SYSTEM REVIEW

of the

PALO VERDE NUCLEAR GENERATING STATION

AUXILIARY FEEDWATER SYSTEM

Before the

AUXILIARY FEEDWATER SYSTEM REVIEW BOARD

VOLUME I OF II

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The Auxiliary Feedwater System Review Board of the Palo Verde Nuclear Generating Station convened in Navajo Room A, Adams Hotel, Phoenix, Arizona, on the 21st day of August, 1980, Mr. Edwin E. Van Brunt, Jr., Vice-President, Nuclear Projects Management, Arizona Public Service Company, Presiding.

MR. VAN BRUNT: For those of you who don't know, my name is Ed Van Brunt. I am Vice-President of Nuclear Projects Management for Arizona Public Service Company. I am the officer responsible for the engineering design, construction, and quality assurance for the Palo Verde Nuclear Generating Station.

The purpose of today's meeting is to perform a system review of the Palo Verde Nuclear Generating Station Auxiliary Feedwater System. The concept of performing a system review was developed in a number of meetings between representatives from APS and Bechtel and Combustion Engineering and the NRC Director of Nuclear Reactor Regulation, Dr. Harold Denton. With this concept, the design of a specific plant system is thoroughly reviewed for adequacy of design and compliance with regulations by Bechtel project personnel in the technical disciplines associated with it. As you know, Bechtel Power Corporation is the engineer-constructor for the Palo Verde Plant. The system review is then formally presented to a review board of

technical experts for their concurrence. Participation by Nuclear Regulatory Commission personnel in this presentation is encouraged and we believe should aid in their understanding of the system design bases, detailed design, construction and operation, thereby minimizing, if not eliminating, the review manhours required for that particular system.

As a result of the discussions that we had with Dr. Denton, APS has performed to date two system reviews, one for the DC power system and one for the AC power system associated with Palo Verde. The first system review was performed here in Phoenix. That was on the DC power system. The second review of the AC power system was done in the Nuclear Regulatory Commission offices in Bethesda, Maryland, to provide an opportunity for greater participation and observation by NRC management and staff. As you all know, today we will be performing a system review of the auxiliary feedwater system.

The Bechtel project staff have prepared the auxiliary feedwater system review and will present it in two parts. The agenda for the first part, to be presented today, will include the system overview, layout and operation, and the standard review plan acceptance criteria compliance. The second part, which will be presented tomorrow, will discuss the reliability study which was performed in compliance with NUREG-0635, which is entitled Generic Evaluation of Feedwater Transients and

Small Break Loss-of-Coolant Accident in Combustion Engineering Designed Operating Plants.

Bechtel will prepare formal responses to any open issues defined by the Review Board during this auxiliary feedwater system review. These responses will be reviewed by the Review Board for their concurrence. When the final resolution of these items is accomplished, they will then be forwarded to the NRC.

For today's review of the Palo Verde auxiliary feedwater system, we have assembled a review board with a varied background due to the complexity of the system being reviewed. This board includes members from the following general areas of expertise: overall project management, licensing, auxiliary feedwater system design, reliability analysis, and mechanical systems design background. Since the responsibility for an adequate review lies with the applicant, i.e., APS, the board's basic formation starts with APS personnel, complemented with personnel from other groups who have expertise and experience not necessarily available within APS. Board members were provided with appropriate sections of several documents to familiarize themselves with the Palo Verde auxiliary feedwater system. These included sections from the Palo Verde FSAR, the Palo Verde Systems Description Manual, NUREG-0635, Palo Verde Auxiliary Feedwater System Reliability Evaluation, and the Standard Review Plan for the Auxiliary

Feedwater System which is promulgated by the Nuclear Regulatory Commission.

At this time, I would like to introduce the members of the board, give you a little bit of their background and why they were selected, and then I will have Bill Bingham, who is the Project Engineering Manager for Bechtel for the Palo Verde Project, introduce the Bechtel project representatives.

John Allen, who is sitting over here, is one of the two APS Nuclear Engineering Managers and reports directly to me. John is responsible for the areas of electrical engineering, instrumentation and control, licensing, and health physics. He is also responsible for our Records Management Section.

Carter Rogers, who is sitting here to my left, is the other APS Nuclear Engineering Manager, who also reports directly to me. Carter has responsibilities for mechanical engineering, chemical engineering, civil engineering, nuclear fuel and other nuclear-related items. Bill Quinn, sitting over here, is the Supervising Licensing Engineer. Bill reports to John Allen and has responsibility for all licensing matters and coordinating the day-to-day interface with the Nuclear Regulatory Commission's assigned project manager. Mike Hodge is a Supervising Mechanical Engineer who reports to Carter Rogers. He has been responsible for the review of the Palo Verde mechanical systems for APS and the day-to-day interface with Bechtel and Combustion Engineering personnel involved in

those systems. This would obviously include the auxiliary feedwater system. Norm Hoefert is the Operations Engineering Supervisor in the operating department for the Palo Verde Nuclear Generating Station and is responsible to the Engineering and Technical Services Superintendent for mechanical and electrical engineering support, including monitoring station performance and the in-service inspection program.

We have also asked Dale Thornburg, sitting down here, Senior Consulting Engineer with Arizona Public Service Company's Generation Engineering Department, to participate as an independent member from APS on this board. Dale is not directly involved in the Palo Verde project, although from time to time, he has been utilized as a consultant in various areas. He has been with APS for some 30 years and has been involved in the design and construction of most of our fossil power plants and is particularly knowledgeable in mechanical system design.

Two of the review board members are from Bechtel's Engineering staff in their Norwalk office. These representatives are Angie Ortiz, Chief Mechanical Engineer, and Sheldon Freid, Nuclear Staff Group Leader. They also are not directly involved in the design of the Palo Verde project; however, they may be used as consultants by the Bechtel project staff as appropriate.

Representing Combustion Engineering, the Palo Verde Nuclear Steam Supply System's supplier, are Mike Barnoski,

Palo Verde Assistant Project Manager, and Rick Turk, Supervisor of Primary Systems and Special Projects. Mike reports directly to the Combustion Engineering Project Manager and is responsible for the CE interface with Bechtel project staff, especially resolution of balance of plant-nuclear steam supply system interfacing problems. He is also responsible for CE interface with APS, providing licensing support, technical support and liaison with the Combustion Engineering plant engineering staff. Rick Turk works in the CE Plant Engineering Department and has not been directly involved in the design of the Palo Verde project. However, he has been involved in the design of auxiliary feedwater systems for CE on other projects and was also responsible for the reliability analysis of San Onofre's auxiliary feedwater system.

To provide added expertise on the board in the relatively new area of reliability analysis as applied to nuclear plants, APS has asked Dr. Boyer Chu, of the Electric Power Research Institute, to participate on this board. Dr. Chu is a Project Manager in the Risk Assessment Group of the Nuclear Safety and Analysis Department of the Nuclear Power Division of EPRI. Dr. Chu has extensive experience related to nuclear power plant reliability, availability and safety. One of his recent projects related to this meeting was a reliability evaluation of the auxiliary feedwater system

of TVA's Sequoyah Nuclear Power Station. He is now involved in a TVA-EPRI joint effort evaluating Sequoyah's full plant safety and reliability.

Ralph Phelps, from Southern California Edison Company, is also a member of this review board. Ralph is a Nuclear Projects Group Leader for Southern California Edison and he was directly involved in San Onofre's auxiliary feedwater system modification. It should be noted that Southern California Edison Company is one of the participants in the Palo Verde project, and this is one of the things that gives us added expertise from time to time when we need it.

The Nuclear Regulatory Commission has sent a number of representatives to observe and participate in this system review. Olan Parr, who is the Auxiliary Systems Branch Chief, is present and will sit on the board, and, Olan, if you would, I would like you to introduce the members of your group and maybe tell us a word or two about their backgrounds and what their participation will be.

MR. PARR: All right, fine. To my left is Jerry Wermiel, who is the reviewer for this project. Jerry and I are, I suppose you might say, the official members of the panel. However, we have other people here. Nick Fioravante and Lynda Huang, back near the wall, are from my branch. Additionally, we have Pat O'Reilly, from the Reliability and Risk Assessment Branch, here. Pat in turn has consultants

from the Sandia Laboratory. George Bradley is here already and I understand Greg Kolb will be here shortly. One last person is Herman LaGow back here, who is a consultant to Harold Denton and more specifically to me in the holding of such meetings as this. As I said earlier, Jerry and I are the official panel members. However, we may vary that. Specifically tomorrow when we get into the reliability portion we will bring up the people from Sandia. That's all.

MR. VAN BRUNT: Thanks, Olan. We will provide a transcript of this review to the Nuclear Regulatory Commission and we have already done that as far as the DC power system is concerned, as soon as we have received it from the court reporter and proofed it and made the necessary corrections. For the benefit of the court reporter, I would ask that the review board members or anyone else who makes a statement during these proceedings please identify themselves before making any statements. We encourage the Nuclear Regulatory Commission representatives present to participate in this review. At the completion of the review, the open items which have been identified will be reviewed and, when agreement on their scope has been reached, Bechtel or other responsible organizations who might be designated will then prepare responses which will be sent to the members of the board for their review, comment and ultimate concurrence. Then, as I said before, we will submit those responses to the NRC as well.

In this connection, I would ask that Bill Quinn, out of my staff, and Gerry Kopchinski, of Bechtel's project staff, act as the secretaries for collecting the specific open items and we will use them as a checklist against each other to be sure we haven't missed any as we go along.

Bill Bingham, based on our experience from the past couple of meetings we had, I would request that the review board and the NRC be allowed to ask questions at the close of each section of your presentation. Also, whenever anybody is referring to some figure or something, that they refer to the number on that figure so that when you read the transcript, you can make some sense out of what is going on. Otherwise, you won't realize what anybody is talking to.

With that, if there are no questions from the board or anything else, I will turn it over to Bill Bingham to introduce the Bechtel project staff and then we will proceed with the review. I would anticipate that we will go until about 10:30 and then take a short break to let the reporter take a breather and then continue until about noon. That is when lunch is, is that right, Terry?

MR. QUAN: Yes.

MR. VAN BRUNT: Bill, it's all yours.

MR. BINGHAM: Thank you, Ed.

My name is Bill Bingham. I am the Project Engineering Manager for Bechtel. As Ed Van Brunt indicated,

we are here today to present the auxiliary feedwater system at the third formal meeting of the PVNGS Systems Review Board. I have with me today Dennis Keith, who is Assistant Project Engineer for Bechtel. Dennis has been involved in the auxiliary feedwater system from the inception of the design and establishing interfaces with Combustion Engineering. He has also chaired the ANS Subcommittee 51.10, which was to develop auxiliary feedwater criteria. Also assisting us today is Gery Kopchinski. Gerry is the Engineering Group Supervisor for the nuclear discipline and responsible for our contribution to the licensing effort. We also have with us Bill Boles, Mechanical Engineer, who is now responsible for the system and is very familiar with the details of the design so that we can provide any information and hopefully answer all questions that the board may have today on the system.

