previous design directed that until the DH -- that the DHR system would not be operated until the reactor coolant system hot leg temperature was decreased below 280° Fahrenheit. The DHR system has been analyzed to evaluate operation at 325° and found acceptable. The higher DHR system cut-in temperature permits operation of the DHR system within thirty-six hours, assuming operation of one POAV from each steam generator.

John could I have the second slide back on, 5C? One of the enhancements to assure achievement of cold shutdown is the addition of a parallel bypass motor-operated valve inside the containment on the DHR letdown line. Though not shown here, there are actually two valves in series where one is shown. These were installed so that a single failure of the valve to open will not inhibit the flow path for DHR cooling.

The next part of this presentation will deal with reactor coolant system natural circulation. The Midland plant has been analyzed to insure that natural circulation will occur during a cool two loop reactor coolant system cooldown without using forced circulation.

In addition, a natural circulation cooldown test will be referenced if a similar test has not been conducted on a plant similar to Midland. If such a test is not available, a test will be conducted to verify that operation of the POAV valves, and under natural circulation will satisfactorily remove heat from the reactor to cool down the plant. The test will cool the reactor coolant system approximately 50° under natural circulation conditions. The data will be used to verify adequacy of prior analytical results.

Another modification that was made to in part enhance natural circulation was the auxiliary feedwater level control. The auxiliary feedwater system and, in particular, the auxiliary feedwater level control will be the subject of a discussion to be held tomorrow. The details of that system are not addressed here. However, the system will include safety grade automatic control of steam generator water level. Steam generator water level is normally maintained at a constant level of about two feet when there is forced circulation in the reactor coolant system. If zero or one reactor coolant pump is operating, the auxiliary feedwater level control system and level rate control system will ramp the feed, auxiliary or steam generator level at a rate of about, currently, around four inches per minute from the two foot set point up to the twenty foot level set point that's desired for natural circulation. The automatic transition from the lower water level to the higher water level in the steam generator provides an orderly transition and reduces the probability of overcooling of the primary loop.

Now, that's the end of my remarks. Back to you, Ed.

MR. HUGHES: All right. Thank you, Tom, and on part of the members of the Review Board, thank you for your patience in listening to these formal presentations, but the purpose of this was to create for the record, and to provide a basis for a review, the history of the plant, the preceding design as we've characterized it and the enhancements to achieve cold shutdown that we've added to the Midland plant for the consideration of the requirement that cold shutdown with safety grade means must be provided for Midland.

With that formality out of the way, I will go ahead and entertain any questions that you desire relative to the presentations. I would ask you to recall that we do plan further presentations in the course of this on cold shutdown versus Chapter 15 type events and cold shutdown versus fire and a comparison of the present design with applicable regulatory guides, so those presentations will be given after this series of questions and appropriate questions on those are perhaps delayed until after you hear the presentation.

MR. GIBSON: Just a couple of points of clarification. Figure IV-2, there's reference to chem addition tank. Am I correct that we don't have -- we have a chem addition system but we do not have chem addition tank? We have boric acid addition tanks?

MR. PRATT: That's correct, Lou.

MR. HUGHES: That is correct.

MR. GIBSON: Okay. Also, just for reference, on some of the slides and drawings that we've seen, there are a number of valves shown as what I call plain gate valves, just a straight cross. Is it true that not in all cases are those manual or was there an attempt to make every one of those accurate or was it only to highlight the valves that were important to the discussion, because it seems to me, if we wanted to go back and get a real, true picture from these slides, we'd have to go to the P&ID, am I --

MR. HUGHES: I believe that is correct, that these are strictly pictorial for the purposes of discussion and do not attempt to include all valves or the mode of operation of each valve or the type in any particular case. The P&ID's which have been submitted are the detailed documents as to valve type and we can get any discussion that you care for on that, but these are just pictorial representations for function.

MR. GIBSON: Thank you.

MR. TAYLOR: On a couple of figures, the operating range for suction from the BWST or the chemical addition system is shown to end at

280. Why does that not go on down to lower temperature?

MR. HUGHES: Basically I believe the 280 is strictly a nominal cut-in temperature, required cut-in temperature for the decay heat removal system and this really wasn't intended to show the complete range of system operation.

Mike Pratt, do you have anything further to add to that?

MR. PRATT: Yes. I think you're referring to figure IV-1B --

MR. TAYLOR: Correct.

MR. PRATT: -- which shows the makeup from BWST and chemical addition system extending to the normal decay heat removal cut-in temperature of 280. I guess that was only an extension of that point for purposes of illustration. Makeup, makeup is certainly possible.

MR. TAYLOR: On down?

MR. PRATT: On down.

MR. TAYLOR: One other point of clarification. On one of the slides that you showed, the connection between the new auxiliary spray line and the existing spray line from the reactor coolant pumps, those valves were shown as manual valves. Are they really manual valves?

There's a line in the existing spray line, I think it was on figure IV-3. The makeup -- the line coming up from the reactor coolant pump into the pressurizer, is that truly a manual valve there?

MR. PRATT: There is a manual valve in the line but there are also parallel solenoid operated valves. I do have another overhead that shows the detailed design, but there is not just a single manual valve in that line.

MR. TAYLOR: There is no need, then, to go inside the containment to realign any valves if you go into the auxiliary spray mode?

MR. PRATT: No.

MR. HUGHES: That is correct.

MR. GIBSON: Could we see that detail?

MR. COOK: It's in the packet. Figure number IV-4 I think is the one you're alluding to.

MR. GIBSON: Oh, okay.

MR. PRATT: Would you like to

see that up on the --

MR. COOK: Why don't you go ahead and do it.

MR. PRATT: Up on the screen and walk through it?

MR. TAYLOR: Okay. So IV-3 is just a very simplified version, then, of IV-4?

MR. PRATT: That's correct.

MR. HUGHES: That's correct.

MR. PRATT: We have the normal RCP discharge going in through the spray valves into the pressurizer. We have the existing or pre-existing decay heat removal auxiliary spray capability for cooldown mode and then the design feature that was added was the supply from makeup pump discharge into the existing line with the addition of motor-operated globe valves for throttling during the depressurization sequence going on into pressurizer spray.

MR. BAUMAN: Where is the containment boundary?

MR. HUGHES: It's depicted there just as the L's.

MR. TAYLOR: Could you point

on figure III-2, which is the physical arrangement showing the spray line, where that connection is between -- or where it is likely to be between the new line and the existing spray?

MR. PRATT: Do you have that in John's package? Now, could you repeat the question?

MR. TAYLOR: Where is the new connection from the auxiliary spray going to tie into that large two-and-a-half inch line, the spray line?

MR. PRATT: All right. That would not be shown on this drawing because that connection is outside the containment.

MR. SLADE: It has to tie into the spray line.

MR. HUGHES: The question is where, physically --

MR. SLADE: But where does auxiliary spray tie into the pressurizer?

MR. HUGHES: With the spray line coming off the loop.

MR. PRATT: We have the existing spray line coming off the reactor coolant pump discharge and coming into the pressurizer.

MR. TAYLOR: Yes. Now, the auxiliary spray line connects into that line somewhere.

MR. PRATT: Yes.

MR. TAYLOR: And I'm interested in knowing where it is. Is it right close to the pressurizer or down close to the reactor coolant system or just where?

MR. PRATT: Well, that I am afraid I can't answer. We can get the isometrics and take a look at those, but I'm not sure exactly where it ties in.

MR. HUGHES: Jim, we can get you that information in the course of this review, but right now we can't provide it to you exactly.

MR. TAYLOR: Okay.

MR. HUGHES: You're talking about the piping isometric location to tap into the auxiliary spray, I believe?

MR. TAYLOR: On a broader basis, what I was really getting to is what kind of -- this auxiliary spray was an addition to the plan and I'm interested in the kind of review that was conducted on the existing system as a result of that addition because this is a much lower temperature than normally is seen by that line.

MR. HUGHES: Are you talking, for instance, the stress analyses, the thermal cycling?

MR. TAYLOR: Right.

MR. HUGHES: Mike, you can address that, I believe.

MR. PRATT: Okay. Yes, we were using the existing line from the decay heat removal system and the complete stress analysis has not been completed. It's in progress at the current time, but that kind of design concern has been taken into account in that we're subjecting a pre-existing section of the piping to a different set of flow/temperature conditions, pressure as well.

MR. VANHOOF: Didn't the auxiliary spray line from the decay heat removal system exist before and that the makeup, the line from the makeup system was the one that was added?

MR. PRATT: Right, it was added.

MR. VANHOOF: So wasn't that analyzed and reviewed prior to this change?

MR. PRATT: It was analyzed for the decay heat removal function.

MR. VANHOOF: And that's the temperature you're concerned about, is it not, Jim?

MR. TAYOR: I'm sorry. I didn't hear the last part of that question.

MR. VANHOOF: The decay heat removal spray line existed before. The only change that was made was a discharge from the makeup pump system into the spray line to give you that capability. So the temperature analysis, I think, was done prior to this.

MR. PRATT: It was done prior to that for decay heat removal operating conditions.

MR. SULLIVAN: Yes, the suction would make a difference in the temperature, though, of the spray because you're taking it from the BWST or whatever rather than returning it from decay heat removal system, so it's not necessarily the same temperatures.

MR. VANHOOF: But you could

take a suction from the borated water storage tank with the decay heat removal pumps as well?

MR. SULLIVAN: Yes.

MR. VANHOOF: So I would think that the temperature for that situation would also be analyzed.

MR. HUGHES: Well, the pre-existing condition was analyzed and we are in the process of analyzing the operating conditions for this condition.

MR. COOK: Can we simply have a discussion of the criteria that you're using for that analysis and where your temperature interfaces are?

MR. HUGHES: I believe so.

MR. PRATT: Okay. Let's go back to the previous figure. Yes, that's the one. That's the one, okay. I, to go back to a point you made, again, I don't believe that suction from the BWST or chemical addition system was a design basis for the decay heat removal auxiliary spray. I think that operating condition is decay heat removal once it's -- I believe once it's gone through the cooler. I'm trying to remember where the connection is, but I don't believe that that operating mode would be taking suction from the BWST for chemical addition.

MR. SLADE: I think, just a point of clarification that may help here is that previously when we were talking suction from the decay heat removal system and using the decay heat pumps to forward spray to the pressurizer, by the time we could cut-in decay heat removal, we were down to very low temperatures in the pressurizer, so you didn't have the thermal problem that you now have when you're trying to provide that same cool water at normal operating pressures in the reactor coolant system.

MR. PRATT: Right, that's correct. Now, as far as the design conditions, the normal reactor coolant pump discharge to the pressurizer spray would be analyzed for cold leg temperature pressure conditions.

MR. TAYLOR: As an action item, I would like to see the before and after design conditions for that portion of the line which is affected by this change.

MR. PRATT: Okay. Let me try to clarify that; temperature, pressure, number of cycles?

MR. TAYLOR: Right.

MR. PRATT: Okay. The first two --

MR. HUGHES: We'll go ahead and take that as an open item to provide that information.

MR. GIBSON: As long as we're on this topic, I had a question concerning the use of the makeup pump when you're trying to run water through the auxiliary spray. It seems to me that that would be a very low flow rate compared to the minimum requirements that that pump can put out and that brings up a question of what are you doing with the recirc and are there any assumptions that you have to make relative to loss of any recirc capability under those conditions? What do you postulate as the worst case, conditions that the makeup pump may have to have relative to its recirc back to the makeup valve? Is it all safety grade going back there or not?

MR. PRATT: Okay. Well, there were a number of questions --

MR. GIBSON: I know.

MR. PRATT: -- included in what you stated. I believe the first one was how do we handle the makeup pump minimum flow requirement, which is 100 gpm and that is handled by a recirculation path to the borated water storage tank in the event that we're taking suction from the borated water storage tank and the recirculation path would be to the makeup tank in the event that we were taking suction from a boric acid addition tank.

MR. GIBSON: Is that manually aligned to the BWST?

MR. PRATT: Yes, it is.

MR. GIBSON: So using the auxiliary spray, you would use either one of those paths that was available, is that correct?

MR. PRATT: That's right.

MR. LOOS: With respect to the recirculation flow back to the makeup tank, how is that aligned and what is the valve configuration?

MR. PRATT: Well, the normal recirculation flow path during makeup operations is to the makeup tank, so the same piping and valve alignment and configuration is used for that that is used for normal makeup.

MR. LOOS: And what is that

valve alignment?

MR. PRATT: That would involve opening two solenoid operated valves in the recirculation line.

MR. LOOS: In series or parallel?

MR. PRATT: In series and depending on which makeup pump you were using, you'd need to tie the makeup pump discharge into the common recirculation header.

MR. VANHOOF: I've got a couple of questions for you, Mike. On the PORV, what kind of indications do we have off those valves now? What is it, a positive type indication or a passive?

MR. PRATT: Indication of open --

MR. VANHOOF: Position.

MR. PRATT: Position?