As Ed mentioned, the presentation will be conducted over two days. There is a considerable amount of material that we want to present and it will be presented in a form to give you a system overview today plus a comprehensive review and comparison of the design with the Standard Review Plan Acceptance Criteria. Tomorrow we will discuss in detail our NUREG 0635 reliability analysis. As the board is aware, we have had meetings with NRC and they have expressed concern that our system may not meet their present criteria for such systems as presented in ASB 10-1, auxiliary feedwater system

diversity, and, further, that it may be necessary to add a fourth auxiliary feedwater train to the system. As a result, we have performed a reliability analysis of the present Palo Verde auxiliary feedwater system and also three modifications of that system to present a comprehensive overview of the reliability of the system as it presently exists and to provide the board with an estimate of potential increased reliability for various enhancements. That information will be presented tomorrow to you.

I would also like to indicate that there have been new requirements since the FSAR presentation for this system, and I would also like to indicate that where we have determined through the review of the design that we don't comply or as a result of the work that we have done to put together this presentation have found areas that need modifying, we have been working with APS engineering and have been making the proper and mandatory modifications. You will hear this a little later through the presentation both today and tomorrow.

At the past system review meetings, it was clear that there was a necessity for me to spend some time to take you through, at least for the board and the observers, an overview of the system design and how it is conducted for Bechtel to assure that the design meets the established requirements. I think also important is that I spend a few

minutes on how Bechtel has prepared for this particular presentation and others that we will do subsequently. Most of the information that you are going to hear today is information that we have discussed with APS over the last six or seven years of the project in various meetings that we have had, various interchanges of correspondence. However, it is not easy for one to quickly pull together all the information to have a complete overview. We have spent about two months, maybe two and one-half months, on this system to go back through the various meetings that we have had and the correspondence and the reviews that have been documented and pulled the information together today to make it easy for the board to understand the design and how the design meets the established criteria. On Figure 1, I have shown the PVNGS Design Development and, as we have indicated to the board before, all of the work kind of centers around the design criteria, which basically we call the hub of the design. This is a set of criteria that is reviewed and approved by the owner and establishes the scope of the system. These three volumes labeled Design Criteria Manual Palo Verde Units 1, 2 and 3 shown here reflect all the design criteria for the plant. This is a dynamic document. It is updated as new criteria are determined necessary to incorporate into the plant and it is the document that is used to reflect the design of the plant.

As you can see from this chart, there are utility or the owner-applicant's specific input requirements for the plant. There are standard NSSS System 80 at this point, interface information to develop the plant information that is fed in. There is from that then information to the licensing documents, development of a standard design, and then, of course, feedback with the regulators. From that, we develop the procurement specifications, system descriptions, schedule, construction specs, and so forth. Also from the design criteria comes the plant arrangement through the use of the model. On this project, for those who don't know, there is a three-quarter inch to the foot scale model of all of the power blocks. Then, of course, from that we go to our detailed construction drawings and planning photographs. The final input to the design criteria covers the schedule, licensing input, basic criteria, and P&ID's. So what we have then is one set of documents that establish the criteria. From that set, we put our descriptions into the licensing documents and, from reviews, we keep it current.

This process generally takes two or three years in order to assure that the design is correct and reflects all of the requirements. We have several multi-discipline reviews This is where the different disciplines get together either at the model or at the reviews and analyze the systems, looking at the design, looking at safety, separation, and all the

criteria to assure that the system does meet the criteria established. As I indicated earlier today, we are going to spend time to tie all of these reviews together and I believe that we will be able to demonstrate to the board that the system as designed does meet the criteria.

Our agenda today is going to have a system overview, and what I am going to ask is that we hold our questions on the presentation until we complete each of these subheadings design criteria, operation, layout, and I will ask for questions then at that time. That will probably take most of the morning session. Second will be the review of the acceptance criteria, and again I would request that at the end of each of the headings that we entertain questions. We will at the end summarize for the board basically what we are going to present tomorrow on the reliability study, and tomorrow again we have given you the major headings under that when we will ask the board for questions.

I believe with that introduction, I would like to ask Dennis Keith if he would start the presentation.

MR. KEITH: First, starting off with design criteria, I wanted to just tell you briefly what our system consists of and then relate the design criteria to the system. (Figure 2)

We have three auxiliary feedwater pumps in our system. Two of them are safety-related pumps, one turbine-driven pump, one motor-driven pump which is capable of being supplied

by the diesel generator, and a startup auxiliary feedwater pump, which is currently capable of receiving power from the turbine generator or from offsite power only. The two safety-related pumps are used only during emergency conditions. The startup auxiliary feedwater pump is used during the normal operation conditions of startup, hot standby, and shutdown. The nomenclature we have used in the PSAR and the FSAR is to call this, just the whole system, the auxiliary feedwater system and we have called these the safety-related auxiliary feedwater pumps and this one, I believe the term we use is nonsafety-related auxiliary feedwater pump or startup in the FSAR. For the presentation today, we thought it would be simpler -- the way that the slides are labeled and hopefully we titled them -- to call the two safety-related auxiliary feedwater pumps emergency feedwater pumps and the pump used for startup, hot standby, and shutdown operation will be called the startup auxiliary feedwater pump. So if you are not already confused, I hope that will simplify things. This is in conformance with the CESSAR terminology that is in the Combustion Engineering Standard Safety Analysis Report which is referenced in our FSAR. Combustion refers to the emergency feedwater system, it would be these two trains which would be applicable in our system.

To get into the design criteria, this is Exhibit 1A-1, the auxiliary feedwater system shall provide an

independent means of supplying feedwater to the steam generator in addition to the main feedwater system and will have a sufficient reserve of feedwater to maintain a hot standby condition for eight hours and have sufficient feedwater to take you to a cold shutdown condition. This is generally done at 75 degrees an hour maximum cooldown rate.

Our emergency feedwater trains are designed to withstand a safe shutdown earthquake. They will remain functional during and following the safe shutdown earthquake.

The startup feedwater train, as I said earlier, is providing feedwater during the conditions of startup, hot standby, and shutdown. This system is designed to remain functional following an OBE. We will get into the details of our seismic design classifications that we use on the project later.

On Exhibit 1A-2, the emergency feedwater pumps are designed to Section III, Class 3, criteria. As a consequence, they also meet Section XI. All the applicable parts are accessible for the in-service inspection requirements of ASME Section XI. We also meet Hydraulic Institute standards and American Petroleum Institute Standard 611. Let me just clarify. We have on this slide in parentheses that we meet CESSAR and then the section of CESSAR. As you know, in a standard safety analysis report, there are various interface

requirements which must be met by the utility referencing a standard safety analysis report. These numbers refer to CESSAR interface requirements. You will see that throughout the presentation.

Exhibit 1A-3. The piping from the condensate storage tank to the auxiliary feedwater isolation valve, that is here up to here (indicating) on both trains and also the crossover to this valve (indicating), meet the requirements of ASME Section III, Class 3, and from the downstream isolation valves to the steam generators, the piping and other equipment in the line meet the requirements of ASME Section III, Class 2.

Our steam turbine receives steam from both steam generators and the piping to the turbine meets the requirements of ASME Section III, Class 3. Up to this point (indicating), it is Section III, Class 2.

This is Exhibit 1A-4. All the other piping and valves which we haven't discussed yet meet the requirements of ANSI B31.1, and, in general, our system is arranged such that we meet the requirements of OSHA, the Occupational Safety and Health Act.

As I said earlier, during normal type conditions, these pumps are not in operation, and by normal plant conditions, I am including the conditions of startup, hot standby, and shutdown as well as normal operations where the reactor is producing power.

The emergency trains, these two pumps here and two trains (indicating), are designed to meet Seismic Category I requirements.

Our trains consist of one 100-percent capacity electric-driven pump and one 100-percent capacity steam turbine-driven pump, and we will get into more about the power supplies to those pumps later. The startup pump, as I said earlier, is a motor-driven pump receiving power from offsite and the turbine generator.

Exhibit 1A-5. The requirements on the emergency feedwater pumps are that they actuate automatically upon receipt of an auxiliary feedwater actuation signal, an AFAS. In CESSAR, you may see the terminology later, CESSAR refers to this as an EFAS. It is the same signal. In that case, it is an emergency feedwater actuation signal. This logic is provided by Combustion Engineering. The logic for the AFAS is such that the emergency feedwater pumps will start automatically during the following accidents: A main steam line break, loss of main feedwater, loss of offsite power, and loss of offsite and onsite AC power. During the latter condition, only the turbine-driven pump would be available. It would start automatically.

The startup feedwater pump is manually actuated and, as we have said, used during the conditions of startup, hot standby, and shutdown.

The motor-driven emergency feedwater pump, this train and these valves (indicating), is capable of receiving power from the onsite or standby diesel generator, so that we have that available in the event that we don't have the turbine generator and offsite power available.

This is Exhibit 1A-6. Now we are getting into the power supply to the turbine-driven emergency feedwater pump. All the valves in this train (indicating), the motor-actuated valves, and the crossover valves to feed the other steam generator from the turbine-driven pump and the steam admission valves and all the controls associated with the turbine, all receive power from the DC bus so that we can meet the previous design criteria, which said that this pump would be operable during a complete loss of AC power. As you can see -- well, let me just tell you, and you can see from the arrangement, but the power supplies and all to these two trains are completely independent so that we can take a single failure anywhere in the system and still feed both steam generators from the other train. We also, between these two trains, have complete physical separation between the two pumps, and we will demonstrate that and show our plant layout later on in the presentation.

Exhibit 1A-7. The requirement on our emergency feedwater pumps is that they have the capability to feed 875 gallons per minute to the steam generator at the accumulation pressure of the lowest safety valve. It also operates at

pressures down to 135 psi, and we have low pressure alarms on the discharge at the pump to alert the operator in the event that we are approaching a runout condition on those emergency feedwater pumps plus meet all those requirements.

The requirement on the availability of the pumps in the event of an auxiliary feedwater actuation signal, they must be available within 10 seconds when offsite power is available and within 45 seconds when offsite AC power is not available. That is giving us time for the diesels to come up to speed, the latter requirement.

We have another requirement which is after initiation of auxiliary feedwater flow, there be no decrease in the flow rate for any reason other than as a result of normal operation of the auxiliary feedwater controls, and there is nothing in our control logic to decrease the flow. You can take manual control of these valves and jog them to an intermediate position, but that is only done when the operator has determined that the situation is under control and we have adequate flow to the steam generators.

This is Exhibit 1A-8. As I stated, the AFAS does automatically control the level to the steam generators by opening and shutting these valves as appropriate. There is no modulation. It is a complete open and complete shut on those valves. So the level is maintained between the bands, the set points, of the AFAS. However, as I stated, the operator can when he has determined that the situation is stabilized

take manual control of these valves and put them in an intermediate position so that the valves are not going at the full open, full shut positions.

As I stated earlier, we do have means, accessibility and all, to meet all the requirements of Section XI for in-service inspection and for testing of the components in the system.

In the unlikely event that we would have to evacuate the control room, we do have controls for the emergency feedwater pumps at the remote shutdown panel. This is a panel in the control building which is remote from the control room where the operators can go and control the auxiliary feed-water system and maintain the plant in a hot standby condition.

The primary source of water for the auxiliary feedwater system is the condensate storage tank. We will be describing this tank in more detail later. It is a Seismic Category I tank. A secondary source is the reactor makeup water tank. This can be manually tied into the system in the event we reached a low level condition in the condensate storage tank.

We have a continuous minimum flow line on each of the pumps to prevent overheating so that you have recirculation in the event these valves shut. The pumps operate continuously while these valves are opening and shutting. When these valves are shut, we have these miniflow lines with the locked open

valves going back to the condensate storage tank to prevent the pumps from overheating.

Exhibit 1A-9. Our system ties into the feedwater system, and this auxiliary feedwater system in conjunction with the main feedwater system is designed to prevent waterhammer transients. These are interface requirements in terms of routing of the piping and all that we meet to avoid a waterhammer condition.

The next requirement is that the auxiliary feed-water system have double isolation from the main feedwater system during system operation, and that is the case with these two isolation valves in the lines.

The auxiliary feedwater temperature as applied to the condensate storage tank must be at least 40 degrees and less than 180 degrees. In our climate here, that is no problem and we meet that interface requirement.

The next requirement is that we have 300,000 gallons available, and that is what is required to support the earlier design criteria we mentioned of being capable of remaining at hot standby for eight hours and then cooling down to the initiation of shutdown cooling. The 300,000 gallons are shown here (indicating) in the condensate storage tank.

This is Exhibit 1A-10. The CESSAR interface requirement is that if the emergency feedwater system is used during startup condition, which is the condition we are

concerned about here, when steam generator pressure is very low, it must have some means of assuring that were the pumps to be operated in that condition that we would not damage the pumps. Our emergency feedwater pumps are not used, as I have stated earlier, during startup conditions when we have that low pressure in the steam generator condition. It is extremely unlikely during those conditions that it would be possible to have an auxiliary feedwater actuation signal. If one did, we do have the alarms which I mentioned earlier on low pressure to alert the operator that we would have a potential runout condition on those pumps.

The next interface requirement is that we have no automatically actuated valves located upstream of the MSIV's except as required to supply steam to the steam-driven emergency feedwater pump, and also that we prevent blowdown of both steam generators through those emergency feedwater pump lines. There are no automatically actuated valves upstream of the MSIV's. The logic on these valves is such that only one of the them can be operated at a time, so these valves do not open simultaneously.

Exhibit 1A-11. Let me now talk just briefly about our quality class designations that we use on the Palo Verde Project. We have three quality class designations, Q, R, and S. Class Q applies to all our ASME Section III components, all of our Seismic Category I equipment, all of our Class IE equipment on the electrical side, and for all those Quality

Class Q items, the quality assurance program meets 10CFR 50, Appendix B, and ANSI N45.2.

Our next quality class, Quality Class R, consists of items which are important to keep the turbine generator on line, keep the plant producing power, and also important to safety of personnel. For Quality Class R items, depending on the item, we invoke certain of the criteria of 10CFR 50, Appendix B. We do have a formal quality assurance program, but it doesn't meet all of the components of the 10CFR 50, Appendix B.

Quality Class S applies to our other equipment, and this is industry standard off-the-shelf items, so there is no quality assurance program as such with our Quality Class S program.

Exhibit 1A-12. In our seismic categories, Seismic Category I, everything that is Quality Class Q is Seismic Category I. Similarly, in Seismic Category I, as you know, are things designed to remain functional during and after a safe shutdown earthquake.

Seismic Category II applies to all the Quality Class R items, so everything that is R is Class II and vice versa. These components are designed to remain functional during and after an OBE.

We also have another seismic category, Seismic Category IX, and this applies to items which in the event of a

safe shutdown earthquake could become dislodged or collapse or something and possibly damage some of our Quality Class Q items, so these items are designed to remain intact or cannot collapse following a safe shutdown earthquake.

Let me show just to relate our seismic categories to the system and consequently the quality class, also. Our startup feedwater train, as I said, was designed to remain functional following an OBE, and it is designed to Quality Class R and Seismic Category II. The startup feedwater pump, as we will see shortly, is located inside the turbine building and our turbine building is designed as Seismic Categories II and IX. It will remain functional following an OBE and it is checked that it doesn't collapse following an SSE.

That concludes the design criteria portion.

MR. BINGHAM: Thanks, Dennis.

Are there any questions at this time?

MR. VAN BRUNT: Bill, could I suggest that to break the question into two parts might be helpful. One, if you go back to your initial remarks and the slides that you use there, see if there are some general questions about the overall development of the criteria and then get into the specifics of the various items, it might be helpful.

MR. BINGHAM: Why don't we do it that way. It might take care of a lot of redundant questions.

Are there any questions on that?

MR. ALLEN: I have one, Bill. On your initial slide here, it is obvious that there is a lot of interdisciplinary cooperation in the design of this. How do you ensure that, for example, your instrumentation control people are involved in design and know the problems that the mechanical people are having, and the same with your electrical people?

MR. BINGHAM: In the early phases of development of the design, John, I have conducted several review meetings not unlike what we have here where I bring together the whole team and we, for example, review the P&ID, which is basically the diagram that describes the system. We have the preliminary design criteria that we review. We hold a meeting where the responsible engineer, an individual like Bill Boles, will get up and present the particular system going through much of the sort of things that you have heard us discuss in some of our previous system reviews. At that meeting, there is a critique by usually representatives from our chief's office to get the overall perspective of input from many of our jobs and, secondly, the project related inputs. So what we have then is the mechanical engineer describing the system, indicating his or her understanding of how the system is to perform and what actuation signals are coming to it and their understanding of the regulatory commitments in the PSAR. Generally through these discussions, these open discussions, we find that

they are developing a better understanding of all the various people that have input, such as electrical and controls people, as well as the nuclear people, who particularly look after the licensing commitments and the regulatory guidelines that exist at that time. So what we do then is we call this a multi-discipline review where we review the basic criteria and how the design is being formulated. That is in the early days.

Carrying that on a little bit further, we are very concerned about the physical development of the particular system; that is, have we properly looked at such things as high energy line break, have we looked at separation of the safety trains, have we assured ourselves that we don't have a conduit or cable from one train crossing into the room of another train and so forth. These reviews are conducted then on drawings as well as on the model where we lay out the system, and you will see some pictures of the model of this particular system later on today, and from that we document all of the information and pass it back through the groups for final review of the information. I think that this gives us a broader perspective then of how the total system is integrated and constantly encourages the various disciplines to make sure that they have given their inputs and they understand the inputs and have reviewed the interfaces provided by CESSAR with Combustion Engineering in this particular case.

MR. ALLEN: Does that go back up then to the chief engineer, as you said?

MR. BINGHAM: Yes, many times, and, of course, depending on what system we are talking about, the operations will end up in a chief's review of the system.

MR. FREID: Bill, one of the things we noticed in previous reviews, and I have just noticed one on this one, too, sometimes the information presented at these review boards are updated versions of what are in the FSAR. Are those going to be denoted at these review boards and how do we get that back into the formal licensing document?

MR. BINGHAM: The answer to that question, of course, is yes. I believe in my introductory remarks, Shelley, I indicated that we would indicate to the board those areas where there have been modifications as a result of our further work from the FSAR commitments and description of the systems, and then also as a result of the work we have been doing to pull together the presentation for today both in the systems overview and comparison with the SRP's and reg guides and technical positions and the work that has resulted from our reliability analysis of the particular system, which as you probably know is new work that is being done by many of the utilities throughout the industry. So to answer your specific question, we meet with APS engineering, review these particular issues, and from these meetings develop a course of action for

incorporation in an appropriate manner these items that we have found in our recent studies. They then will be reflected as a design criteria change and will be incorporated into the design.

MR. VAN BRUNT: Bill, as you pick up an item here, what is the formal process you go through to assure that that item does in fact get factored back into the FSAR, which from a regulation viewpoint is the document that will control the future changes that are planned, the operation, and other things?

MR. BINGHAM: We have a system, Ed, that when we initiate a change to the criteria, one of the boxes on the sheet indicates is an SAR change required. That is reviewed by our Nuclear Group Supervisor to determine whether that has been interpreted properly by a discipline. To take an example Bill Boles determines that there is a particular feature, a valve or something, that wasn't properly handled in the system and that we really hadn't established criteria properly. He will indicate what we call a design criteria change request indicating the change and that will go to the Nuclear Group Supervisor, Gerry Kopchinski in this case, for review, and he'll say, "Yes, check off the box; that indeed is required." The change then goes through the other appropriate cycles for approval, is incorporated, and there is another system that takes those and says from this information, then we must assure

that this gets in the licensing document. That becomes Gerry's responsibility. We have the other side of that that occurs, and that is that if there is a licensing change that is noted for some reason, there will be an SAR deviation form which is written, and on that it will check whether the design criteria has to be modified. It goes through the proper line of approval including a sign-off by APS and then it is the responsibility of the responsible engineer to put it in the design criteria. So there are cross-checks to make sure that any of these changes between the licensing documents and the design criteria are matched and there is a closeout on each of those.

MR. ROGERS: Bill, the importance of the design criteria is evident. In order to get the design criteria initiated properly, you get input from the utility, you get input from major contractors such as Combustion Engineering. I wonder if you would describe how you would receive that input and what assurances are made and how the assurances are made that Bechtel has understood the criteria input from balance of plant interface requirements that Combustion might have or utility requirements. How is that initially made and how do you ensure that as time goes on those criteria are implemented properly in the design?

MR. BINGHAM: That's a mouthful. Olan?

MR. PARR: Could I add just a little bit?

MR. BINGHAM: Yes, a little more.

MR. PARR: How does Combustion, as an example, review how you have interpreted these criteria that you got from Combustion, as an example?

MR. BINGHAM: Let me take the two separately. I'll talk about the utility first and then I'll talk about the utility and Bechtel and Combustion interface, because there has been quite a bit of emphasis on the part of assuring this interface works properly, particularly by Ed, throughout the life of the project.