MR. VANHOOF: Yes.

MR. PRATT: Let me --

MR. HUGHES: Mike Gerding would probably be a better one to answer that. This is really in our area of control systems and the provisions we are making in the PORV.

MR. GERDING: The indications that would have a positive, we have Class 1E limit switches on the solenoid valve which is seen in figure IV-4 and in addition from the discharge of that valve, there is an acoustic monitor which is also safety grade which monitors flow in that discharge line.

MR. VANHOOF: Said you have very brief switches --

MR. GERDING: Yes.

MR. VANHOOF: -- which are dependent upon valve movement in order to actuate?

MR. GERDING: That's correct.

MR. VANHOOF: So that would be a positive, in addition to the acoustic line?

MR. GERDING: That's correct.

MR. VANHOOF: Okay. I have another question, Mike.

MR. GIBSON: Can I follow that up?

MR. VANHOOF: Oh, fine.

MR. GIBSON: Mike, does that

mean that when you get a stem movement that you see with those switches, that that valve has to be moving or can that be a pilot or something else that's moving?

MR. GERDING: It's actually the valve, itself. There's a stem inside the valve which moves and is detected by -- it's, I believe, it's a magnetic type reed switch in the valve, itself.

MR. GIBSON: But is it possible for that to move and the valve to stay closed or for the valve to stay open and that move back closed?

MR. GERDING: No.

MR. HUGHES: Mike, I believe the question is, is it a direct connection to the valve disk, itself?

MR. GERDING: It is not exactly a direct connection. As I mentioned, it's operated magnetically in this particular valve design.

MR. GIBSON: Thanks.

MR. SULLIVAN: While we're in that area, though, you had, on figure IV-1A, the set points. Can you explain a little bit the logic on block valve isolation and the set point there? It says the block valve will close automatically on coincident indication, the PORV not shut and 2100 psig. First of all, what's the pressure that the PORV should close automatically?

MR. PRATT: You mean open?

MR. SULLIVAN: No, should close. I assume it's opened already. You've reached the 2260. Now you're coming down in pressure.

MR. PRATT: Okay.

MR. SULLIVAN: In other words, how far below the point at which the PORV should have closed automatically is that 2100 psig?

MR. PRATT: Mike, do you --

MR. GERDING: Okay. The reset set point for the valve when the pressure decreases after the valve is open is currently 2235 pounds per square inch.

MR. SULLIVAN: Okay. So you've gone through a transient. You've hit the high pressure trip set point and, if not, something else. The reactor has tripped. If the PORV opened, you're coming back down, you pass through the -- what did you say, 2235?

MR. GERDING: That's correct.

MR. SULLIVAN: The PORV, for some reason, stuck open and you reached 2100 psig. Now you've got one part of your signal that the PORV is stuck open. What other indication, then, are you using, which of the two indications or both are you using as an indication that the PORV is not shut, besides the pressure indication?

MR. PRATT: Valve position indication.

MR. SULLIVAN: Okay, and the acoustic monitor, then, is strictly a backup for the operator's information?

MR. PRATT: That's right.

MR. GERDING: The valve **limit switch,** the PORV valve limit switch is used to close one of the block valves coincident with the 2100 pound decreasing signal and the acoustic monitor is used coincident with the 2100 pound signal to close the other block valve.

MR. SULLIVAN: Okay. So you've got sort of a combination of diversity and redundancy there?

MR. GERDING: Yes, that's correct.

MR. GIBSON: Mike, acoustic monitor, sometimes acoustic monitors are flow monitors and sometimes they're just microphones. I guess they're all microphones but is this -- would you characterize this as a flow monitor?

MR. GERDING: I can say that it detects the flow. The actual mechanism I'm not familiar with. I would have to investigate that further and get back to you.

MR. COOK: Does that matter interest you?

MR. GIBSON: No.

MR. VANHOOF: Mike, on the pressurizer heater, you say there's two banks that are 1E. As I recall, the breakers for those pressurizer heaters were located in the lower level of the turbine buildings. Are they still there or have the 1E breakers been moved; my concern being that in the event of a break in circulating water, that you'd have a flooding condition in that area and you might lose those breakers. Where are they located now?

MR. PRATT: That I can't answer. I think John --

MR. KOVACH: The upgrade included utilizing new Class 1E breakers from the switch gear located in the safety switch gear equipment room.

MR. VANHOOF: So you've moved it out of the lower level of the turbine building?

MR. KOVACH: We did not physically move the breakers. We utilized new breakers in the Class 1E distribution system.

MR. VANHOOF: So breakers are in the same location?

MR. KOVACH: No, we are not using the non-Class 1E breakers with the previous design. We are using new breakers from a Class 1E electrical distribution system.

MR. SLADE: Those breakers are still in the basement of the turbine building but now they're enclosed inside a water tight enclosure, is that correct?

MR. KOVACH: They're in the safety-related equipment rooms, yes.

MR. VANHOOF: Thank you.

MR. HUGHES: John, what he just said is that the old breakers are enclosed in water tight --

MR. SLADE: No, no, new ones.

MR. HUGHES: Okay, the new breakers --

MR. COOK: But they're physically at the bottom elevation of the turbine building still?

MR. HUGHES: No, we must forget about the old breaker because they were non-1E. The new breakers are in a safety grade structure, not in the turbine building, and they are the 1E power supply distribution to the pressurizer heaters.

MR. VANHOOF: Not in the turbine building?

MR. BAUMAN: Seismic category one building, aren't they?

MR. HUGHES: Right.

MR. BAUMAN: Gene, they're not in the turbine building anymore, the new breakers being used, fully safety grade in the safety grade building, right?

MR. KOVACH: Correct.

MR. TAYLOR: I don't know

whether the other designer board members got that clear or not, but I didn't.

MR. HUGHES: Essentially when we went to 1E requirements for heater banks five and six, the old non-1E breakers were essentially neglected. New 1E breakers were placed in a seismic and 1E location.

MR. TAYLOR: Which is?

MR. HUGHES: Which is in the -- what is it -- the safety equipment --

MR. KOVACH: The switch gear room is in the aux. building.

MR. HUGHES: In the auxiliary building, the switch gear.

MR. SLADE: Okay, adjacent to --

MR. VANHOOF: Adjacent to the turbine building?

MR. KOVACH: Right.

MR. TAYLOR: So the old breakers are no longer in the picture anywhere?

MR. KOVACH: Right, that is correct.

MR. VANHOOF: As far as the pressurizer heaters are concerned, they're still there, usable,but not for the pressurizer.

MR. SULLIVAN: Mike, as long as we're on this subject, can you give us a feel for the basis for selection of this heater capacity? You know, it was stated that the pressure control could be maintained during hot standby or the transition to cold shutdown using one of the banks.

MR. PRATT: That's right, one.

MR. SULLIVAN: How many kilowatts and how is that determined?

MR. PRATT: I cannot answer that question.

MR. BAUMAN: That analysis was done for us by B & W to set the capacity of the heater banks, if somebody can answer that.

MR. HUGHES: Jim Agar from B & W, do you have any particular recollection on the heater bank sizing?

MR. AGAR: I can speak off the top of my head but rather than do that, I would take that as an action item to feed back to the board the results of the calculations.

MR. BAUMAN: I recall a significant amount of discussion back and forth on that, Terry. There was several inter-relations so that we were convinced that the sizing was proper. I don't recall the details but I know that it was a subject of discussion.

MR. COOK: The open item to the board, then, is the basis for the sizing to document the question.

MR. SULLIVAN: Yes, because as I recall -- well, we had started this before the TMI accident occurred and some of the requirements after TMI -- there were talks about a number of banks but there really wasn't a basis for the sizing.

MR. SLADE: I guess I'd like to just expand that just a little bit further and you're identifying two banks and I am making an assumption that each of those banks is powered from a separate power supply, is that correct, so that if we lose either power supply, a single bank of heaters is all that's available to control pressure and that's what we're concerned about establishing, that the output of that bank is sufficient to maintain pressure?

MR. HUGHES: That's the statement that's made, that one bank of heaters will do it and that's the size and basis but we'll supply the particulars of the criteria and selection for sizing.

MR. VANHOOF: I would like some clarification or perhaps some broadening of the reason for installing the emergency boration system. As I recall, the shutdown with rods, you can attain a one percent Delta k shutdown capability with rods most worth -- the largest worth rod being stuck out. Why was the emergency boration system added? Is this because of xenon or what?

MR. HUGHES: Mike, why don't you touch on that briefly and then Jim Agar from B & W can supplement it.

MR. PRATT: Okay. You can, with a highest reactivity worth rod stuck, you can achieve cold shutdown. It can achieve a one percent subcritical margin with letdown but in the event that letdown is not available, the use of the emergency boration system is required.

MR. BAUMAN: But didn't it also have to do with the fact that the chemical addition system was not fully safety grade or am I wrong?

MR. PRATT: Not fully safety grade and the boric acid concentration in the chemical addition system is three-and-a-half weight percent whereas the determination was made that a six weight percent solution is required for the emergency boration system.

MR. SULLIVAN: So if you can't let down from the primary system, then, you need a higher concentration boric acid because there's not enough volume in contraction there, is that it?

MR. PRATT: Yes. I think, you know, a lot of the criteria for this aspect of the design of the emergency boration system were provided by B & W and perhaps it would be better for some of the follow-on kind of questions, maybe to clarify something that I may have misspoken, to defer to B & W.

MR. HUGHES: Jim Agar, do

you have anything further to add to that? Gene's question really was the basis for the emergency boration systems and the response of ours, really the decision to use emergency boration is keyed to the availability of letdown and the criteria for cold shutdown using strictly safety grade equipment.

MR. AGAR: That's correct.

MR. GIBSON: I'd like --

MR. SULLIVAN: Let me follow up.

MR. GIBSON: I'd like to follow up.

MR. SULLIVAN: Well, what's the approximate worth? It seems to me that a most reactive rod stuck out is the key assumption here. What's the approximate worth, say, for the first quarter of the most reactive rod?

MR. AGAR: The way I understand it is it varies with the operating condition but I would let Rich Lange from B & W address this question and he's the one who did the calculations.

MR. LANGE: The worth of the stuck rod is covered by the control rod design. The control rod design compensates for the stuck rod and compensates for the temperature deficits reactivity insertions down to 532° for the fuel and the moderator. The purpose of the chemical addition, the use of BWST and the emergency boration system is strictly xenon, the build-up and decay of xenon. Within approximately twenty-two hours **or** twenty-three hours after reactor trip, xenon life level will have peaked and returned to its equilibrium value and then will subsequently decay. So it's to compensate the xenon decay that the emergency boration system was evolved.

Now, as far as the concentrations go, the reason for it being six weight percent as opposed to a number such as five, which a lot of plants have, is related to the amount of storage volume that's available and in order to design a new system and accommodate the tanks, there was a limited spacing available and so it was decided to go with six weight percent. Originally it was thought to go with twelve weight percent but it was felt that six would be better if you can squeeze in a larger tank, and that was subsequently the route that was taken.

MR. COOK: Let me tag along

on this. In terms of the interface between the nuclear engineering requirements coming out of B & W and the mechanical engineering requirements and system design from Bechtel, do we have a design criteria that is specified in terms of boron concentrations of the primary system as a function of the various operating conditions you have to deal with for this particular application that has been transmitted to Bechtel to compare your mechanical designs to -- how has that interface been covered?

MR. HUGHES: Mike, would you care to answer that? The question is ppm boron and who has told us.

MR. PRATT: The criteria for a six weight percent boric acid solution, minimum 1800 gallons, was provided by B & W.

MR. COOK: In just that basic set of criteria?

MR. PRATT: Well, there were other discussions.

MR. HUGHES: There have been a series of meetings and discussions with B & W on the sizing of the system and on our difficulties in space to come up with a suitable objective of parts per million boron given the tank sizing, so we iterated between the percentage and the gallons available to meet the B & W requirements of so much boron in there at a given time and volume of available --

MR. COOK: Let me restate my question, then. Where do we have a performance analysis of the system as it is currently designed for all the possible operating conditions that you might experience that is compared to B & W's nuclear requirements?

MR. HUGHES: Right. The performance analysis is essentially one of B & W. Ours is a performance of a flow delivery. In the Bechtel calculations, we would analyze the flow rate, time, pressure, the performance of a mechanical system and it would be married to B & W analyses that with that performance and that concentration, that much boron in the reactor provides a given reactivity or reactivity margin.

MR. COOK: I'd just like to see the process, the system that says that, you know, the engineering system that says that the performance of that system to carry out its design function has been analyzed by the appropriate party in whichever organization it has to be and that we have verified, to the satisfaction of both organizations, that we have met the intended function.

MR. HUGHES: Let me take it in a two-step, if you will, then, and Rich, would you go ahead and give him a brief rundown on your design analyses and then the providing of criteria to Bechtel?

MR. LANGE: The way we --

MR. HUGHES: Excuse me, Rich. You can come forward a bit to allow the reporter to hear you.