On the utility inputs, generally what we have is a letter or result of discussions with the utility that says these are our particular requirements. I am talking from the beginning, the inception of the particular job. For example, they may say, "I want a system that has 100% reliability," or "I want a system that --" excuse me, 90% reliability, or availability -- I am sure you would like 100%, but it is not quite achievable -- or they may have some particular requirements for the layout of the plant, and that information will come to us. We will apply it to the design and then we will send it back to the customer in the form of preliminary drawings for their review. That is followed up by subsequent meetings and presentations. I would guess that over the life of this project that we have probably had over 100 presentations by Bechtel on how we interpret and have included the

criteria set by the utility into the design of the plant. They then have the opportunity to review that, to offer comments and suggestions, and the result is then that the design that we submit to the utility has had their review, and for key documents such as general arrangements, P&ID's, single lines, design criteria, system description, the customer reviews those and assures themselves that the documents are in order.

MR. VAN BRUNT: Bill, just to carry that further before you go into the others, are those reviews documented and the resolutions of any differences of opinion, and so forth like that, documented as well, and how?

MR. BINGHAM: Generally, there usually aren't differences of opinion when we get all done with the review. I mean that is the objective. I think over the project that there may have been one or two cases that I can remember, and in that particular case, there are special letters that have been written to document the particular disagreement.

MR. VAN BRUNT: What I was really thinking about is you have had these 100 or more meetings, I would expect it is more than 100, wherein a particular system, take the aux feedwater system for example, is reviewed in some detail. Are the results of those meetings and any open items that come up documented in some form and then is there some mechanism to ensure that whatever the area of concern is is in fact finally

resolved and put to bed?

MR. BINGHAM: Yes, there is. We write minutes of each of our meetings not just with the utility, but generally with every vendor or with regulatory agencies that we are involved in. At those meetings, we will discuss the outcome of the particular subject and with it is an action item that has a date for responding. We flag the responsible party and then we have a system to track in very great detail the results of those outcomes. We have a system that closes out each of these items. It is tracked. It is all computerized and there is a small roomful of printouts that if one really wanted to, they could track these things from the inception through the completion of the particular review.

Let's get on to the vendor. In particular, I think, Carter, you asked about Combustion Engineering in this case, although many of the comments I would give pertain to other vendors as well. With Combustion Engineering, through the standard System 80 documents, we received early on a volume called their standard or SEP, Standard Engineering Package, and that gave the basic criteria for the particular interfaces that we had to provide. Subsequently, through the CESSAR-P, interfaces were established that we used, and, of course, as most of you know, CESSAR-F now has the final interfaces that Bechtel is using for design. These interfaces are taken by us and incorporated into the design. We have

then set up a system that is computerized whereas all of the information that affects CE, that is, all of the drawings, all of the key documents, are flagged in our document control system and those are sent to Combustion Engineering for review. They review them and reply back formally to us any comments that they may have. This is a system that APS has implemented contractually. It is a system that works extremely well and I think generally we have had very good success with making sure that Combustion Engineering and Bechtel truly understand the intent of the interface requirements. There is also a utility involvement, kind of an overview of what the two organizations are doing, to make sure that conflicts are readily resolved and that the project moves on smoothly.

MR. VAN BRUNT: Bill, I might ask again in that context what is the documentation of this interface review and has that been subject to audit from time to time by either your organization or mine or CE's?

MR. BINGHAM: The documentation is in the form of letters. There is a transmittal letter that goes to Combustion Engineering and on the bottom of the letter is a place for them to sign when it is received. We assure that those are closed out through the system that we have in our document control. In other words, the drawings come in and are issued. In our document control procedures, it has a flag

to tell whether it goes to Combustion, the letters go out to Combustion with proper signoff by our people, and the return then is monitored to assure that it has come back. I am not sure whether APS has audited that particular issue, Ed, but I do know that we have from time to time looked at the process.

MR. ROGERS: Bill, you have mentioned meetings and correspondence. Can you give us an example of the types of meetings that you had, both formal and informal, and can you tell us if Combustion comes into your shop often to visit and help you with the design or that type of thing.

MR. BINGHAM: Sure. Depending upon where we are in the project, it has been our policy to set standard or routine reviews with the utility. That generally is every month, and I think without fail we have met about once a month since the inception of the project formally in what we call the design review meeting. We have also extended that concept to the particular vendors and generally, depending upon the involvement, we will meet with that vendor either once a month, quarterly, or at least twice a year during the formative phases in the development of the basic criteria. With Combustion Engineering, because of the intensive interfaces, of course because of the licensing requirements, we were probably meeting with them on the order of every two to three months. We now from the engineering side meet with them

perhaps every four or five months. Those reviews were documented. Review meetings with preestablished agendas included the utility as well as Bechtel essentially reviewing all of the information presented to make sure that it was incorporated properly in the documents and, further, many times to expedite information from the vendors, CE in this case, to meet our particular schedules for release of drawings.

In addition to that, because of the fact that System 80 was new to Bechtel, we did have the resident Combustion Engineering engineer in our offices for about three years. In the first year and one-half, we had an individual that was oriented toward mechanical and systems design so that the information when it came in in those areas at that time, Carter, would be reviewed by the individual, he would take the time out on the floor to explain how to interpret it to the individuals doing the drawings, and, in addition, would help to obtain information that was required to make the design go on. The latter part of that work was with an individual with a background in instrumentation controls and electrical areas and, as we moved through the project, then we were more focusing on the ICE area from Combustion Engineering and the individual there would then take the time to explain to the designers the logic, the interfaces, and obtain information that was necessary. We really had the meetings, of course, at the same time going on in order to make

sure that we have an overall understanding, but we also had a system to work with the individuals at the working level to make sure that the information was interpreted and incorporated properly.

MR. ROGERS: Bill, are the design review meetings with Combustion Engineering still continuing and are there other types of meetings that are being conducted to tackle such things as construction problems and these types of items.

MR. BINGHAM: Yes, there are. We still have a lot of loose ends to clean up with Combustion Engineering as well as the new issues that have resulted from the TMI, so I would say that generally about every four months we have been getting together with Combustion Engineering back in Windsor, Connecticut. With regard to the construction, there is a resident engineer at the site, I guess supplemented now by other individuals, and we conduct a Combustion-Bechtel interface in the field about every six weeks. There are some interrelationships between engineering and construction that go on in those meetings that are necessary, and we use that forum as well to assure that all the established criteria have been implemented properly and all the interfaces that occur and that affect engineering are quickly resolved so that construction can continue.

MR. ROGERS: Let's assume that the Combustion Engineering person discovers something in the field that

appears to be incorrect and it appears that a change must be made in Bechtel's design in order to meet his idea or his interpretation of the interface criteria. How would a change of that type be handled from field back to engineering and back to appropriate resolution, correction, and signoff?

MR. BINGHAM: Generally what happens is the NSSS supplier, Combustion, would issue an internal document called the FAR and that is signed by the project manager at Combustion Engineering. The project manager will write us a letter through their procedures informing both Bechtel and APS of the change that is required. That change comes in through our formal system. It automatically gets an action assigned to it and a due date. Depending upon what the issue might be, a particular discipline would take that and, if it would be something that affects design criteria, they would review it, review it with the other disciplines and their supervisors, and initiate a design criteria change request if it was for the design criteria or they would issue a drawing change notice if it was something that affected a particular drawing. Then through that avenue, it would go to the field, be recognized as a later addition, and would be incorporated into the construction. I might indicate that, being far along in construction, as Palo Verde is, particularly Unit 1, it may be something that already is built. In that particular case, Combustion or some other vendor or Bechtel would provide the

details for making the change with a document called the Design Change Package. That goes to the field, is incorporated, signed off, and comes back to the engineer to assure that it has been properly installed. Of course, you have a QC that checks it out, also. So that is kind of the overall general flow. In many cases, they are handled just a little bit different, but there are procedures to handle those.

MR. VAN BRUNT: Are there some other questions? I have a couple others in that area, but I don't want to monopolize.

MR. PARR: I have about four questions, but only one of these applies to this particular figure that is on the board at the moment. At the construction permit review, of course, at that time, it became very proper to talk about interfaces, and you have touched on them here today. There are many types of interfaces, those between the NSSS and BOP, those between the utility and how he is going to do this, that, and the other thing. Are you as the AE controlling all of these interfaces or does the applicant control some of them? A second part of that question is, Keith has touched on the fact that Combustion has many interfaces and had some in his slides, have you found that Combustion did a good job establishing interfaces or have you had to go back to them and have them modified.

MR. BINGHAM: Let me take the first one. We do for

the utility as their agent control all of the interfaces. In other words, there is one place where all the interfaces are controlled. It may be that there are particular inputs, and so forth, that come from the utility, but they do look to us to aid them in this particular area.

The second point is that we have had many, many meetings with Combustion Engineering on interfaces, and because System 80 is a new system, not the fact that it is much different, say, than a San Onofre plant, but it does have some new features, and the fact that we must become acquainted with it, and Bechtel has been extremely involved in nuclear power with many, many plants for the last few years, we found areas where we have thought that the interface as given to us by the vendor perhaps was not practical to incorporate in the design and we have asked in many cases that they reconsider and assure themselves that these interfaces are proper. I think to put it in perspective, Olan, what I am saying is that in CESSAR P, there may have been an overreaction from the NSSS supplier to provide or have the balance of plant AE provide capabilities that really pushed the problem away from the NSSS. So we said well, that's nice, but there has to be a compromise for these two, not in any event talking necessarily about safety, because the safety issue was always fairly clear. What we were talking about was how do you implement it? Where do you

establish it? What does the NSSS really do with regard to this scope? What does the balance of plant architect-engineer do with regard to their scope, and, depending on the system, it may be that the AE can do a little bit more to have the more optimum achievement of the overall safety goals or that the NSSS may have to do a little bit more to get practicality in it so that you truly can build it. So there have been many, many meetings with Combustion over several years to review these interfaces.

MR. WERMIEL: Can I assume then that where there are differences that you have developed over the course of your design from the interfaces that have been identified by CE that the FSAR or some other document to NRC reflects this?

MR. BINGHAM: Yes, that's correct.

MR. WERMIEL: In other words, when we look at the FSAR, with a reference to CESSAR we will know where there is a difference in the interface interpretation?

MR. BINGHAM: Yes. In the licensing document, we use a different color page, I think it is pink in this particular case, to flag those differences, and in the front of the document it explains where they occur and what they are. There are very few of them. One?

MR. KOPCHINSKI: I think there may be three or four.

MR. BINGHAM: Okay. It is less than five.

MR. VAN BRUNT: It used to be one.

MR. BINGHAM: It used to be one. So those are flagged for everybody understanding.

MR. ROGERS: A quick one this time. You indicated that Bechtel controls the interfaces. Is the utility involved at all in overviewing this interface?

MR. BINGHAM: Yes, extremely involved.

MR. QUINN: Bill, you have described all the inputs that were taken to develop the Design Criteria Manual and also that it is a dynamic document. Could you explain how you assure that a specific engineer in your organization is using the correct, up-to-date particular section of that document?

MR. BINGHAM: Yes. There are, I guess, about three different ways that we assure that. The particular documents are controlled on the project, updated, and are with each of the discipline group supervisors. The group supervisors are charged with assuring that their people have the proper documents in front of them as they are doing the design or are made aware of the changes. It is the responsibility of the individual responsible for the system, what we call a responsible engineer, to take that information and make sure that it is incorporated properly. There are checks and balances on that system, although that is the primary system that we rely on. We have quarterly training sessions reminding all of the responsible people on the project, and

for your information, for a project this size, that is about 70 people who form the key for the design, of the importance of this, and we also review key issues that are important for them to know at the time. Second, we have audits that we conduct internally both in engineering and in our management group to go to the individuals and to check first of all that they have the right version of the criteria in the documents and, second, they go to the designers and ask questions to determine whether or not they have the proper details at hand or they know about them. In addition, there are audits by the utility to assure that we are doing what we said we are going to do from a pure audit side, and from the engineering side, through our monthly meetings, we are constantly reviewing the information, current changes, and the implementation. So not only do we have our own internal checks and audit checks, but we have an engineering check that information is being processed properly. That is not to say that things don't slip by from time to time, but it is a quite in-depth way that we have established between the utility and ourselves of assuring that all of the changes are implemented properly.

MR. VAN BRUNT: Do we have some other questions? Anybody on the board? I have one other, but it is in a different area entirely.

Bill, let me just ask one other area. Then I think we will take a break. In your design development process up

there, it is fairly obvious that the design model plays a very important part. Just exactly how representative of the design is that model, and if in fact it is a detailed design tool or construction tool, what, if anything, is left off the model, and secondly, what are the controls to ensure that that model does in fact reflect all the things that are on the engineering drawings?

MR. BINGHAM: Maybe it would be useful if I could show Model Slide 1 so that I can give you a prespective of the model. We will show some details later on as Dennis gets into his presentation.

I indicated earlier, Ed, that we had a scale model for every building in the power block. I talked about the turbine building, the main steam support building, the containment building, the control building, the fuel building. This happens to be the main steam support structure, which you are going to hear a little bit more about. It is a three-quarter inch to the foot scale model. It shows all of the piping including the small piping, it shows all the hangers and supports, it will show all the HVAC, it shows the electrical trays, and in many cases, particularly in congested areas, it will show all the conduit. This model is large enough that we can work out interferences at least within six inches, depending upon construction tolerances, and in some cases to less than that. The design, as I indicated from the

other slide, is conceptually put together, that is, we make preliminary layouts. We then put that on the model for all the disciplines working out the interferences, and once it is on the model, interferences are worked out, we then make the key drawings, the construction drawings, on this project. The drawings are checked with the model. They are reviewed at the model and, of course, the final check is when we build it in the field as far as interferences, but the design before it goes to the field I would say has a majority of the interferences worked out. It has had them all by a multi-discipline review conducted, it has had the separation review completed, it has had the high energy line break review completed, and it has had a constructability review completed, as well as assuring that the systems have the correct vent and drain points and are set for easy startup of the particular system. So we use it as a model, Ed, for not just engineering, but for the complete, overall, total review of all the requirements. Once those are in order, then we issue the drawings.

MR. VAN BRUNT: Are those documented reviews and if some interference or something is identified, is there some loopclosing on that?

MR. BINGHAM: Yes, they are all documented. There is a loopclosing system. There are periodic model reviews. Every Friday morning, we have a model review covering a particular area, a particular level, and there are records of those

particular reviews with action items. I think I might add, also, that I didn't mention that periodically there is an operations and maintenance review that is conducted by us with the utility, both operations and engineering, to review the design to assure that you can meet your ALARA requirements for removal of equipment, it can be removed easily, and that there is access to the various points that you have to get to.

MR. VAN BRUNT: Any other questions in this area?

MR. O'REILLY: Bill, I assume from your response that these models are at your office.

MR. BINGHAM: They are at our office. Perhaps you might have seen the model that SNUPPS has.

MR. O'REILLY: Yes.

MR. BINGHAM: The model is very similar to the one that SNUPPS has. One of the differences is that on the SNUPPS model, the drawings are made, then checked on the model. Here we build it on the model and make the drawings. That is kind of on purpose to determine in our company what is the best combination and ways to use the model.

MR. VAN BRUNT: I might point out for the record that when the plant is completed, the model is going to be shipped to the field to be used as a tool for our operating department in the operation of the plant.

Any other questions in this area or about the particular slides that were talked about? I think it was

helpful to deal with it generally and ward off a lot of specific questions about interface.

MR. PARR: Excuse me, are we going to come back to some of the other slides? So far I thought we just covered the first slide.

MR. VAN BRUNT: That's correct. I thought it would be helpful to cover this in a general way rather than talk about a specific item of equipment and how the interfaces were covered, because I had a whole lot of questions about that.

Are there any other questions? If not, let's take a 15-minute break until about a quarter to eleven.

(Thereupon a brief recess was taken, after which proceedings were resumed as follows:)

MR. VAN BRUNT: Why don't we go to Item 1A, I think it was, on the agenda, which was the information that Dennis Keith presented, and I will open it up for questions on that portion of the presentation. Who would like to go first?

MR. BINGHAM: I am not sure I mentioned it earlier, but I would prefer that you address all the questions to me and we may caucus from time to time and get the proper individual to answer the question on the detailed presentation.

MR. VAN BRUNT: Okay, fine. Mike.

MR. BARNOSKI: I have a few questions. First is on Figure 2. There were a couple symbols there that I am not

sure I recognize. I think one of them is containment penetration and right before it is some kind of flow element. Could you clarify those two?

MR. KEITH: Yes. These symbols (indicating) are containment penetrations and these (indicating) are flow elements for flow transmitters.

MR. BARNOSKI: Just for measurement?

MR. KEITH: Just for measurement, yes.

MR. BARNOSKI: Secondly, you show normally closed valves on I believe the steam admission to the turbine, and do you have provisions in your design to remove the water that may accumulate in there so that it doesn't become a problem on actuation of the turbine?

MR. KEITH: Yes, there are steam traps in those lines.

MR. BARNOSKI: On Exhibit 1A-4, you mentioned that the system is not pressurized. I assume it is full of water.

MR. KEITH: That's correct.

MR. BARNOSKI: What are the materials of the piping and the valves and what provisions have you made to minimize corrosion problems for just a system standing in water for a while?

MR. KEITH: All the piping and valves are stainless steel to minimize corrosion that way. The condensate storage tank does have a nitrogen cover on it to minimize oxygen content.

MR. BARNOSKI: Is there any chemical addition?

MR. KEITH: No, not for the aux feedwater system.

MR. BARNOSKI: Another question related to Figure 2. I note that you have recirculation on the pumps. Does the capacity of the pump include that so you have 875 GPM to the generator plus the flow required?

MR. KEITH: Yes, the pump is sized such that I believe it is 110 gallons per minute recirc flow -- 135 gallons per minute recirc flow, so we have that plus the 875 to the generator.

MR. BARNOSKI: I have one final question, and that is on Exhibit 1A-9, Item 23). You said the feedwater temperature will be at least 40 degrees, and my concern centers around the thermal transient at the junction of the emergency feedwater system that the main feedwater system is going to see. I believe your main feed would be at about 450 degrees. Injecting 40-degree water seems to me to be a rather severe transient thermally on that juncture. I seem to recall that boiling water reactors at least a while back, and I happened to work on that, for similar application used what they called the thermal tee to minimize the thermal transient at the junction of the cold and hot water interface. Could you tell me specifically if you have looked at a thermal tee and what analyses you have done in addition to the normal analyses required of ASME Section III, Class II piping to assure that

this thermal transient will not be a problem.

MR. KEITH: Well, as part of the stress analysis we do on the piping, we look at thermal transients. The number of cycles is given as a requirement from Combustion Engineering so the stress analysis of the piping considers that problem. As far as the thermal tee, let me caucus for a minute.

As I stated, the design has taken care of those transients. If you want further information as far as whether specifically we have used a thermal tee, we are not sure at this point. We could provide that to you.

MR. VAN BRUNT: I think, Bill, why don't you put down on the list of items that we will verify what the results of the analysis are that show whether the piping is any problem under the 40-degree condition that you mentioned or that a thermal sleeve has been used to take care of the situation.

MR. BARNOSKI: Fine.

MR. VAN BRUNT: Any other questions?

MR. HOEFERT: The steam line to the auxiliary feedwater steam turbine is normally closed and on a start signal, the valves come open, and it would seem to me that the steam piping and the turbine would undergo a rather severe thermal shock as well. Has this been considered in the selection of the turbine and the design of the piping?

MR. KEITH: Yes. They even say they can take water slugs in that turbine. It is made specifically for this type of duty.

MR. HOEFERT: What about the piping design? Has that been looked at for the thermal transients that it will undergo repeatedly?

MR. KEITH: Yes. Similiar to what Mike Barnoski brought up, our stress analysis looks at exactly that type of thing.

MR. BINGHAM: I might indicate, Norm, also, that there are some plants that have a turbine that has not been designed for this particular slug of water and, consequently, there are some people in the industry that are looking at their particular applications, but we have been aware of this and have assured ourselves that the design is capable of taking this particular condition.

MR. HOEFERT: Has the vendor stated this in a tech manual or letter?

MR. BINGHAM: Yes, they have. We have it in writing.

MR. HOEFERT: I have another question, again with regard to the steam line, but a little different area. I notice that a portion of one of the steam lines runs through the pump room, the motor-driven pump room. Doesn't this violate the separation criteria? It would seem to me a rupture of that line would wipe out the steam-driven pump and could also affect operation of the motor-driven pump.

MR. KEITH: A steam line does not go through that

motor-driven pump room.

MR. HOEFERT: Yes, I verified this by observation. There are two lines coming down the main steam support structure and they come together in the steam-driven pump room, but one line does go through the motor-driven pump room for perhaps 20 feet of piping.

MR. BINGHAM: Let's hold that question. We do have a slide here that will show it and we can take care of that particular one.

MR. VAN BRUNT: Norm, we will come back to that.

MR. KEITH: Apparently I was incorrect on saying that it doesn't.

MR. VAN BRUNT: Before I call on other people, are there other questions in this same general area or would somebody want to go to a different area?

MR. WERMIEL: I have one in this area. On the steam admission valve itself, you said one of the two normally opens on an AFAS signal. What is my assurance in the single failure when the valve doesn't open that the other one will? Is there an automatic system that will open the second valve or do I have to rely on the operator to open it?

MR. KEITH: No, it is part of the logic. If the turbine is not up to a certain speed in a certain time, then the other one will open.

MR. WERMIEL: There is a time delay then for the turbine to reach a particular speed and then the other valve

will open if it doesn't?

MR. KEITH: That's correct.