MR. TAYLOR: While you're going up front, Rich, one of the corollary questions to one of the questions Mr. Cook asked is are the design criteria for the EBS documented in a specification which has been transmitted to Bechtel and are the bases for that specification documented?

MR. LANGE: Yes. They are documented in eighty-six internal documents that were sent to project management. Functionally, the way the system was designed was that we took the criteria of compensating for xenon and based the design around the ability to increase the boron concentration enough to compensate for the burnout of equilibrium xenon. Okay, that, as far as the particular mechanism, was then, as far as when you really need the boric acid to go in, is based on a consideration of trips from equilibrium conditions as well as double reactor trips.

MR. GIBSON: I've been going over this, even before the board meeting today. One thing that strikes my mind that we should know is if we have a normal reactor trip from, say, full xenon, we level out at 532, we haven't started the cooldown; do we need that EBS even without letdown? I don't see why we need the letdown under those conditions yet anyway, frankly, but --

MR. LANGE: The control rod design in compensating for the deficit size specified earlier is based on equilibrium xenon, so you will have, under limiting conditions, you will have only one percent shutdown margin after xenon has peaked and returned to equilibrium. If xenon continues to decay, you will eat into the one percent shutdown margin.

MR. GIBSON: So you don't

have to use that EBS until you're back to equilibrium xenon?

MR. LANGE: Yes, that's true.

MR. GIBSON: And that is with one rod out?

MR. LANGE: With the most worthy stuck rod out and in a most limiting fuel cycle with respect to shutdown modules.

MR. SLADE: Let me go on just a little bit farther from Lou's scenario there where I've tripped the reactor from equilibrium xenon and now I've approached my peak and I'm ready to put the unit back on line. Do I have a limitation at peak xenon for need of that emergency boration system? Will I still have adequate shutdown margin available to me as I'm putting the unit on line?

MR. LANGE: If you could start the reactor up with greater than equilibrium xenon, you're not in a limiting situation with regard to shutdown margin provided by control rods. You didn't have any reactivity to insert in order to get the unit back up. This is predicated on not starting up prior to returning to equilibrium xenon because in a limitating situation, I don't think you can physically do it.

MR. SLADE: I can't bring my unit back on a peak xenon?

MR. LANGE: Not if you're --

MR. SLADE: Certainly I can.

MR. LANGE: I don't think if you're in a limiting situation with respect to control rod shutdown --

MR. HUGHES: Bear in mind that you have a rod out, stuck out, identified as stuck out and questionable.

MR. SLADE: No, no. Let me trace it again. I don't think we're assuming the same things. We're at equilibrium xenon, have a reactor trip. Everything is fine. I'm ready to start the unit back up again. Pull the unit critical by diluting the boron concentration, okay, so that at peak xenon, I now have rods out. I now have diluted the xenon and I'm starting -- or diluted the boron and I'm now starting the reactor up.

Okay. Now, I have a trip as a result of the safe shutdown earthquake or whatever, okay? Am

I ready? Do I have sufficient margin, and I think what you're telling me is that I don't have the power deficit to be concerned about and that that makes up the difference, is that correct?

MR. LANGE: Well, what you could not have done is dilute the system because if you were at a limiting situation with respect to shutdown margin where you only had the one percent and --

MR. SLADE: I didn't have a stuck rod yet. I didn't have a stuck rod until the second trip.

MR. LANGE: I understand, but in order to start the reactor up, a limiting situation is based on 17 ppm in the core and you simply couldn't dilute enough to get back up to power under those circumstances. So you couldn't have returned to power by dilution.

MR. SLADE: What you're telling me, then, is the limiting situation is end of core life?

MR. LANGE: Yes, with respect to --

MR. SLADE: And under those

circumstances, I couldn't start the --

MR. LANGE: Yes.

MR. SLADE: -- unit back up again because I couldn't dilute the negative boron?

MR. LANGE: That's right.

MR. SLADE: How about earlier in core life?

MR. LANGE: Yes, you could dilute to start back up.

MR. VANHOFF: Same situation and he trips that.

MR. LANGE: But he doesn't have a one percent. He's got more than one percent on the control rods now.

MR. VANHOFF: With one control rod stuck out?

MR. LANGE: Yes.

MR. SLADE: So what you're telling me is that as long as I can meet my tech spec requirements on control rod withdrawal at the power level at which I am at, that I'm going to have sufficient margin?

MR. LANGE: Yes.

MR. SLADE: Regardless of what the xenon concentration may be?

MR. LANGE: Yes.

MR. SLADE: Okay. Now, in conjunction with that, we were talking earlier about how much boron I have to add to the system or how quickly I can add the boron to the system in the event of this incident, okay, based on inventory control. If I'm at peak xenon and I am losing reactivity or gaining reactivity as a result of that loss of xenon, is there sufficient volume available in the RCS to inject the boron under those conditions?

MR. LANGE: I may have lost the precise conditions regarding your question in that last paragraph, but what we based it on is being able to utilize volume in the pressurizer and cooldown volume between 579° and 532° -- actually that's 542 -- starting from a high level in the pressurizer and be able to get enough boron in to reach the required conditions so it's -- the analysis we did is based on really available volume.

MR. SLADE: But available volume based on equilibrium xenon conditions, not based on peak xenon conditions?

MR. COOK: Let me break in for just a second. I think we've gotten off on a very detailed line of questioning that's going to be difficult to resolve in this particular forum. If I can try to come back and summarize where I think this line of questioning has gone, first of all we were interested in making sure that we understood that the detail requirements from the nuclear engineering aspect, the B & W side of the house, were **fully documented** through the project process to the architect engineer and that there was a full interface review to make sure that all the conditions that we're required to make were specified and understood by the designers and that there was some check that that had been verified. I think beyond that you've gone into some additional thoughts on the operating possibilities of that system that you're interested in, and rightly so, from an operating point of view.

I would suggest that by pulling out of the system the documentation, you know, that specifies all the conditions that were utilized in specifying that system and in designing it, you and your operating people should review that very carefully to make sure your questions have been answered in terms of, you know, your considerations on plant operation. Is that a fair statement in the way we ought to proceed to try to move on?

MR. SLADE: Okay. I guess I need to have more data on the background, the assumptions that were used in calculations so that we can do that review.

MR. LANGE: I might add one point. I think the thrust, I think I've gotten the thrust of your question. It is based on equilibrium xenon, not greater than equilibrium xenon; the reason being, in a limiting situation, not being able to start up before you get back to equilibrium xenon, so that in a nutshell is the philosophy that we've used.

MR. BAUMAN: What we need is a set of criteria in design assumptions that B & W used in your analysis so we can make sure that all plant operating conditions have been factored into your analysis. We need the input to your analysis, the basis of your analysis for our review.

I don't think we have that now. All

we have is the numbers that B & W gave to Bechtel as far as the percent boron and the volume, but what were the assumptions that went into that analysis? That, I think, we need and I don't think we have that, do we? Jim Agar?

MR. AGAR: We have formally transmitted a document around to Consumers and Bechtel that **give the bases and backgrounds** and the calculations that Rich Lange has completed. You should have that document and perhaps that's the one you can review to get at least a good start in response to that question.

MR. SULLIVAN: I guess where we're at, though, now is Jerry, you need certain data in order to develop your normal operating procedures and emergency procedures?

MR. SLADE: Yes.

MR. SULLIVAN: And what you would usually do is take that document, review it and see if there is enough information there for you to develop your procedures. If not, then you would ask for additional analysis or whatever d I guess the question would be, are you at that point already where you are developing those procedures or is that some point in the future and are we jumping ahead of ourselves?

MR. SLADE: The answer to your question is we're beyond the point. The procedures are already developed and what I need to know is whether I need to change the basis on which those procedures were developed. Is there going to be a revision to the operating spec as a result of this B & W document and the bases, have they changed the assumptions that were in the original operating specs that were provided to Consumers.

MR. HUGHES: Jim, the original operating specs provided to Consumer did not envision the emergency boration system at the time.

MR. AGAR: That is correct, yes.

MR. HUGHES: Therefore, yes, there will eventually be further information and consideration.

MR. AGAR: This would also be a consideration of an emergency procedure and the use of the emergency boration systems will have to be, I assume, written up. To my knowledge, you haven't written that emergency procedure, is that correct?

MR. SLADE: No. Our procedures do not yet include consideration of the emergency boration system.

MR. AGAR: That's the word that I got back yesterday and I understand that from Mr. Ivan Green, Dr. Ivan Green, who is on the committee for reviewing these operating procedures, and we'll get into that chain of review at that time, I would guess.

MR. HUGHES: Jim, the original question --

MR. COOK: Excuse me, Jerry. Go ahead.

MR. HUGHES: -- was the basic design process and we had gone through Mr. Lange to identify the B & W analyses that went into it. Should We go on further for the board to where the architect engineer comes in? Do you have an answer to your question as you originally posed it?

MR. COOK: I have an action item but I didn't have an answer.

MR. HUGHES: That's correct.

MR. COOK: With your understanding of what the action item is, we can go on with it.

MR. HUGHES: We have received from B & W documentation as to the requirements for this system and as the architect engineer we have designed a system we believe meets that requirement for delivery of a volume of borated water to the reactor under given conditions and we have reviewed those with Consumers Power and with B & W, a series of meetings, and are now presenting this in this form for -- as a new system which has been added to achieve cold shutdown under given conditions; namely, without letdown.

MR. COOK: Where is the check that says B & W certifies that the system you have designed meets all the requirements that they have established for this sytem? Is that in the record already?

MR. AGAR: We haven't reached that point of complete confirmation. We have some calculations that are ongoing. Apparently there's some stress calculations within Bechtel that are still ongoing and I would guess that in the very near future we should have full agreement between the architect engineer and the NSS supplier with regard to the EBS, the emergency boration system.

MR. COOK: I think, with the condition that everybody is sure that all of the operating situations that have to be looked at have been looked at as far as establishing the criteria, that would satisfy my original question. I think the other half of the discussion that we went onto was the operating side of Consumers Power Company is interested in making sure they understanding all those operating conditions and can review their procedures and requirements and what they have to do to get ready to operate the plant to make sure they understand it and have it totally integrated into their work.

MR. SLADE: Yes. Jim, I'd like to go one step beyond that and assure that we are going to receive operating specifications for the emergency boration system and the affects on the other operating specifications which we have already received.

MR. BAUMAN: Jim, it goes farther than that. In the total cold shutdown package, there are a lot of interfaces with the operators and I would suggest that we consider strongly an operating guide and an emergency spec for the entire cold shutdown package. You just talked the one system here but as you go through the B & W analysis and the Bechtel analysis, you'll see where there are a lot of areas that will require close operator attention and I think, as a total package, we need to develop an operating spec and an emergency spec.

MR. GIBSON: One final point, I have observed, looking at the EBS, since it is a manually aligned system, I think B & W should be very careful on just telling us how soon it's needed. I say that because I envision a lot of the loss of letdown events as being temporary. There are a lot of things that can kick that off and then you can restore it, and I think if you have an accurate picture of how soon you need that EBS, you may find the prudent course of action is to have that letdown system back so you don't just arbitrarily have that thrown in right away and assume that the letdown is going to be returned.

MR. HUGHES: Again, the EBS

is a system provided for given circumstances as a -- let me say an emergency procedure, and the whole question of emergency procedures is handled in the course of getting the plant on line and, yes, the design information we provided in whatever form, the utility operating department requires it, but for the course of this presentation, this really isn't a presentation on procedures except as it explains the operation of the system and the designer's intent for capabilities, so I believe offline from this forum, we can provide this information as it's needed. Is that satisfactory to the board? We have normal procedures in effect for doing this, in the course of exchange of information with B & W and with Consumer engineering and do involve Consumers' operation in this, I believe.

MR. LANGE: Ed, just to address that last point, that was a consideration in the design, which is basically why it's manual as opposed to automatic, and the time requirement is that the system is not required before two hours, so we did try to take that into account.

MR. HOOD: Could I ask

Mr. Slade, if he would, to identify the document from B & W to which he earlier referred?

MR. SLADE: I'm just trying to get the right number on it. I guess it's identified as Consumers cold safe shutdown and the number on it is 86-1123863-00 and it's dated February 11, 1981.

MR. GARRICK: I would like to make a comment and then ask a couple of questions.

MR. COOK: On the same subject or a new one, John?

MR. GARRICK: Well, it involves -- it will come to this same subject but it's more general and then I was going to converge on a couple of specific items.

MR. COOK: Okay. Why don't we point it towards convergence.

MR. GARRICK: All right. Okay, well let me talk, then, specifically about the emergency boration system because as I hear you talk, it sounds like -- that there has been an attempt here to get considerable credit for this system and as it's presently designed, it, of course, requires local, manual operation. I wanted to ask -- and, therefore, it's a slow-acting system, at least relatively speaking. I wanted to ask if the specification for the system does talk to the time constant for the use and effectiveness of this system. How slow acting is this system?