MR. WERMIEL: Is this all part of the DC power system, this logic?

MR. KEITH: Yes, it is all associated with it. The turbine driven aux feedwater pump is powered off the DC.

MR. WERMIEL: Also in that same vein, when the valve opens, then I get the sudden slug of steam, is the governor designed such that I don't immediately overspeed the turbine and trip it?

MR. KEITH: Yes. When it gets an aux feedwater actuation signal, there is a signal to the control valve as part of the turbine that shuts it down so that you don't overspeed on that initial slug. There is a ramp input gradually.

MR. PARR: I would like to continue that one. You open one valve, just in case the steam generator has got a break in it someplace, was that the logic that led you to this, or what?

MR. KEITH: Well, we don't want to open a valve from a ruptured steam generator.

MR. PARR: So that was the reason?

MR. KEITH: Yes. Well, plus we didn't want to open -- When you have both steam generators intact, we didn't want to have both valves open.

MR. PARR: Not have both of them open?

MR. KEITH: Yes.

MR. PARR: May I ask why?

MR. KEITH: Well, I believe that the CE interface requirement on cross-connecting both steam generators is what you have in that case. Although we do have check-valves in the line, we just thought it best to just be feeding from the one steam generator.

MR. WERMIEL: Then that means that if I have, say, a steam line break in one steam generator, the valve for that one, of course, won't open.

MR. KEITH: That's correct.

MR. WERMIEL: Then I do ask the other valve to open and it single fails, then I cannot take credit for my turbine except perhaps by manual action.

MR. KEITH: That's correct.

MR. WERMIEL: Then I have to rely on my motor-driven pump.

MR. KEITH: That's correct.

MR. VAN BRUNT: Was there another question back here?

MR. KOLB: In the area of thermal shock, let's say that your steam generators would dry out and for some reason your aux feedwater was delayed in getting water to your steam generators, what effect would it have on your U-tubes if you reflooded that hot generator with a shock?

MR. KEITH: Well, first, the aux feedwater actuation signal, all the logic in the system and all is designed such that we avoid a dryout condition. We have gone over our system design very extensively with CE. As far as the effects on the steam generator, I would really have to defer that to Combustion Engineering for the metallurgical effects and all, and I think -- Well, I just better not say what they have in terms of cycles for that kind of thing in their design.

MR. VAN BRUNT: Shelley, you had a question.

MR. FREID: Yes. On your Exhibit 1A-3, you talked about the line classes and you mentioned that it was ASME Section III, Class 3, from the valves to the turbine and you did not say what the line class was from the main steam line to those valves. Your last all-inclusive statement was that everything else is B31.1, and I don't believe that is really true of the lines from the steam lines to those valves.

MR. KEITH: I thought I mentioned this, but you are correct. The lines from the steam lines to the valves are Section III, Class 2.

MR. VAN BRUNT: Rick, you had a question?

MR. TURK: Yes. On the criteria for waterhammer, I forget which one that was on, it was basically that waterhammer has been designed for. One of CE's specific requirements was that a checkvalve be placed on the upstream side of

the downcomer line to prevent feeding back through the cross-connect into the economizer box with cold aux feedwater. Those checkvalves are in place on the emergency lines, but I don't see a checkvalve on the startup pump to prevent feeding with the startup pump to the economizer box. Is that an omission from the P&ID? In other words, there is a path to take the cold condensate and deliver it from the startup pump to the economizer line.

MR. KEITH: I think, Rick, that the way that is taken care of is that when that pump is in use, you have already shut your main feed isolation valves, these valves here (indicating).

MR. TURK: Yes, but is there anything to prevent operator action, inadvertent operator error, from opening those valves? That was the intent of the checkvalve to prevent waterhammer, to prevent operator error from inducing that cold water into the economizer box.

MR. KEITH: As far as on the startup pump, no. All the valves are shown. This is obviously a simplified P&ID, but the valves are shown here as we have it. I think we interpreted that it is there to be primarily with the automatic starting system where you didn't have time to take care of isolating yourself from the economizer section.

MR. TURK: Well, I guess the case I am thinking of is that you are feeding during startup and you have operator

error to open the main feed reg valves and you could introduce that cold water into the economizer box, and there was a specific interface requirement for a checkvalve in the downcomer line upstream of the intersection of emergency feedwater.

MR. BINGHAM: Excuse me, you say there was an interface requirement or there is an interface requirement?

MR. TURK: There is. I don't have it.

MR. VAN BRUNT: Well, Rick, if there is in fact an interface requirement, then I would ask that you fellows verify that that is the case, and if you have not complied with that, then you better demonstrate that what you have done is appropriate or whatever. So that is an item that we ought to have on the list of items to check.

MR. TURK: I had one other question. I believe it is Criterion 25, which was if the emergency feedwater trains are used during the auxiliary or startup mode, and you said that because your pumps weren't used during that mode that it wasn't a problem, that the protection here would provide runout protection on the pumps. By that, did you mean that you have the automatic feature blocked some way during startup when you are using the auxiliary pump or the startup pump?

MR. KEITH: What I think I said, what I meant to say, was that in the unlikely event we get an AFAS -- I didn't say

we had the AFAS blocked. I just think it is extremely unlikely that you get one during that startup condition when you have a depressurized steam generator.

MR. TURK: I think most of the data indicate that there are a lot of low level trips during startup operations and cooldown operations, because you are controlling in a manual mode, and the intent was there that if the pumps do start automatically that there is a criterion for protecting them from runouts so that you don't wind up damaging both pumps even though they are not needed immediately because you are in a low power level type situation, so is that criterion included in your criteria in your overall?

MR. KEITH: The way we have taken care of it is by having the low pressure alarms on the pump discharges so that the operator would be alerted to an unsafe condition and have to shut off those aux feedwater pumps.

MR. TURK: Can he do that in sufficient time to prevent damaging the pumps?

MR. KEITH: On the turbine-driven pumps, we do have a feature that prevents it from overspeeding and reaching a runout condition, so that is taken care of on the turbine-driven pump. On the motor-driven pump, though, in the event you get into this kind of condition, you would be relying on the operator when he sees this low pressure alarm to stop that pump. It is not that it is going to be damaged in two

minutes or anything, but you can't let it run for an extended period.

MR. VAN BRUNT: Jerry, did you have a question.

MR. WERMIEL: Yes. I would like to get back to waterhammer. There is the general requirement there that a waterhammer be prevented. I would like to know how you have assured yourself that your design does do this. In other words, we have required in the past tests of all the pressurized water reactor plants. Are you going to commit to do a waterhammer test to verify this criterion? If so, will you use one or both steam generators and at what time and precisely how will the test be conducted, this kind of thing.

MR. PARR: How will you select which steam generator you are going to use? If you go with one steam generator, how will you select that one, which one of the two?

MR. WERMIEL: Have you thought about a test at this point? It may be premature.

MR. BINGHAM: Jerry, I don't know of any commitment that we have made to run that particular test. There are requirements in our test specifications that we will take a look at and can advise the board on where we stand. Generally on some of these small lines, we have not done any more than do the analysis and checked the analyses from other plants where perhaps there may have been a concern that occurs. Analytically, there are a lot of tests that we do run where we

can't make those particular comparisons. I wasn't aware that NRC is looking at other plants that are running these particular tests and I think perhaps that would be informative to us, Ed, if we could be made aware of what is going on.

MR. WERMIEL: We can tell you all you need to know.

MR. PARR: All the plants that are starting up presently are running the tests.

MR. WERMIEL: The thing I think that comes to mind right away is I believe this is the first steam generator of its type that will come into operation and, therefore, there may be unique design features one way or the other for mitigating, or something we hadn't thought of that may cause a waterhammer, which is. I think one of the particular reasons why something should be included in either the startup test program or hot functional testing something like that. To identify the potential for waterhammer is going to be a very important thing for us to look at, I believe.

MR. VAN BRUNT: Bill, would you put on the list of items or questions that as an open item, Becthel will respond as to how we plan to demonstrate that the system is adequately designed to accept waterhammer situations.

MR. ALLEN: Ed, I would like to add one thing. NUREG 0635 has a recommendation in it or something like that where they want to find out if we plan to throttle back on the valves to avoid waterhammer, so I think we should put that

on the same criteria and verify that they don't intend to throttle back to prevent waterhammer.

MR. VAN BRUNT: Bill, will you add that to the list?

MR. BINGHAM: We could add the information then from Olan.

MR. VAN BRUNT: Yes. Olan, if we could, we would ask you to provide us with anything specific in this area that you have been applying in some of the recent plants.

MR. BINGHAM: And some of the things learned. I think that is the important thing.

MR. VAN BRUNT: Mike, you had some questions?

MR. HODGE: Bill, I have a question as far as the applicability of some of the standards. You indicated that the plant is designed at HIS standards, the design of this particular system, and I looked at a few of the isometrics and there is a reducer which goes into the suction pipes and the HIS standard recommends that when you use a reducer going into the suction that you use an eccentric reducer with a flat top on it to prevent air entrainment and such into the pump. This particular design has switched the reducer so that the flat part is on the bottom. Do you have any reasons or any decisions why you decided to go that way?

MR. BINGHAM: Yes, I think we can respond to that.

MR. KEITH: Our design guide calls for it to be installed in the way which it is, and we understand that the latest version of the HIS standard differentiates on

whether the pipe is coming up to the pump or down to the pump. Let's say this particular pipe is coming down to the pump and the reducer is oriented in the correct direction for that by the latest version of the HIS standards.

MR. BINGHAM: Any other questions on that?

MR. ROGERS: I would like to proceed on that line. If the reducer is oriented with the eccentricity towards the top, the flat toward the bottom, will this get you into a condition where air or steam could collect in that upper level and provide an inhibit to pump suction?

MR. KEITH: No, I think with the pipe coming down, you have a vent path for any possible gas that might collect there.

MR. VAN BRUNT: Dennis, if I understand you correctly, you indicated that the latest edition of the Hydraulic Institute Standards allows this type of installation to this particular situation. I think in light of that that I would ask that we just verify that that is the case.

MR. KEITH: Fine.

MR. HODGE: I would like to see, if we could, the standard.

MR. ROGERS: I would like to continue on a little bit further on that. Were you aware of a problem that occurred on Arkansas 2, which is a CE-Bechtel plant, which is a case where the emergency feedwater pumps lost suction due to high

temperature water being brought into the suction side of the feed pumps? This is an incident that occurred on April 7, 1980. I don't think it is an I&E Bulletin, but it is --

MR. VAN BRUNT: It is an LER that has come out recently.

MR. KEITH: We are aware of that. The only suctions that we take on our aux feedwater pumps are from the condensate tank or from the reactor makeup water tank, and both of those tanks are sufficiently low in temperature that we don't think there is any problem.

MR. VAN BRUNT: Dennis, let me just pursue that for a second. You indicate that the tanks are sufficiently low in temperature. Those tanks are out of doors. It does get warm here in the summertime, 120 degrees sometimes, particularly out at that site. Is there any particular protection provided to the tanks or insulation or have you done some computation on heat-up of the water to assure that the 180-degree limit that has been set will in fact be met?

MR. KEITH: Yes, we have taken a look at it analytically, Ed. At this time, let me just describe -- we are getting a little bit ahead of ourselves. The condensate storage tank is a concrete tank with a stainless steel liner. It has a steel top, but the top has insulation. The concrete as I recall is about a foot thick.

MR. VAN BRUNT: The concrete is there for tornado

protection probably.

MR. KEITH: Correct. That is for the tornado protection.

MR. HODGE: I would like to ask just one last question. How are we verifying or how do we prevent valves from getting closed in our suction line? I notice that we have several valves that go between the pump and the condensate tank.

MR. KEITH: Those valves are locked open. There will probably be a technical specification to check those on a periodic basis.

MR. ROGERS: You said that that tank has a nitrogen overpressure in it. You've got 180-degree water or it could get up to that temperature. At least your criteria indicates that you don't keep it any lower than that. Since this is not an open vented tank, could you pull a vacuum in the tank and therefore get some sort of water vapor formed in the suction of the pump?

MR. KEITH: We have looked at both the possibility of a vacuum and a pressure building up in that tank due to the temperature changes and have determined that the design is satisfactory. That is one of the reasons for providing the insulation in the top of the tank.

MR. ROGERS: Do you have vacuum breakers or that type of thing?

MR. KEITH: Yes, we do have vacuum breakers on that

tank.

MR. VAN BRUNT: Ralph, you had a question.

MR. PHELPS: I had a couple of questions. Some of them you might want to save until a little bit later. I couldn't tell from reading your handout whether any of the valves in your auxiliary feedwater system received main steam isolation signals. Do they?

MR. KEITH: No.

MR. PHELPS: Let me ask a hypothetical question, then. If they don't, how do you prevent continuing to feed a ruptured steam generator if you have a steam line break at zero power condition? Presumably you are on your nonsafety-related motor pump.

MR. KEITH: Yes.

MR. BINGHAM: Ed, I believe we have the answer, but we would like to have a few minutes time maybe at the break to go through that particular scenario and we will answer that.

MR. VAN BRUNT: We will defer the answer to this question until after the lunch break. Okay, Ralph?

MR. PHELPS: Yes. I have one more question, if I could.

MR. VAN BRUNT: Go ahead.

MR. PHELPS: Does your Seismic Category II exclude Seismic Category IX in all cases unless specifically stated?

MR. KEITH: Generally, anything that is Seismic Category IX is also Seismic Category II. You are asking the opposite of that.

MR. PHELPS: Yes.

MR. KEITH: No. The converse is not true, that anything that is Seismic Category II is Seismic Category IX. That is not true, and we would have to just answer for specific pieces of equipment.

MR. PHELPS: Let me ask you a specific question. On the suction line from the startup feed pump, the nonsafety pump, you have categorized that as Seismic Category II. That is the line with the two motor valves in it. If you had a design basis event, what would prevent that line from rupturing and causing a leak at the tank?

MR. KEITH: I wasn't complete in my description. You are getting a little bit ahead of me. This line from here (indicating) to this valve (indicating) is Section III, so that is how we take care of that, and Seismic Category I.

MR. VAN BRUNT: Are you finished, Ralph?

MR. PHELPS: Yes, I am.

MR. VAN BRUNT: Olan, I think you had a question.

MR. PARR: You spoke that the Tech Specs will allow 72 hours for a particular component to be out, and I am thinking particularly of the turbine-driven pump. The electric-driven pump is off of one diesel. Now they have a 72-hour time out, is that right?

MR. KEITH: I believe the 72 hours is kind of going through the -- I believe you're correct.

MR. PARR: Might I then conclude that if you took a specific 72 hours, both the turbine-driven pump and the diesel could be out?

MR. KEITH: If your Tech Specs weren't written correctly, I guess that would be possible.

MR. PARR: My question then is how will you take care of this in the Tech Specs?

MR. KEITH: Well, the Tech Specs will state -- No, I take it back. Let me scratch what I said earlier about them not being written correctly, because the Tech Specs will state that you can only have one aux feedwater pump down. Then it is a matter of interpretation on whether if the Train B diesel, which is the diesel feeding our motor-driven emergency feedwater pump, then it is a matter of interpretation on whether you would consider with the diesel out whether that would mean the aux feedwater pump out, because if you didn't lose offsite power, obviously that aux feedwater pump would be available.

MR. VAN BRUNT: I guess I would like to have an item put on that we assure that the Tech Specs will be properly written so they are clear and understandable to deal with the problem that Olan has raised.

MR. WERMIEL: I realize that this may not be the

appropriate time to bring up Tech Specs in general, but we do have a concern about the Tech Specs for the auxiliary feedwater system, the general presentation I think of the Tech Spec which relates to other Tech Specs, and I don't know if you are going to dwell on it later or whether I should do it now.

MR. BINGHAM: Why don't you indicate your concerns and then we can --

MR. WERMIEL: Since this review in general here today is concerned with the auxiliary feedwater system, I thought I would look at the Tech Specs in Chapter 16 of the FSAR. What you have done in there is to make a statement for the aux feedwater system that I refer to CESSAR Chapter 16 and appropriate Tech Spec. We have had discussions in house at NRC about this and we have been informed that if this reference is only meant to indicate a general idea of what the Tech Spec will eventually look like, it is fine as shown, but eventually Chapter 16 and specifically the license for Palo Verde will have to have unique Palo Verde generated Tech Specs with no cross-reference to CESSAR. We, of course, are unsure how you are going to do it and I guess it hasn't been done, but the way of presenting it here we don't think is going to be acceptable as far as a license Tech Spec document goes.

MR. BINGHAM: Can you indicate a couple of areas where

it would need enhancement to be acceptable.

MR. PARR: That is not the question. What we are saying is we are taking your cross-reference to CESSAR as guidance, that your Palo Verde Tech Spec will be complete and it will look like what we found in CESSAR here.

MR. BINGHAM: Okay, specific for Palo Verde.

MR. PARR: Specific for Palo Verde. The cross-reference would not be acceptable in that type of thing.

MR. VAN BRUNT: Let me again suggest that on your list of items, Bill, we put an item that we will clarify how the -- I guess I would call them representative Tech Specs or Tech Spec requirements that are presented in CESSAR will be ultimately promulgated as Tech Specs for Palo Verde and we will respond to that as a specific item.

Dale, you had a question?

MR. THORNBURG: Yes. This question relates to Exhibit 1A-7 and 9 to some degree. Would you discuss the methods, procedures, assumptions that you used to develop the 875 gallon per minute flow rate for the pump, 75 degrees per hour cooldown rate on the steam generator for eight hours, and the determination of the 300,000 gallon requirement in the condensate storage tank.

MR. BINGHAM: Before Dennis answers that, I would like to make one statement that from our perspective that is input that is provided to us by Combustion interface and they

are responsible for it. However, as general information and from our reviews with Combustion, we can at least cover this general form if you would like.

MR. VAN BRUNT: I guess I would also like to say, Dale, that as a part of the commission's review of CESSAR and the preparation by Combustion of CESSAR to develop these interfaces, the specific mechanisms that are involved in developing these numbers are covered there.

Mike, why don't you let Bill go ahead and outline it and then if you don't agree, you can comment on it.

MR. KEITH: The 875 gallons per minute is what is required. It corresponds to a 5% reactor power level. The decay heat on the reactor following a shutdown for accident or for normal conditions is decreasing with time and the 5% corresponds to a period very shortly after shutdown and the requirement actually drops off as you go out in time. The 75 degrees per hour cooldown is a limitation such that you don't introduce stresses to the reactor vessel. So we are limited to not cooling down any more than 75 degrees per hour.

MR. THORNBURG: How do you know that this is occurring or not?

MR. KEITH: By the reactor coolant loop temperature indication that we have.

MR. THORNBURG: Then the determination of the quantity in the condensate storage tank, there is a hiatus in your

Exhibit 9 and your Exhibit 2. One shows 300,000, the other 330,000.

MR. KEITH: We put in a 10% margin. Three hundred thousand gallons is the Combustion Engineering number and we put in a 10% margin.

MR. VAN BRUNT: Angie, you had a question?

MR. ORTIZ: Yes. On your Exhibit 1A-9, No. 21), has a transient analysis been conducted of the aux feedwater system?

MR. KEITH: That is in process right now, that analysis. Of course, we will be looking into that aspect.

MR. ORTIZ: On the same exhibit, No. 24), the capacity of the condensate storage tank, I notice in your diagram that you have the takeoff for the startup pump above the 300,000 storage capacity. Bill stated that you are considering perhaps a fourth train, and I believe he also stated or I have heard that one of the means of accomplishing the intent without having to put a fourth train was with the use of a startup pump, so my question is if that is your present thinking, shouldn't you take the suction to that pump from the bottom of the tank as you do with the emergency pumps?

MR. KEITH: Yes, we agree with you completely. Figure 2 is schematic and it is in error. The suction line to the startup auxiliary feedwater pump does come off the bottom of the tank, so it does have the 300,000 gallons available.

MR. ORTIZ: The condensate lines leading from the condensate storage tank to the pumps, are they also Seismic Category I and missile protected?

MR. KEITH: Yes, the lines to the two emergency pumps are Seismic Category I and missile protected. This line (indicating) is missile protected and Seismic Category I. This (indicating) is the line to the startup pumps to this point, to the second suction isolation valve is Seismic Category I and missile protected.

MR. ORTIZ: How do you accomplish the missle protection on portions of those lines which are running in the yard?

MR. KEITH: They are in a pipe tunnel which provides that protection.

MR. VAN BRUNT: Do you have any other questions, Angie?

MR. ORTIZ: Yes, a couple more questions, Ed.

MR. VAN BRUNT: Go ahead.

MR. ORTIZ: Obviously you have postulated main steam line breaks and main feedwater line breaks in the pipe support structure. Have you documented analysis that such breaks will not affect the aux feedwater system piping?

MR. BINGHAM: Ed, several of these questions are getting substantially ahead of our presentation and I wonder if it wouldn't be good to let us go through the operation and the layout portion of part one and then entertain the questions at that time.

MR. VAN BRUNT: Bill, I think that is your prerogative to indicate to Angie that you are going to cover that area or you will cover it later in the presentation with some additional information that you have. I think it is kind of hard for the board to deal with whether it is going to come later or not. You can only tell us that. So if you run into that situation, just put the question off and we will make note of it and be sure that we cover it later.

MR. BINGHAM: That one falls in that category, Angie.

MR. VAN BRUNT: Angie, do you have any other items?

MR. ORTIZ: I don't have any other items.