MR. HUGHES: Well, as stated, the system is not required for, by calculations, for two hours. Therefore, we believe that the manual alignment of the system is appropriate for a system whose need is in that time frame.

MR. GARRICK: Was there any consideration given to its utility if it were available sooner than two hours?

MR. HUGHES: For the design, it being an add-on system, it was answering a need rather than looking as an integrated package as to all possible functions it might perform. It was rather a -- what basic need does it require and what is required to provide that need. Therefore, no, it was not examined as far as other potential where we were starting from an earlier phase.

MR. GARRICK: So I take it from that that the isolation valves, consideration of motor operated isolation valves and control from the control room was not something you looked at?

MR. HUGHES: We looked at it originally in the system as to whether it was required and when it was determined it wasn't required, then a decision was made that we would not provide them. Based on the stage of design of the project, any additions to control room are additional design problems relative to cabling switches, space available and so, no, the decision, examination was that manual valves would suffice, then there was no decision to enhance it by making it motor-operated.

MR. SULLIVAN: Can you elaborate, Ed, on the criteria for the manual valve? I mean, you said you made a determination that the manual valve would suffice. I assume that the Consumers people were involved. What were some of the -- what did you consider?

MR. HUGHES: Well, essentially Consumer, B & W and Bechtel people were involved in a review of this entire system and based on the location of the valves and their accessibility and the time duration that was required for the system, and the availability and the purchase of valves, it was decided that it was sufficient to provide manual valves and that an operator had sufficient information, direction to go open the valves or to align the valves, that there was no need for electric operation.

Now, that is principally a time consideration and a location and availability of the valves consideration, but that was extensively reviewed and is documented in various meeting notes over the course of, I guess, the past year.

MR. GARRICK: Well, the only question I was getting to is whether or not the intent here was really a mitigating system and if indeed that was the intent, then the time constants could become important.

MR. HUGHES: I guess I need a further definition of the mitigating system because it is a reactivity control system. It is designed to mitigate or to insure that you are in fact one percent shutdown for the conditions postulated. My interpretation of mitigating, yes, it mitigates against a condition that you would be less than one percent shutdown, but as far as a rapid response similar to the emergency core cooling systems, no, it's not in that category.

MR. GARRICK: Okay. So, well, what I was thinking as far as short term was maybe less than an hour or half an hour and a system that would enable you to perform boron injection or inventory makeup and I guess what you're saying is that it was not intended to do that in the short term?

MR. HUGHES: No, it's not in the short term.

MR. GARRICK: And the short term might be an hour or less?

MR. HUGHES: Well, our design basis for the plant for the short term for emergency action is ten minutes and that's the basic criteria.

MR. GARRICK: Well, that's what's bothering me. There seems to be a substantial difference between that kind of short term and what you said earlier about a couple hours.

MR. HUGHES: Well, the two hours is a figure unique to the analysis of this system.

MR. GARRICK: My closing

comment on this is that I'm having a little trouble seeing the real utility of this system.

MR. HUGHES: Jim Agar, see if you can shed a little more light for Mr. Garrick on this.

MR. AGAR: Well, for the record, I would like to add a document titled -- a number that has been transmitted to Consumer and to Bechtel that discusses in some detail the analysis and calculations. The title is Xenon Dynamics and Shut-down Margin. The document number is 86-1123880-00. This document will shed quite a bit of light on the time aspect of utilization of the emergency boration system.

MR. SULLIVAN: I think the primary -- just a comment on the utility, John, is the primary concern really came out of -- there had been a lot of concentration before TMI about getting to a certain condition and in our opinion after TMI and some of the problems they had where they were afraid for awhile of losing letdown, for instance, and other limiting conditions. When you really look at the limiting assumptions, you can talk about getting to a safe condition but if for some reason you don't want to go somewhere from that -- in other words, you want to stay at hot standby or even, in the long term, a transition to cold shutdown -- the plant designs were not always such that under the limiting assumptions, most reactive rod struck out, loss of letdown -- under most limiting conditions, one rod stuck out, loss of letdown, seismic events and so forth. You couldn't demonstrate that you could maintain those types of conditions wherever it was you wanted to be for an extended period of time and so the emergency boration system rationale was not a quick response system like in a BWR, for instance, but the idea was can we maintain a safe condition for an extended period of time and that's why the time limits are on the order of hours rather than what you normally see.

MR. HUGHES: John, again, I think, getting more to the thrust of your question, really we were in need of a relatively low volume, high boron concentration system whereas other available sources of borated water were of a lower concentration, and there's only a certain amount of space available in the reactor coolant system, so we needed a system that could pack in more boron with less volume than we otherwise had available.

MR. SULLIVAN: The low boron system really, as I remember early in the design, were selected based on the desire for normal operating conditions to avoid large runs of pipe with heat tracing and so forth and the attendant problems of reliability, maintainability and so forth. So it's effectively a compromise between the normal operating and the emergency conditions.

MR. TAYLOR: Let me see if I understand what you've just said, Terry. The emergency boron system was to deal with the situation where, by the time you got back to equilibrium xenon and started to decay below that point, which is fifteen, eighteen hours, I don't know -- it's way out there in time -- and you made the assumption that you still had no let-down capability and were not able to do anything about the stuck rod, at that time frame, way out in several hours, that's when this system would be required to start adding or it would have had to add negative reactivity by that time, is that correct?

MR. SULLIVAN: That's correct,

as I understand it, and as the B & W gentleman said, after xenon decays, you start slowly to eat into your margin and if you don't have maneuvering capability at that point, say two hours and beyond, then this system gives you the safety grade capability to maintain a safe condition.

MR. TAYLOR: When you say eat into your margin, you mean reduce the one percent sub-critical margin?

MR. SULLIVAN: Yes, under the most limiting conditions.

MR. TAYLOR: I had a -- I'm sorry, John.

MR. COOK: John are you getting your questions answered?

MR. TAYLOR: Do you have another one?

MR. GARRICK: Well, I had a similar kind of anxiety on the HPI auxiliary spray and as I recall, it must be aligned through a local manual valve operation before it's available, available for pressure reduction and, of course, during this period, the PORV can cycle several times and could even fail to open and could stick open on any of the cycles. So I was looking at the auxiliary spray system as a pressure reduction mechanism in, again, in the interest of trying to implement the cold shutdown under the conditions that are specified, the thirty-six hour period, et cetera, and again, it's the same kind of problem. With the manual alignment and the possible time that's involved, maybe we're not taking advantage of this system as much as we certainly could as a reduction, pressure reduction device.

On the other hand, I am assured by operations people that this particular system, from an operations standpoint, is very valuable and very functional, but again, as a risk analyst, I'm looking at it from the standpoint of what it provides to enhance safety where for the moment we're talking about cold shutdown as an enhancement of safety.

MR. GIBSON: John, I would like to challenge your question in one area. There is not a tradeoff, as I understand it, between the auxiliary spray and PORV operation in that the auxiliary spray is a cooldown and if you didn't have it, you would not be challenging the PORV. You just wouldn't be cooling the pressurizer. The only mechanism to challenge the PORV under those conditions would be more a function of imbalance and heat removal causing pressurizer insurges, I believe.

MR. GARRICK: So it's not so deep, is what you're saying, as far as impacting the -- or it's something you'd like to have available in advance of cycling the PORV?

MR. GIBSON: I'm going to back off and yield to Bechtel and the designers.

MR. BAUMAN: I think we need to have somebody summarize, like you did for the emergency boration system, what the purpose is for that auxiliary spray, why it's there and what the timing is.

MR. HUGHES: Mike Pratt, would you please give them a brief summary?

MR. PRATT: Should the operator determine that it is desirable to go to a cold shutdown condition, the auxiliary spray system would provide the capability to do that, but the fact that alignment of the system requires local, manual actions is not a detriment to the overall safe condition of the plant. There's adequate time to provide that manual alignment prior to the starting of the depressurization and the cooldown sequence.

MR. BAUMAN: In other words, the thirty-six hour time we have to achieve cold shutdown, you can maintain hot shutdown without the spray, right?

MR. PRATT: That's correct.

MR. BAUMAN: So the only reason you need this auxiliary spray is when you opt to go to cold shutdown and you have adequate time in the criteria to allow for an operator action?

MR. PRATT: Right.

MR. GARRICK: I guess my real question, then, would the availability of the spray within a short time period following a transient, say less than a half an hour, be desirable from the standpoint of limiting pressurizer PORV demand cycles.

MR. PRATT: Well, let me just comment briefly. We have not yet covered a section that B & W will present on recovery of plant from accident, transient scenarios, so I think some of your questions related to that may be answered when we get to that part of the presentation.

MR. HOOD: Mike, can I ask, would that presentation get into the use of the emergency boration system after certain transients?

MR. SCHOMAKER: No.

MR. HOOD: Basically my question is I'm wondering if Mr. Garrick's questions about the manual actuation of that system will come into play again after the transient.

MR. PRATT: For the emergency boration system or the auxiliary spray?

MR. HOOD: I'm referring now to the emergency boration system.

MR. PRATT: Okay.

MR. HUGHES: Darl, I can answer that. No, we aren't going into that. We can explore any questions that the review board wants to go into but the actual presentation won't go into that.

MR. SULLIVAN: Well, again --

MR. HUGHES: Transients and accidents are really getting to a stable and safe plant condition and the later decision to go to cold shut-down is, in fact, viewed as a later decision and not one of the immediate actions. Therefore, the emergency boration system with the rods stuck out or the auxiliary spray, which is reactor coolant system controlled depressurization, are really later events, not immediate responses.

MR. SULLIVAN: Except that John's line of questioning will be answered in the sense that you have to address the immediate response of the plant to get to a stable condition and if in the presentation, whenever it takes place, you show that you do that without needing the spray or in the emergency boration system, then at least indirectly his questions are addressed, right?

MR. HUGHES: This is correct. By process of elimination, it has not been determined to be needed; therefore, it is not needed in the short term.

MR. BUDZIK: I'd like to make a suggestion here. I know Rich has the slides that he needs in that and we've talked around and around the emergency boration system and I don't see any sense to it because I think we have all the information that you need to understand where the criteria and what the basis of the two hours were and the sizing of the system and so forth. It is all based on xenon curves for worse case conditions and I think Rich could run through that in five minutes and give people an understanding of how we got to that point and summarize the report that B & W has given Consumers and Bechtel for their review and concurrence.

Rich, why don't you go ahead.

MR. HUGHES: If that's of interest to the board.

MR. COOK: Excuse me. Let me ask the board if it is their sense that they would like to hear additional information on the design basis for the emergency boration system? I think we had identified that it had been done by the work groups and I was going to have you certify to us as part of the follow-up. My question is, do we want to spend more time now on the detailed background of the emergency boration system?

MR. TAYLOR: Well, is that document that Agar referred to going to be made available to all the board members?

MR. BUDZIK: It can be. It's right here. Certainly is going to be at least by reference and then if you wanted to, we could make it -- it can be made available. We have it right here in our hands. I can run Xeroxes in a half hour.

MR. COOK: I think the sense of the board that I have is that we'll take that by reference and then if the individual members want to pursue it further by reviewing the actual reference documents, we'll do that.

MR. BUDZIK: Fine.

MR. COOK: Or if we have additional time later on and it makes sense, we may come back to it.

MR. SLADE: I have a couple other questions.

MR. HUGHES: Could we go off the record for a minute in that we need to change the paper for purposes of the transcript.

(Short break.)

MR. COOK: We're back in session.

MR. HUGHES: Jim, if I might take a minute, I believe that Mr. Lange has one comment relative to the emergency boration system criteria that may be useful for the record and further explain action to some people as far as criteria.

MR. LANGE: Just a couple words about the timing aspect. The most probable condition is operation from one hundred percent power. In that case, the actuation requirement is going to be about twenty-four hours. It is a very long term operation. The two-hour criteria is based on a double reactor trip where the second reactor trip is the one where the rod sticks out. There are some calculations made regarding the reactivity insertion rates at that type of situation where you theoretically got back up to hot full power temperature but really didn't disturb the decay profile of the xenon. That was where the two hours came from.

So, the two hours is under worse case situations as opposed to most probable.

MR. HUGHES: Okay. With that, the board's questions?

MR. COOK: I believe we're at the point at where it's profitable to go ahead. I think where we came in that entire extended discussion was; one, questions on the design basis and interface in the design process, the documentation requirement and ability to analyze multiple operating conditions with regard to the operating and emergency procedures and, three, the observation by Mr. Garrick that his sense as a risk analyst in hearing some of the system descriptions and design bases is there might be opportunities for additional enhancement of the safety of the plant based on his experience in risk analysis, which he is doing right now for the Midland plant. I think, therefore, we should, not this Design Review Board but rather the ongoing risk analysis of the Midland plant, should take advantage of the potential he sees and evaluate as part of the ongoing program and I'd refer that really back to Dr. Sullivan and Mr. Garrick to take that as an action item in their ongoing work.

I don't think the design board was constituted to try to, you know, attack that question and clearly not to try to look at it, and much less resolve, potential design changes, you know, ongoing unless we find a deficiency, so I think we would simply refer that potential which I think we ought to explore to the ongoing PRA work.

MR. SULLIVAN: Okay. I'm sorry. I didn't realize we were missing Darl Hood when we went back on the record. Does anybody --

MR. MAZETIS: He went to make a phone call.

MR. HUGHES: Would you prefer to wait or would you prefer to proceed?

MR. COOK: Do you gentlemen have any sense of whether we should --

MR. MAZETIS: Let's go on.

MR. PRATT: Ed, I've just got one point that I would like to make. Mr. Taylor had asked a question previously about the design basis information for auxiliary spray and we had an open action item to provide to the Design Review Board the details of that design criteria. We're assembling some information now and, time permitting today, we'd like to provide that within the presentation rather than at a later date, if that's acceptable.

MR. COOK: Well, I think the procedure we were going to follow was that the board is going to reserve time to caucus as we get towards the end of the overall meeting and at that point I would ask us all to reconsider exactly what we thought we needed to pursue and then we'll come back and specify it and discuss it with the, you know, with the presenting organization to make sure we all understand where we go from here.

MR. HUGHES: All right. If there are no more questions on information to date --

MR. BAUMAN: I've got questions on some other aspects. Can we do those at this time?

MR. COOK: Yes. The floor is still open for design board questions on the material that's just been presented to us.

MR. SLADE: Before we go onto a new topic, can we clarify the action item associated with the operating specs?

MR. COOK: I say, we'll do that later today.

MR. SLADE: All right.

MR. BAUMAN: This may not be the appropriate time, and someone tell me if we are going to address this later on, but I think we need to get into the natural circulation cooldown report steam generator and the fact that there is still an analysis to be completed on that. Is this the appropriate time or will that come out of a later part of the presentation?

MR. HUGHES: I believe that the statement really is that natural circulation cooldown and one steam generator has not yet been fully analyzed and I really can't say anything further about it at this time.

MR. BAUMAN: Well, I would like to know when the analysis is going to be complete and what the schedule is. Do you have any other references where you've done similar analyses on other plants and so forth? Do you care to discuss it at all? What I would like to have is feedback on discussion.

MR. HUGHES: Jim Agar, would you care to address that?

MR. AGAR: Ron, the best I can do right now in responding to that question is to say that the natural code is being revised at this time to include the ability to be able to analyze the cooldown, natural circulation condition with the use of one steam generator. The schedule for completion of this model is being developed and I would guess that within the next two or three weeks that we should have a schedule when we can complete such calculations.

MR. GARRICK: In that analysis, are you also considering two-phase recirculation, circulation?

MR. AGAR: I would assume that they are, yes.

MR. GARRICK: Okay. It seems that I remember somewhere in some of the material that such a study was going on and I guess I'm asking.

MR. AGAR: Well, we're not contemplating --

MR. COOK: Through the board or some other external material?

MR. GARRICK: Well, I'm not sure.

MR. AGAR: We're not contemplating really a two-phase mixture. To my knowledge, there's no special study being done, at least to my knowledge, within B & W for a two-phase recirculation. The code, like I say, was used for the -- two steam generator cooldown is being revised to be able to just look at one steam generator.

MR. TAYLOR: I could clarify that a little bit, John. There is, not in connection with this cold shutdown issue but in connection with the small break issue, two-phase circulation on the primary side and the effect of non-condensables and so on. That is used, being given a lot of attention in connection with a NUREG document 0565, but two-phase circulation is, to my understanding, this particular issue is not being addressed.

MR. COOK: In response to the comment, the material handed to the board on top of page 17, I think, is clearly an open item and we'll take that as such from B & W.

MR. AGAR: That's true, it is.

MR. COOK: Mr. Jensen?

MR. JENSEN: I was wondering if the consideration of reverse flow in the non-operating reactor coolant loop will be concerned in the natural code? Will that possibility be allowed for?

MR. AGAR: I would imagine so, yes.

MR. COOK: Can we specify with certainty or does that have to be followed up on?

MR. AGAR: Until the details of the code modifications are known, you know, it would be very difficult to answer that question.

MR. COOK: So we'll consider the response to be uncertain, to be confirmed?

MR. AGAR: The issue is still open until we can confirm that, right.

MR. BAUMAN: Okay, so that will be an action item, then, to complete that analysis and continue to evaluate it.

MR. TAYLOR: I have a specific question which I think may relate to the question that Mr. Jensen just made or just asked and that is in connection with single loop cooldown. Is it correct that the emergency boration system connects into one loop? It is not -- this schematic is correct in that the system coming in from -- is only connected into one reactor coolant loop?

If you put the high concentration boron in with one makeup pump, is that going to be separated so that it only goes into the high pressure injection nozzle; the background for the question being, could you end up with all of the concentrated boron in a dead loop and not in the reactor?

MR. PRATT: The specific injection path needed by way of makeup or the HPI line has not yet been determined.

MR. TAYLOR: It would then seem that that's an issue that ought to be pursued in connection with the overall emergency boration system design evaluation, including the provision for sampling during operation to not only make sure that the concentrated boron is going into the core but that the sampling provisions for measuring that are really representative of what's in the core.

MR. PRATT: Yes. There may be some additional clarification that B & W would like to make on that. This subject came up early on in the design of the system, consideration of mixing and getting the boric acid where you want it.

MR. TAYLOR: The only thought is here an eighteen hundred gallon tank is not very big compared to the loop volume and so if that happened to be -- if you're putting the boron only into one loop and that loop happened to be the idle loop, would want to have assurance that it was being distributed into the core.

MR. SLADE: There would still be some flow in the idle loop. It's just a question of what the time concept would be for getting to the core.

MR. GIBSON: Mr. Taylor's question really is appropriate. Whether you're using the EBS or BWST, you are under natural circulation or non-forced load conditions. Should be concerned that the way you inject the increased boron, whatever the source, that it be appropriate.

MR. TAYLOR: Could somebody describe the sampling provisions when you would be in the mode of using the emergency boron system? It's my understanding from reading the material that the sampling line is connected to the letdown line but one of the things that requires the use of the emergency boron system is the inability to use the letdown line so what reviews have been made or what assurances can be provided that the sampling you get out of that line, which is not in use, is really representative?

MR. BAUMAN: I would like to just add to that question, and Lou just mentioned it, too, that the boron mixing in the reactor coolant system during natural circulation cooldown, I'd like to hear a discussion from the appropriate --

MR. COOK: Can we give the design team a chance to answer these, you know, one at a time as they come up?

MR. BAUMAN: Well, they're related. It's more than just, one, the loop. It's whether you've got forced circulation or unforced circulation, the whole big question about boron mixing.

MR. HUGHES: I believe that we will cover the boron mixing and go on into those questions in better form after we've had the presentation of Chapter VI, which is the comparison to applicable regulatory guides, and I believe that's in fact addressed in the material there briefly.

MR. COOK: Take that as a comeback item, fine. We'll defer to when you want to address it.

MR. MAZETIS: Has the analytical model referred to earlier been submitted to the NRC staff? I believe B & W referred to it.

MR. HUGHES: Gerry, this is the question of the natural code and the modifications that Agar referred to?

MR. MAZETIS: No, the discussion referred to an analysis of one steam generator under natural circulation.

MR. HUGHES: Okay. That was referred to as the natural code. Mr. Agar, would you care to answer that?

MR. AGAR: To my knowledge, Gerry, that code is not completely certified yet at this stage. I don't know. Perhaps Mr. Taylor could help me out here in the licensing area, but I don't believe that there has been discussions with the staff on the natural code yet, is that right, John?

MR. TAYLOR: As far as I know, they are not.

MR. AGAR: It is not a certified code yet. They are still working on the certification of the code.

MR. MAZETIS: Are there plans to submit it to NRC?

MR. TAYLOR: Not that I know of, no. In terms of topical reports or that sort of thing, I don't think so. In terms of topical reports, I believe not. I believe there is not a plan for that code to be described in the topical report.

MR. GIBSON: As long as we're talking about the natural circulation considerations, I had a question. It's probably twofold. One, it has to do with the DHR cut-in. We've alluded to an elevation of the DHR cut-in temperature in the primary system and, first, I would like to know what kind of cycle limitations there are. I assume that they change as you elevate a temperature on a system that was designed for a lower one; and secondly, if you're into natural circulation, it seems to me that one of the prime reasons that you might be would be a loss of offsite power and, therefore, you would need that elevated temperature and I would think that maybe the hot leg temperature would start the diversion with cold leg. You'd be in a problem.

MR. HUGHES: Tom Ballweg?

MR. BALLWEG: Regarding the number of cycles, I don't know that number. Do you?

MR. PRATT: Well, we have assumed, obviously, not a normal situation. It's defined as an emergency condition and I believe we're designing to one cycle per year, forty cycles during the plant life.

MR. BALLWEG: The second part of the question, yes, the hot leg and cold leg temperature are in fact much different under natural circulation conditions and we are talking about a hot leg temperature of 325 for cut-in. I do not remember exactly what the cold leg temperature would be under those conditions.

Am I getting to your question, Lou, or not on that part?

MR. GIBSON: Well, I think it is the hot leg temperature or the highest point that you have to --

MR. BALLWEG: Yes, it is the hot leg temperature.

MR. GIBSON: I think we'll get into the rest of it in aux. feedwater, I imagine. I'm concerned about whether we have any steam left to drive the turbine drive.

MR. TAYLOR: Do I understand that the only basis for changing from 280 to 325 was in order to meet the thirty-six hour requirement?

MR. BALLWEG: Basically the requirement is to enable -- falls out in order to get enough steam venting capacity off the main steam lines, off the steam generators and cool the reactor coolant system down in a reasonable amount of time. The thirty-six hour number comes from Reg. Guide 1.139.

MR. MAZETIS: Do you have a calculation of the amount of time it would take to get to the 280?

MR. BALLWEG: To 280?

MR. HUGHES: Gerry, you have 280, under what conditions are you asking, under normal cooldown?

MR. MAZETIS: Yes.

MR. BALLWEG: Under a normal cooldown, you're basically limited by the RCS spec, 100° per hour cooldown rate for most of the cooldown and then at the very tail end where you were dumping to the condenser, you're limited by the valve capacity. It takes less than six hours to cool down to 280 under a normal plant cooldown.

MR. MAZETIS: Okay. Using the same assumptions utilized to derive the thirty-six hours, how long would it take?

MR. BALLWEG: I don't understand the question. Could you expand a little?

MR. HUGHES: Are you relating to using only Class 1E equipment?

MR. MAZETIS: Yes, right.

MR. HUGHES: And a loss of offsite power?

MR. MAZETIS: Right, if they were the assumptions. As I understood what you just said, you said it would take thirty-six hours or you could do it within thirty-six hours, get to the 325° emergency cut-in point. So my question was, using the same assumptions, what would it take to get to the 280° cut-in point; forty-eight hours, seventy-two, seventy-two hours? Do you have a feel for that?

MR. BALLWEG: I don't know that that's been analyzed out that far. I don't really know.

MR. SULLIVAN: Without decay heat removal?

MR. MAZETIS: To get to the cut-in point.

MR. HUGHES: Yes. The question is without offsite power and using the Class 1E components, how long would it take you to get to the 280?

MR. SLADE: In my review of this previously, I recall looking at the saturation pressure associated with 280°. I think the concern is that you don't have enough pressure to operate the auxiliary feedwater tubine-driven pump and if your single failure is the motor-driven pump, then you don't have -- you need to cut in at a higher temperature so that you still have feedwater at the point where you're cutting in auxiliary feedwater.

MR. GIBSON: Can I ask for a clarification? The thirty-six hours is the cold shutdown, am I correct, for the right guy? That's 200°, not 280 or 325?

MR. GUNNING: May I clarify? The thirty-six hour time period is the time to have your DHR system operational.

MR. GIBSON: Okay. So it's

not 200? Thank you.

MR. PRATT: And one other point, correct me if I am wrong, some of the licensing people, but I do not believe that the licensing position on the Midland plant is that attaining a 325 or 280° decay heat cut-in temperature as a design basis for the plant. It's a design objective in the plan.

MR. TAYLOR: You mean in thirty-six hours?

MR. PRATT: Within thirty-six hours.

MR. HUGHES: That is correct. This is a new regulatory guide relative to the construction permit in the vintage of the Midland plant, so this is an enhancement to demonstrate capability and we will go into that when we get into Section VI, I believe it is, on the comparison of the present design.

MR. TAYLOR: I'd like to ask for a clarification as a follow-up action item as to just exactly what the basis was for shifting from 280 to 325 because it seems, if it was simply to meet the thirty-six hour requirement, which is an arbitrary requirement, it might be worthwhile to reconsider having to subject the system to that change. Correct me if I am wrong. Is the thirty-six hours an arbitrary requirement?

MR. MAZETIS: I agree, it's an arbitrary. It's a number that in the past five, six years has been utilized to focus on the term, reasonable period of time. We've accepted values greater than thirty-six hours; forty, forty-eight hours, particularly for near term O.L.'s. While I guess I agree with Jim, the thrust of your comment, I would presume that all they were trying to demonstrate was the capability if needed to get to the RHR system within that period of time. The actual need for doing that would be determined under the conditions of the reactor at the time this fast shutdown was required and presumably for a normal shutdown, they would, you know, they wouldn't take advantage.

MR. HUGHES: Let me clarify one thing. I don't believe we stated that the thirty-six hours was the only reason we went to the 325. Tom, would you go back to what you said about the steam venting and pressure?

MR. BALLWEG: Basically, well, the 325 does fall out not specifically from the thirty-six hours. It more falls out from the reasonable time assumption where you basically come at -- and I'm reflecting strictly on memory, something that I saw quite a long time ago -- that it took, to get to 280, it took something in the range of three days, two to three days to get there using one valve and with the idea of meeting a single failure requirement to assure the -- we had a steam vent path for each steam generator and providing a reasonable capacity and during a reasonable time, the 325 kind of fell out in the wash as being the number which was achievable from a DHR system design and still compatible with a reasonable cooldown time.

It was a compromise number considering both the DHR system performance, equipment and limitations and capabilities, and the implementation of the reasonable time concept.

MR. TAYLOR: My only concern is whether or not there are any significant adverse effects on the decay heat system as a result of shifting 280 to 325.

MR. BALLWEG: I think the short answer to that is the stresses, thermal stresses are going to be higher. They have been analyzed and determined to be acceptable as an emergency level stress.

MR. TAYLOR: Are those trade-offs worth whatever the basis for shifting really was?

MR. SLADE: Let me interject here, because I did have in my notes the numbers of the saturation pressures for those temperatures. At 280° Fahrenheit, the saturation pressure is fifty pounds absolute. Okay. The required pressure for operation of the auxiliary feedwater turbine-driven pump, I believe, is thirty pounds gauge, is that -- or, no, forty-five pounds gauge, which would be sixty pounds absolute and, therefore, you could not assure the pump volume necessary at the 280°. You had to go to some elevated temperature.

Now, whether 325 is an appropriate basis or not, 325 happens to be ninety-seven pounds absolute and clearly is above the required pressure to operate those pumps So someplace between 280 and 325 is necessary in order to assure that you can put auxiliary feedwater to the generators if you don't have a motor-driven pump.

MR. SULLIVAN: It is stated as an emergency operating condition. It's not something the operator would routinely do, Jim, so it's not, you know, as I read it, you know, it's the option of the operator when he gets there to make the judgment as to whether he needs to cooldown that quickly.

MR. TAYLOR: These numbers have a habit of creeping into the operating procedures and it would certainly be worthwhile to have that be an option to the operator, let's say, to go to 280 if you can. You don't have to actuate this sytem in these conditions unless you're without your motor-driven pump.

MR. BAUMAN: This would have to be the case of giving the operator an option because they're, therefore, limited to 40 cycles. That's going to be controlled and that will have to be identified somewhere as operating procedure.

MR. GIBSON: I think what Jerry alluded to and what Jim may be coming up on is that when you get down to the point where you have to utilize that 325, if you don't have conditions in your primary system such as some kind of a major leak or something else, in other words your conditions are acceptable from a safety standpoint, then it's prudent not to exercise the emergency switchover. I agree with you. I can see where the operators get down there and they say, all right, the clock is cranking away. I'm at thirty-two hours. What's my course of action. The smart course of action isn't necessarily to meet the thirty-six, is what you're saying.

MR. SLADE: Lou, this gets back again to the need for operating specification requirements as long as were identified the number of cycles that are available that are in the operating specs. Those are control basis for our operating procedures and emergency procedures. We will factor that into the operating procedures as limitations for the operator. I would propose that -- or I would not expect that we would even give the operator the option of cutting into the decay heat removal system before 280° unless we're in an emergency operating condition. The only place where that limit would show up is in the emergency operating procedures, not in the normal operating procedures, and then only when the steam-driven auxiliary feedwater is not available -- or, excuse me, when the motor-driven auxiliary feedwater pump is not available.

MR. COOK: Just one practical follow-up question, Ed. In terms of the original thrust of that question, we're looking at really verification of the system to be able to do what we said it could do; in this case, be able to cut in at 325°. The changes have actually been made in the plant design, have they not?

MR. HUGHES: That is correct and they have been analyzed and reviewed with B & W's and Bechtel's equipment and found to be on acceptable limits. They are code equipment and they have specified limits.

MR. COOK: Okay. I think the thrust of the comments of the board are, you know, appropriate in terms of not doing anything you don't have to do that might be additional wear and tear on the plant.

MR. TAYLOR: I have some additional questions on emergency boration system.

As I understood the way the conversation went earlier, there were some specs prepared for the emergency boration system and these specs were turned over to Bechtel and they designed the system and that loop is being closed or will be closed to see that the requirements that were set have been implemented.

Now, the third part of that question is, for those parts of the system which were physically unaffected, has there been a review for compatibility with the new functional requirements; for example, all the things that are now going to see six weight percent boron, have they been looked at to see whether or not they are really compatible with that higher concentration, like the makeup pumps or whatever? Was that a clear question?

MR. HUGHES: I believe you just asked, have we reviewed, where we've changed the system, that the existing equipment we're utilizing is compatible with the new requirements. I believe the answer to that question is an unqualified yes.

MR. PRATT: Yes.

MR. TAYLOR: Is that review documented anywhere?

MR. PRATT: Not that I'm aware of.

MR. HUGHES: Rather I believe what you'll find is in the equipment specifications, the requirements on the system and where a new imposition does not take you out of that boundary of the requirements, no further documentation is provided. Should you require additional qualification information from your vendor or from the materials that we have supplied, then that would show up in the records. There is no formalized review procedure of this particular aspect except as it's in the design descriptions and the licensing documents.

MR. BAUMAN: Jim, I know in your case we actually funded an effort where you went back to your heat exchange suppliers and had them analyzed for this type of condition and that will obviously be documented.

MR. TAYLOR: You'll have to -- I'm not involved with that detail.

MR. BAUMAN: I know in the case of your equipment it is documented.

MR. TAYLOR: So to get at

what you just said, and perhaps to reflect what Ed just said, somewhere or another there's a piece of correspondence that says the high pressure injection pump has been evaluated for compatibility with six weight percent boric acid and it's okay?

MR. HUGHES: No, that's not what I said.

MR. COOK: No, that's not what I heard either, that he's revised these design documents to make sure that those at the higher concentration, that it might say due to the EBS is now included in the design documents.

MR. HUGHES: Where affected.

MR. COOK: And you'd have to go back and audit the design documents to verify that it was done right.

MR. HUGHES: It's a reverse procedure. The design documents that specify the requirements for the system when a change is made are reviewed and if the equipment specification and equipment supplied are compatible, no further change is necessary. There is not a piece of paper saying a review was conducted for this purpose and found to be acceptable. Rather the documentation for the equipment specifies its conditions and if you look at the new conditions, you find them within the envelope.

MR. TAYLOR: Well, then, to put that in different terms, someone would have gone back and said, six weight percent is within the envelope of these portions of the system which are already designed and so, therefore, we don't have to look any further?

MR. HUGHES: That's correct.

MR. COOK: Okay. One follow-up, if you found cases where it did not fall in the envelope, then the design document would have to be upgraded to include the new more limiting condition and you would do something to either, you know, verify that you could meet the new condition or make a modification?

MR. HUGHES: That is correct. You'd either be back to the vendor for certification as to additional capability or you would be into replacement of equipment and/or components.

MR. COOK: Jim, my sense of what I heard was that the only way you could really verify your question or to successfully answer it would be to audit the design documents.

MR. VANHOFF: If I might interject, I think at one time we were looking at seven percent boric acid for the addition system a long time ago.

MR. HUGHES: That's correct.

MR. PRATT: Yes, the history.

MR. VANHOFF: So I would assume that the documentation for the pumps would have included six and a half percent.

MR. SULLIVAN: And as I mentioned before, I think we went to the lower concentration to avoid the heat tracing problem we had had at Palisades and the operator inconvenience of trying to maintain large piping runs and tanks with elevated boron concentrations.

MR. COOK: But from quality assurance aspects of Mr. Taylor's question, the claim is that the design documents specify the requirements of the equipment. We'll have to see and it's really, you know, an auditing review function that would either prove or disprove that.

MR. TAYLOR: Okay. What temperature does the six weight percent crystalize at?

MR. HUGHES: Mike Pratt?

MR. PRATT: Yes, that crystalizes at approximately 83° Fahrenheit and I have the basis for that provided in a -- that number is from a B & W specification.

MR. TAYLOR: The follow on to that is has the periodic testing that will be done on the emergency boron system been determined yet?

MR. HUGHES: Jim, what do you mean by periodic testing?

MR. TAYLOR: Well, to make sure that the lines are free periodically when you need it and so on.

MR. HUGHES: Are you talking once the plant is in operation?

MR. TAYLOR: Right, correct.

MR. HUGHES: I believe that that has not been determined yet. I'm speaking for the operations department in part and I guess I really have to go back to Mr. Slade, but as far as I know, that has not been determined yet. Periodic maintenance and tests on the emergency boration system has not yet been established by the Consumers Operating Department.

MR. SLADE: We don't have the system designed yet.

MR. GIBSON: I recognize we're seemingly hung up on EBS, and I guess I'll add to it. The design considerations when you need that EBS after two or twenty-four hours, you want it into the primary, am I correct? Do you shut off the recirc to make sure it gets there or do you put a lot of it back into the makeup tank?

MR. PRATT: You secure the recirc panel.

MR. GIBSON: Okay.

MR. PRATT: The reference for the 83° temperature is B & W standard guide, specification number 2016, boric acid for nuclear plant application, figure 1, which is a solubility curve of boric acid.

MR. GIBSON: I would ask you how you secured the recirc, but I know the answer and that will be, developed in the operating procedures so --

MR. TAYLOR: Well, at the risk of sticking on emergency boration systems for awhile longer, I realize what you said, Jerry,was true, that the periodic testing has not been set because the system has not been designed completely yet, but these are not unrelated. It could be that there are some recirculation lines required for periodic testing which would have to be included in the design, and so I would just ask that the need for periodic testing be given some consideration or suggest the need for periodic testing be given some consideration before the design is absolutely finalized. If there are some special recirc lines to make sure that the boron has not crystalized in some low temperature spots or something like that where you're going to run a test once a month or whatever, that that be a factor in the design, the final design review.

MR. COOK: Let's ask the question a little bit differently. Can we have the design team tell us what the operating conditions or characteristics, considerations that have been put into the design?

MR. HUGHES: Mike, why don't

you go into the considerations in the design of the EBS as far as prevention of crystalization.

MR. PRATT: Okay. I don't believe I have an overhead on that. There is one approximately twenty-three hundred gallon EBS tank per unit. There is a single approximately 15 gpm recirculating pump to recirculate the contents of the EBS tank during normal plant operation, mix it. The tank contents are heated by way of immersion heaters. They are non-1E immersion heaters which maintain the contents of the tank at approximately 160°, well above the crystalization temperature.

There are capabilities for addition of concentrated boric acid and for addition of demineralized water and there are also capabilities for periodic sampling so the operator would, by tapping into the recirculation loop, draw off a sample, take that to a lab for analysis of boric acid concentration or for whatever as determined by the operating procedures, but those capabilities do exist in the design. I think that pretty much describes the design of the emergency boration system as far as its normal standby mode when it's not being injected.

MR. TAYLOR: So it is normally in circulation, then?

MR. PRATT: That's right and that's done to keep it mixed, uniform temperature, uniform concentration.

MR. HUGHES: Mike, in the course of our design evolution of the EBS, has this system been discussed with both B & W and Consumers Operating Department?

MR. PRATT: Well, we issued a system summary description for the emergency boration system and that was provided to B & W for comment and to Consumers Power for comment. We have received those comments, finalized the system summary description, finalized the design.

MR. HUGHES: Did we have a meeting with Consumers operating at the job site?

MR. PRATT: Not specifically on emergency boration.

MR. HUGHES: In several of the design changes, we have had meetings at the Midland job site with both Bechtel construction as far as effects on schedule and with Consumers operating people so that they're aware of and can plan for future changes, and I presume that we will probably do this for the FBS and other changes, an ongoing program.

MR. COOK: Do we have further questions on the presentation we've heard so far? John?

MR. GARRICK: I wanted to comment a little bit about some of the systems; in particular, in reference to the earthquake and since we're talking about evaluating cold shutdown in terms of the ability to do it in the presence of the safe shutdown earthquake and the loss of offsite power, the question of the ability of the equipment to all run effectively under these conditions is kind of important. I wanted to hear a little bit of discussion on some of the specific key systems and I guess, in particular, will the borated water storage tank in the service water piping survive the safe shutdown earthquake?

Also, the layout of the plant is such that the borated water storage tank is located in the back of the plant buildings and the service water structure is a considerable distance from the aux. building and so the issue of the interconnected timing becomes kind of important and maybe rather than ask a question of will it survive, maybe somebody can talk a little bit to what the earthquake levels are or that these have been designed to in terms of something like equivalent peak background acceleration.

MR. HUGHES: Well, essentially the design basis of the Midland plant is a .12g horizontal ground deceleration and the seismic category one structures, equipment components have all been analyzed to withstand the decelerations associated with a .12g earthquake and the stress levels have been acceptable under the industry standards.

MR. COOK: To follow John -- a little bit more completion than that in terms of the damping values and the actual specter that's developed and so forth, you have to get a full feel for it. You have to go through all of that.

MR. GARRICK: Well, also, it's my understanding that the chemical addition system is not seismically qualified.

MR. HUGHES: That is correct.

MR. GARRICK: And if you try to track down the water sources, then I guess the question is, even though it's not seismically qualified, because it enters into the water supply question, do we know what its relationship -- do we know what its resistance is, for example?

MR. HUGHES: No, we don't do a -- what I call a back calculation in terms of what it will withstand. The chemical addition system is not required for any safety response to an earthquake condition.

MR. GARRICK: I guess if the borated water storage tank line fails, for example, that there's a good chance that the high pressure and the low pressure pumps will fail due to loss of suction, is that right?

MR. HUGHES: I believe that's correct.

MR. GARRICK: In that regard, have you considered some type of low suction pressure protection, particularly for the HPI and the DHR pumps?

MR. HUGHES: The design basis for the Midland plant does not include the passive failure of a seismic Class 1 line as part of the plant design basis.

MR. GARRICK: Okay. Well,

one of the reasons for the question is I know the design basis is not, but coming from the point of view of a risk analyst, we have to address the question of what the ability of these structures are and so part of the question here is really what is the threat to these key components and interconnecting piping with respect to achieving cold shutdown during an emergency condition, not concerned about a normal condition. In that connection, speaking of being a risk analyst, I'm --

MR. GIBSON: Could I interject for a second?

MR. GARRICK: Yes.

MR. GIBSON: I heard something that didn't seem correct. You said that if we lost the BWST, we would lose the HP and LP pumps or their capability.

MR. GARRICK: Well, in the absence of -- yes, I think so. We would lose the capability.

MR. GIBSON: Okay. At first I thought you were saying they'd destroy themselves and I'm thinking, well, that assumes that they're running off the BWST, which is not a hundred percent assumption.

MR. GARRICK: In that specific part of the question of whether or not there is any low pressure protection.

MR. GIBSON: But they, in fact, you would need to lose that tank and have a ECCS signal in order for that loss to occur.

MR. GARRICK: Well, you'd probably get an ECCS signal if you had a seismic event. You'd probably get that safeguard actuation.

MR. GIBSON: That's possible, possible.

MR. GARRICK: Possible. Well, it depends on the earthquake.

MR. GIBSON: We don't have a seismic switch. Thank you. Go on, now.

MR. GARRICK: I'm just trying to develop a feel for the extent of the analysis and what the levels of these different systems are. In evaluating the real threat to the systems, that kind of information becomes important, but what I was going to comment on is that the truth is I'm having trouble getting over the first hurdle and the first hurdle is what has cold shutdown under prescribed conditions got to do with risk? I'm not convinced that it has much to do with risk and I realize that's not what we're addressing here. What we're addressing is the adequacy of the design to achieve cold shutdown, and I was encouraged by Jerry's comment. I think the context was more of its capability than thou shalt achieve within a period of time and under certain load conditions such as a safe shutdown earthquake, because those kind of conditions are extremely arbitrary and, as a matter of fact, in a scenario sense and the frequency of occurrence of scenarios, it may turn out that they don't add safety but could even conceivably add risk. We have to be prepared for that kind of an evaluation as well.

When you talk about safety grade systems, again, that's kind of an arbitrary thing, especially from a risk standpoint because experience is telling us that as far as risk is concerned, there seems to be very little difference between seismic category one components and non-seismic category one. In other words, those differences do not seem to be visible in the fragility curves and so the truth is, when you're faced with wanting to cool down, you ought to have everything at your disposal, available to you to achieve that and to create the state of mind that says that you've got to get there by way of safety grade equipment may not only not be the best way to get there but could create an unsafe condition.

MR. MAZETIS: Just one piece of actually what you're talking about, John, it's my understanding that in the RHR suction, there is a valve outside containment that's motor-operated. My question is, during normal shutdown cooling, is the power to that valve removed, and if not, the question is, is there a low flow alarm in the RHR system lines to alert the operator to a condition where the valve was inadvertently closed?

MR. HUGHES: Gerry, you're talking about a valve outside containment?

MR. MAZETIS: Right, in the RHR suction, a common header with a single motor-operated valve.

MR. PRATT: The valve is locked open. The operator will not be in place, okay, so functionally, I'd call it a vestigial organ much like an appendix. It's there because, from the stress point of view, it was easier to leave the valve in place than to take it out, but the valve is locked open. And let me clarify, if the operator has not been removed or will not be removed, the power supply will be removed and that description of the design is shown on the P&ID. I believe there's a note on the --

MR. TAYLOR: Yes. The FSAR drawing has a note for that system which says the motor operator on this valve is not connected to any control or power supply or power circuit.

MR. HUGHES: The original design had a motor-operated valve and the considerations of enhancement, rather than cut out the valve already installed, it was merely disabled.

MR. MAZETIS: Okay, and you don't have low flow alarms in the RHR system?

MR. HUGHES: Mike, can you answer that?

MR. GERDING: Yes, we do have low flow alarms in our system. In fact, there is a low flow interlock to the DHR pump which will trip it in the event of a low flow. This equipment is there for normal operation. It's not a safety grade function.

During the emergency core cooling actuation, these systems are bypassed in the circuitry.

MR. GARRICK: I have just one more earthquake kind of question because I was trying to work up a couple of scenarios. It's possible that an earthquake will result in an extended loss of off-site power. Can you tell me if the following items are powered from the diesel generator buses; for example, the instrument or control air compressors? No?

The diesel generator fuel oil transfer pumps?

MR. BALLWEG: Yes.

MR. HUGHES: Yes.

MR. GARRICK: Yes? The auxiliary feedwater, feed only one good generator logic.

MR. BALLWEG: It's off the DC. 1E, DC preferred, AC preferred power system, yes.

MR. GARRICK: Yes.

MR. BALLWEG: Battery pack and DC.

MR. GARRICK: The instrumentation and control power providing pressure interlocks on DHR cooldown isolation valves?

MR. BALLWEG: Yes, it's all 1E.

MR. GARRICK: DHR heat exchanger cooldown bypass valves?

MR. GERDING: Let me --

MR. HUGHES: John, can you wait a minute and let's take a check on that one.

MR. GERDING: Yes, let me check that one and I'll get back to you.

MR. GIBSON: Could I ask a question? Are you through with the list? I just want to elaborate on one. If you lose the instrument air compressor, is there a figure of merit or whatever for how long you'll have the instrument air?

MR. BALLWEG: Nothing that will be defensible.

MR. HUGHES: We don't, Lou, I believe it's true that we take no credit for the operation.

MR. BALLWEG: That's right. We take no credit for it.

MR. HUGHES: For the

instrument air system for safety requirements.

MR. GIBSON: So it's not really used for any of the things that we talked about?

MR. COOK: I think that gets back to John's point about -- how about in terms of what your real expectations are for that supply?

MR. HUGHES: Jim, we're really demonstrating a capability against a requirement using 1E so that while there are a great number of other features, the plant that we would hope and expect to be available in the process of demonstrating the capability, we take no credit for them. The negative is not true, that, therefore, they are useless and not available.

MR. BALLWEG: We have the answer to that DHR bypass valve. They do, in fact, get diesel power.

MR. GARRICK: They get it from the diesel buses?

MR. BALLWEG: Yes.

MR. TAYLOR: And the two are separate; I mean, one for each cooler? There's no way that they are common?

MR. BALLWEG: That's correct.

MR. SLADE: Are we ready to move on?

MR. COOK: Okay. John, do you want to follow?

MR. GARRICK: No, I'm fine.

MR. COOK: Okay.

MR. SLADE: I have a question that's unrelated to what we've discussed so far, I think, but in reading the text in preparation for the meeting today, in the written presentation on page 9, there was some discussion that the PORV will in fact prevent a reactor trip from occurring. I thought that I had understood previously that we had changed the logic on those so that we would, in fact, get a reactor trip before the PORV's came open and that in addition -- no? I see a lot of heads nodding.

Could we review the current design state of what the order, the sequence is of power-operated relief valves, RPS trip and pressurizer safeties?

MR. HUGHES: Jim, is this appropriate for you to answer?

MR. AGAR: Well, let's take them one at a time. Would you ask your question one more time so we can make sure we got it?

MR. SLADE: Okay. I would like to know what the sequence of operation is for the power-operated relief valve, the set point, the set point for the reactor protection system trip and the set point for the safety valves on the reactor coolant system. What is the sequence of operation?

MR. AGAR: Bob, can you answer that, Bob Schomaker from B & W?

MR. SCHOMAKER: Yes. The normal operating pressure for Midland plant is twenty-two hundred pounds. If one was going through a rise in pressure, one would first see a PORV open around twenty-two sixty, which was shown in one of the previous slides. The RPS trip set point is currently twenty-three fifty-five psig.

MR. SLADE: I'm sorry?

MR. SCHOMAKER: Twenty-three fifty-five psig and the pressurizer safety valves are set at twenty-five hundred psig and they would open in that order. These are typical pre-TMI type set points.

MR. SULLIVAN: Well, they're also post-TMI set points.

MR. SCHOMAKER: For Midland, that's correct.

MR. SULLIVAN: And for the other, a similar thing for the other -- the 205, the other backlog B & W plant.

MR. SCHOMAKER: The 205 plants have a higher high pressure trip set point than twenty-two fifty.

MR. SULLIVAN: Similar sequence?

MR. SCHOMAKER: Similar sequence, that's correct.

MR. COOK: Jerry, do you have further pursuit of that issue?

MR. SLADE: No, that resolves my questions.

This may not be appropriate at this meeting -- if it's not, redirect it for tomorrow, I guess.

MR. COOK: Okay.

MR. SLADE: Again, on page 11,

they discussed the auxiliary feedwater suction switch-over and in some of the review materials, there was reference to a four second time delay on the switch-over of that service water supply after the AFWAS and low pressure, low suction pressure signal was available. I'd like to know what the basis for the four seconds is, whether it's pump protection or whether the four seconds is based on the need for the cooling water to the steam generators.

MR. HUGHES: Tom?

MR. BALLWEG: Four seconds is based on two considerations. The fundamental consideration is to minimize the possibility of inadvertent actuation of service water that you might have during a pump start. You'll have a decrease in suction pressure any time the pump starts.

MR. SLADE: My concern is why not four hours instead of four seconds? Why not less than four seconds?

MR. BALLWEG: The second is the forty second requirement that B & W has imposed for establishment of aux. feedwater flow to the steam generators after initiation of the demand signal.

MR. SLADE: Forty second?

MR. BALLWEG: Forty seconds.

MR. SLADE: Again I'll ask my question. Why do we have a four second time delay instead of a forty second time delay?

MR. BALLWEG: Because it takes time, the auxiliary feedwater pump is sequenced onto the diesel gener .cor. The combination of its sequencing and twenty-five seconds plus ten seconds for the diesel generator to start leaves you at thirty-five seconds. I would like to beat forty. That leaves me five seconds, so I took four.

MR. SLADE: Okay. So it has to do with the start sequence logic?

MR. BALLWEG: That's correct.

MR. SLADE: And it is based on flow to the steam generator, not on pump protection?

MR. BALLWEC: That's correct.

MR. SLADE: Thank you.

MR. COOK: And I think we've finished our preliminary questions now.

MR. TAYLOR: I have a couple more.

MR. COOK: Whoops, sorry.

MR. TAYLOR: I'd like to shift over to auxiliary spray again, shift back to it. In the write-ups that we had, there was something about the number of cycles that the auxiliary spray system could be actuated and I heard, I think, Mike say that this system is designed for forty cycles.

MR. PRATT: I believe I was talking about the emergency --

MR. HUGHES: No, Mike was talking about the decay heat removal system analysis for 325 based on one cycle per year.

MR. TAYLOR: Where do we stand on the spray nozzle coming into the top of the pressurizer and the rest of that in terms of number of cycles?

MR. PRATT: Well, I believe B & W can best address that. My understanding is that the analysis is ongoing.

MR. HUGHES: It's in progress at this time and I guess I'm going to ask Jim Agar to comment upon it. We have not received results yet.

MR. AGAR: The answer is as

given; the calculations are being done right now, Jim, in-house.

MR. TAYLOR: I'm a little bit concerned about that line, that when we tie into that big line which normally comes up from the reactor coolant pumps and the flow coming from the auxiliary spray line is going to be very low. The curve, I think, one curve said five or ten gpm, something like that. I'd like to know, has the evaluation included or does it have plans to look at the effects of that very, very low velocity coming through that big line and whether or not, just in the course of normal operation, that spray line could be partially full such that if you have five gpm or so coming in and running into the pressurizer spray line, could the nozzle and the piping have a very potentially adverse circumferential temperature variant such that the bottom half of the line might be at 50° or a 100°, whatever, and the top be subjected to steam from the pressurizer?

If that hasn't been looked at, I would like to suggest that it be looked at and as a part of that, also, to find out whether or not the effectiveness of the spray, itself, where that line is normally designed for, I don't know, fifty or a hundred gpm, to have five or ten gpm coming into it, whether that will really effectively promote heat transfer in the pressurizer between the subcooled water and the steam space so that you get an effective depressurization. So the first question is, does the analysis that is ongoing for the number of cycles on both the piping that Bechtel is doing and the surge line or the spray line nozzle in the pressurizer that B & W is doing look at the possibility of a partially filled line; and the second one is, is the effectiveness of the spray water, that big nozzle, what confidence can we have that you will really have complete heat transfer between the subcooled water and the steam space?

MR. AGAR: Well, I'll address the -- since I was talking about the B & W calculations, Jim. The only thing that we're going to address is the nozzle in the pressurizer, itself. To my knowledge, we're not considering partial flow through that nozzle. Is that right, Bob Griese? Do you concur with that?

The results of our calculations

using the auxiliary spray system is confined in the 1092 spec and I don't believe there is any restriction in there or any consideration being given to partial flow through the nozzle. I won't address the Bechtel part of the lines, where the lines connect. That's a Bechtel consideration.

MR. TAYLOR: Well, I'd like to know why not because it seems like it's a real possibility, particularly if the line is perfectly level coming into the top of the pressurizer and then coming down. It seems like the possibility exists that the line could be partially filled with a very small flow to a fairly large line.

MR. AGAR: Well, let me try something, Jim, before -- Bob Griese, could you address that question now to get it on the record or should we wait until later to address that?

MR. GRIESE: It would be better if we addressed that later when we have at least some drawings to demonstrate the configuration inside the pressurizer. The nozzle is not just a simple elbow coming into the nozzle pressurizer, but I didn't bring any drawings with me.

MR. AGAR: We cannot address that now, then. We'll have to take that as an open item, I guess.

MR. SULLIVAN: Well, I'm relating that back to your first question which was the first action item on this same subject.

MR. TAYLOR: It's an extension, really, of that. One of the problems that could come from that is that if the calculations assume that the spraywater is completely mixed in the pressurizer and it's not, then you could have to inject more water than you had counted on and thereby use up more of the available volume than you really counted on.

If you don't have the letdown flow, you might not accomplish the desired depressurization using the portion of the volume you had available.

MR. HUGHES: Tom Ballweg?

MR. BALLWEG: Can I ask a question to that or -- if you've got steam over water, you are going to have energy transport across that interface and so the water temperature will be virtually instantaneously the same temperature as the steam above it, will it not?

MR. TAYLOR: I don't know.

MR. BALLWEG: Well, in general, it is.

MR. TAYLOR: If it's spray, certainly, yes.

MR. BALLWEG: Well, even if you're talking about a pipe with a half of an inch of water in it and two inches of steam or even vice-versa or maybe half-and-half, the energy transport across that face, steam condensing onto the water is a very, very rapid phenomenon and your question about requiring or concern about requiring more water to depressurize recognizing the very high rates and very high heat transfer rates across the steam water interface, direct contact heating, I don't really understand the basis for that concern.

MR. TAYLOR: I'm concerned about two aspects of it. If you just had a cylinder and the bottom half of the cylinder was filled with cold water and there was steam above it, the stresses would be very high on the top and there could be a lot of stress built in to make it look like a hotdog. How far back the piping you might have to go before you say I've completely raised the water up to saturation temperature, I don't know. It's a question, really, and then if you -- however far back you have to go, that ought to be considered in the design of the piping to see if it will meet the number of cycles that the system is designed for, and the other part is whether or not there is good heat transfer between the steam and the water, but whether it's good enough is the question. It certainly is excellent as you break it up into smaller and smaller drops.

MR. BALLWEG: Yes, I agree with, the first part of your concern I take no issue with. The second part --

MR. COOK: Okay. I think we're going to have to go ahead to try to proceed. Jim, do you have more questions you want to get on the floor?

MR. TAYLOR: Is there a flow meter in that line such that you can tell what the auxiliary spray flow is or are you just relying on pressure reduction?

MR. PRATT: Okay. There is no flow instrumentation in that line, no. was it considered to be a design requirement. The operator will monitor the cooling, the depressurization rate and then adjust the throttling valves to control that depressurization rate, essentially by using a direct variable rather than an indirect variable.

MR. SLADE: You say adjust the valve. Is that an adjustment in the control center?

MR. PRATT: Yes, yes, remote manual throttling of a motor-operated globe valve.

MR. HUGHES: And again your assumption here is depressurization.

MR. SLADE: Pressure control.

MR. HUGHES: So that you would be reading pressure.

MR. LOOS: I've got about three questions. One, as I read the B & W cold shutdown documents, there is a concern about the core flood tank and the ability to isolate that in a safety grade manner. With the current arrangement of the single valve, how are we going to establish we don't get dilution by core flood, and then the next question --

MR. HUGHES: Shall we answer

that first?

MR. LOOS: Yes, why don't we answer them one at a time.

MR. PRATT: Yes, we've considered the potential for a single failure of the core flood tank isolation valves, specifically the event that you could not get it closed and, therefore, when you depressurized to 600 pounds, you'd have an insurge of core flood tank contents, which B & W had told us would not be acceptable in a cold shutdown scenario. Therefore, we have added the design capability to vent the core flood tank nitrogen gas in the event of that single failure.

MR. LOOS: Okay. With respect to the scenario where using the boric acid addition tanks as a means of making contraction volume, you have the three tanks, is there going to be a low level requirement on those tanks that will eventually end up in a technical specification or something like that?

MR. HUGHES: We can speak to the design.

MR. PRATT: Yes. There will be a need for a tech spec to maintain approximately sixteen thousand gallons per unit. There are three boric acid addition tanks of ten thousand gallon capacity each per unit. There will be a need to maintain slightly over sixteen thousand gallons per unit, so just less than two of the three tanks will have to be available.

MR. LOOS: Okay, and the other one is that with respect to your makeup tank, that has got a nitrogen or a hydrogen overpressure on it and if you lose the capability to provide the nitrogen or hydrogen, is that going to affect any of your pumping capability?

MR. PRATT: We're going back and looking at the NPSH calculations for the makeup pump to verify that we will have adequate NPSH in the event that you are drawing from the makeup tank and you've lost the nitrogen or hydrogen overpressure, and I can't comment yet on the results.

MR. HUGHES: The results of that --

MR. PRATT: I believe we will have adequate margin but that hasn't been documented yet.

MR. COOK: Mr. Jensen?

MR. JENSEN: Yes. In adding the manual vent lines from the flood tanks, have you looked at the possibility of inadvertent opening of the vent during the LOCA?

MR. PRATT: Not specifically. I guess the scenario you might consider is a jet impingement on the vent line or something like that?

MR. JENSEN: Well, the operator just opens it, makes a mistake and opens the valve.

MR. PRATT: Okay, during the LOCA or --?

MR. JENSEN: During the LOCA.

MR. PRATT: Well --

MR. COOK: Loss of original primary safety function due to the new add-on.

MR. PRATT: Any isolation, any venting path that we provide will have two valves.

MR. JENSEN: So couldn't he open up both valves at once if he wanted to vent it, if he opened both the valves?

MR. PRATT: Not through a

single control.

MR. HUGHES: Mike, are you saying that the vent path will have two valves and that each one will be individually controlled?

MR. PRATT: Yes.

MR. HUGHES: Okay, and we don't design for multiple operator errors.

MR. PRATT: The operator cannot just throw one switch and open both valves. He would have to deliberately this one and this one.

MR. SLADE: Just a point of clarification there. You're not concerned with having that tank vented normally until you're at a much lower pressure. You're not going to be inserting those tanks into the system until you're down to, what is it, about 600 pounds?

MR. PRATT: Six hundred pounds, right.

MR. SLADE: So that you have a lot of time under normal circumstances before you ever get to that 600 pounds and the operator does it, so it's not the kind of thing that the operator is going to immediately respond or have to make a quick action to turn those valves?

MR. PRATT: Right.

MR. SLADE: I guess I'd like to pursue that line of logic a little bit farther and ask whether those switches are key-operated switches or whether they're just normal manual switches. Is it something that the operator has readily available to him or is it something that has an administrative control associated with it?

MR. HUGHES: I'll have to ask Mike Gerding for that and I don't know whether the design has progressed to the point of the exact type of switch, have we?

MR. GERDING: The design has not been finalized. The choice of the switch has not been made. The consideration for administrative control, we have to go into that process of determination of the switch. That's about all I can say about it.

MR. JENSEN: I think it would be important to have some positive indication to the operator whether or not the flood tank, the flood tank was isolated by the single valve that does exist before he would take this additional step to vent the flood tank.

MR. HUGHES: Walter, are you suggesting that we have a position indication on the valve, is that the --

MR. JENSEN: I would think it would be -- well, I was wondering, instead of having the operator as he goes down this, brings the plant down --

MR. HUGHES: Down to 600 pounds.

MR. JENSEN: In this scenario of depressurizing the system, would he routinely vent the flood tank or would he do it only if he had some indication that the isolation valve that was in place was not closed?

MR. HUGHES: It is certainly the designer's expectation that he would only vent the tank where he had indication that the valve was other than in its expected position.

MR. JENSEN: So, then, there would be some indication, then, on this flood tank?

MR. HUGHES: Now, the specifics, Mike, do they have a position indication?

MR. GERDING: Right. The

core flood tank outlet valves have indication provided both from geared limit switches on the motor-operated and stem model limit switches, both inside the control room.

MR. SLADE: Also there's indirect indication in that for a slow leak you would see a reduction in the core flood tank level which would cause another alarm to alert the operator to the fact that he had a problem, correct?

MR. PRATT: For a slow liquid leak.

MR. SLADE: Yes, as the level of the tank went down, there's also another alarm to the operator that identifies to him that he has a problem.

MR. PRATT: Or low pressure.

MR. GIBSON: I think the practice scenario, it is a cooldown scenario that we're concerned about where that valve fails to close when you ask it to. It's one where you are deliberately causing the pressure to come down in the plant and those core flood tanks will start to bleed in. They won't blast in because your pressure differential is starting at zero and increasing, so I would envision, like Jerry says, if you started to see a lack of position by two sources, a level decrease followed by a low level alarm, you would have indication that your tank was starting into the system and that's when you'd start into this venting, I would think. I haven't done it.

MR. SLADE: Normally during a shutdown sequence, again we're talking several hours into the sequence, normally during the shutdown sequence, by that time the operator -- the control center has quieted down from all of the alarms that flash on immediately. He's pretty well resolved what his status is at that time.

MR. HUGHES: Jim, based on time, I'd like to suggest, in a couple of minutes, that we do break for lunch. Are there some more questions we might --

MR. COOK: I had hoped that we, you know, could resolve the questions on this area because we need to get onto the other presentations. I would like to ask the board if there are any burning questions they would like to get in as one last shot?

MR. SLADE: I have one burning question and last shot.

MR. COOK: Burning?

MR. SLADE: That arose as a result of another question and that is that if we are required to have sixteen thousand gallons per unit available, that was -- what did you say -- one, two tanks?

MR. PRATT: Just less than two tanks.

MR. SLADE: Oh, it's less than two tanks?

MR. PRATT: Right, of the three.

MR. SLADE: All right. My burning concern just went away.

MR. COOK: All right. How much do we allow for lunch here, and I think we better be brisk about it.

MR. HUGHES: I'd really like to get back here at 1:00 if we break right now, because we have a lot more to cover and would like to plan on, if there is no further questions on this section, we start on --

MR. COOK: Start right in.

MR. HUGHES: Fine.

MR. COOK: One o'clock?

Thank you, gentlemen.

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CERTIFICATE OF NOTARY PUBLIC

I, Susan A. Simpson, of the firm of HURON REPORTING SERVICE, a Notary Public within and for the County of Wayne, State of Michigan, dc hereby certify that I reported stenographically the foregoing proceedings consisting of (167) typewritten pages and is a full and correct transcript of my stenographic notes so taken.

DATED: May 3, 1981

Susan A. Simpson
Certified Shorthand Reporter