MR. VAN BRUNT: John.

MR. ALLEN: Dennis, I noticed in the design criteria that there wasn't any design criteria for instrumentation, control, or electrical. Could you comment on that, where you would pick that up for the aux feedwater system?

MR. KEITH: Yes. We have separate design criteria for each of the disciplines and the control system has a design criteria covering that engineered safety feature actuation system.

MR. ALLEN: One other question. Are all electrical components and instrumentation and control components classified as IE on both the emergency trains?

MR. KEITH: Yes.

MR. VAN BRUNT: Shelley, you had a question.

MR. FREID: Yes, I have several questions. One is on Exhibit 1A-7, Item 15), which had to do with the sequence. It has to do with, in fact, the time at which the pumps have to be able to deliver feedwater. The first one is within 10 seconds when offsite power is available. The other one is within 45 seconds when offsite power is not available. When we went through the AC system, one of the things we note is that the sequencer has to be able to handle concurrent, prior, and post-loss of AC power. The question I have is if one gets an AFAS signal and before the 10 seconds is up one loses offsite power, which could happen due to turbine trip, you then lose the power that you had to the auxiliary feedwater pump and you put it on the sequencer and then it goes through the sequencer, could you lose both of those time criteria by having a loss of offsite power within that 10-second window before you first started putting the feedwater out?

MR. KEITH: At the time we get an AFAS, the auxiliary feedwater pump is on the 10-second step on the sequencer. It is sequenced on whether we have the diesel available or offsite power available. Now, if offsite power is not available, the diesel generator breaker will close in 10 seconds and then the auxiliary feedwater pump is on the 10-second step, so the maximum time should be 20 seconds with offsite power not available before we have that pump on.

MR. FREID: And it would be back up to speed in time

to deliver the flow?

MR. KEITH: Yes, it gets up to speed very quickly.

MR. FREID: I have another question on Exhibit 1A-8, and that is in terms of your backup water supply. What is the signal that tells you to go to a backup water supply and how long do you have to get that water supply on, and the question is is there enough liquid left in the bottom of the condensate storage tank to make that transfer before you cavitate the pump?

MR. KEITH: We have a low level alarm in the condensate storage tank which provides us with 30 minutes to make that switch over to the reactor makeup water tank.

MR. FREID: So you have 30 minutes to do this and you have gone through the sequences to know that that is well within the time necessary to make that transfer?

MR. KEITH: Yes.

MR. ALLEN: Dennis, is that level indicator Class IE on that tank?

MR. KEITH: No, that level indicator is not.

MR. HODGE: In that same light, do we have any backup capabilities in our makeup water to the condensate tank? Do we provide makeup water for the condensate tank, also, at the time we are using water? Is that an additional margin that we can have?

MR. BINGHAM: We are going to be covering that one also,

Ed. Why don't we wait until that time.

MR. VAN BRUNT: Okay. Jerry.

MR. WERMEIL: I have I guess a general question on some of the things that have recently been raised. A lot of these are included in the March 10th letter on aux feedwater systems. Specifically, the generic short-term and long-term requirements that we developed from NUREG 0635, is that going to be addressed separately in this presentation?

MR. BINGHAM: Yes, Jerry. As I indicated earlier, the reliability analysis did use the March 10th letter and we have determined that there are concerns that need to be addressed. We have addressed them and have made some modifications already to the design. Tomorrow you will hear all about those and what we have done.

MR. VAN BRUNT: Shelley, do you have another? I'm sorry, I didn't mean to cut you off.

MR. FREID: On the same exhibit, if we can get the P&ID on -- In fact, I don't know, it may be covered tomorrow, too. One of the items that was of concern was the lock open valve in the suction line and whether or not it has surveillance. We talked about that before, but there is another concern, and that has to do with the miniflow line, which may get closed since the system is not normally operated. Are we going to have surveillance on the miniflow line as well to assure that it is open when the pump needs to be started?

Will that be a Tech Spec, or how do you handle that?

MR. KEITH: I think the Tech Spec -- I can't really talk for APS, which is responsible for the Tech Spec. I think the Tech Spec would probably include a complete valve lineup on the system at some periodic basis.

MR. FREID: The last question I have, since we did not get into the controls, one of the salient features of this system is the ability to feed the good steam generator only. Are you at any point going to get into the logic of that system?

MR. KEITH: We will be discussing it somewhat briefly later. We can go into more detail if you would like to, but that is in the next section of our presentation.

MR. FREID: The question relates to when you established the criteria for the condensate storage tank volume in order to be able to handle the eight hours, did you include a significant amount of spillage through a broken line or is this system so fast that that is not a credible addition to the volume necessary in that tank?

MR. KEITH: The volume in the tank did include a broken recirc line so you are losing a continuous amount of 135 gallons per minute.

MR. ORTIZ: For how long?

MR. KEITH: Continuously for the whole period.

MR. FREID: But my question is somewhat further down

the system. Is that precluded from the design because of the logic sequence in the feedwater good steam generator only?

MR. KEITH: Yes. You could eat into some of the eight-hour margin with some of these accident scenarios, but in the 300,000 gallons, I believe the only margin is this continuous 135 gallons per minute for a broken recirc line. We do not take, you know, dumping a lot of water through a faulty --

MR. ORTIZ: I don't read it that way, Dennis. The way I read your Point 20) is that you have a continuous recirculation back to the tank, but I believe the question was if you have a broken recirculation line, then you are losing 135 GPM continuously.

MR. KEITH: Yes.

MR. ORTIZ: Does the 300,000 capacity reflect that loss?

MR. KEITH: That's what I was saying. It does reflect that loss. It does not reflect additional losses which Shelley was talking about. It reflects a continuous loss of 135 GPM.

MR. PHELPS: Let me just interject one point, which maybe I will address to Shelley. Don't forget all the valves in the emergency system are initially closed, so if you were worried about additional water feeding the steam generator,

they are all closed to begin with. The EFAS logic will selectively feed the one that is not broken.

MR. FREID: That's what I said, the ability not to consider any additional losses because of the feedwater good steam generator logic, and since we haven't discussed it at all, I was wondering at what point in the presentation we would get into that just to make us all feel very warm and comfortable that that is a good assumption.

MR. VAN BRUNT: Go ahead, Mike.

MR. BARNOSKI: I think the CESSAR requirement requires 300,000 gallons to the steam generator storage, and I would like to get a little clarification. Presumably that 300,000 includes some spillage out of the recirc line, and that is not the way I read the CESSAR interface requirement.

MR. KEITH: Well, the CESSAR interface requirement -- What I was getting into was the calculation behind the 300,000 gallons, Mike.

MR. TURK: No, our calculation is a thermal calculation based upon the decay heat requirements, the sensible heat requirements, and the reactor coolant pump heat requirements, and the interface is worded that you have to have 300,000 gallons available to be delivered to the generator. In other words, any spillage or any recirculation flow would have to be added on a plant-by-plant basis.

MR. KEITH: Let's hold that as an open item. I would

like to get together on a break on that point.

MR. VAN BRUNT: You want that as an open item to be responded to later in your presentation?

MR. KEITH: I think we can.

MR. BINGHAM: I think, Ed, if I could make a comment, since we have a two-day presentation, we don't have all of our capabilities here, and if we can answer, I would like to close out as many of these items as we can while the board is in session.

MR. VAN BRUNT: I agree with you.

Yes, Mike, go ahead.

MR. BARNOSKI: I am concerned about the suction line to the startup feed pump and any tornado missile, or any credible events that could draw down on the Tech Spec volume on the water tank and how you preclude that.

MR. BINGHAM: Mike, would you repeat that question, please?

MR. BARNOSKI: Yes. My concern is with the Tech Spec volume in the storage tank and an event that would, in essence create a leak in the suction to the startup feed pump and drain it down, take some of the Tech Spec volume away from what it was meant to be. You indicate you've only got protection through the isolation valve. I don't see any kind of automatic system for closing those valves on sensing that something is wrong downstream. I wonder how you preclude that

from happening.

MR. KEITH: Mike, these valves -- As I said, we are tornado protected up to this point (indicating).

MR. BARNOSKI: I am worried past those.

MR. KEITH: Okay, so we are talking about a break down here (indicating). All we have is in the event of an AFAS auxiliary feedwater actuation signal, these valves will close. That is the protection you have.

MR. VAN BRUNT: Does that satisfy your question, Mike?

MR. BARNOSKI: I am not sure, but I'll think about it and go back.

MR. VAN BRUNT: Anybody have any other questions? I've got a couple. Go ahead, Norm. I will wait until the end.

MR. HOEFERT: Assuming you have an AFAS, both pumps start, all eight valves open, you are now pumping an awful lot of water into the steam generators. What does this do to your reactor coolant system? What type of transients does it cause on it? I am specifically concerned if the cooldown rate would be so fast and the shrinkage that would result from it that you could initiate a safety injection signal. Is this possible?

MR. BINGHAM: Ed, this again is a question that is in the CE side, which has been analyzed, and the established criteria are such as to preclude these sorts of issues

becoming a problem. We could discuss it or, if the board prefers, we could get a response directly from Combustion Engineering as an open item.

MR. VAN BRUNT: I would suggest, Bill, that in a general way if you or Dennis could deal with it, and if Mike or Rick take exception to it, then we will get Combustion to provide some additional information, but if we can, I would like to deal with Norm's question and put it to bed at least to his satisfaction at this point.

MR. BINGHAM: That would be fine.

MR. KEITH: Well, there are some events such as a steam line break where you do get excessive cooldown and an SIAS is initiated. I can't really deal with whether the SIAS is due to the auxiliary -- Obviously, it is a combination of the aux feedwater and the steam line break, so it is kind of difficult to separate them out. On the loss of main feedwater I am not sure whether we get an SIAS on that accident analysis.

MR. TURK: The question is dealing with the idea of delivering feedwater in excess of the actual heat requirements and that is inherent in a system that requires redundancy. In other words, the system has been sized for maximum heat loads and then it is required to be redundant, in some cases tertiary redundancy. So that ability to cool in excess of the heat requirement is inherent in the system if the system is actuated, for instance, a couple days after startup when

you have low decay heat levels just as the 875 is going to be in excess of the heat load requirements. So it is essentially the operator action and the ability to regulate the feedwater flow after the initial actuation that accounts for regulating the feedwater flow down to an acceptable amount. That can be done coarsely by turning off one pump after both have started, but inherently the redundancy required for the safety function takes precedence over the necessity to regulate flow to the actual required amount. So that regulation process is not a design criteria, but rather an operator action. In other words, we looked at trying to determine what a maximum flow should be; in other words, to give a window on flow. In other words, what flow would be sufficient to prevent safety injection actuation. But if you take the worst case heat loads, in other words, no decay heat, a plant that has just started up, and a loss of power or you have no reactor coolant pump heat, that number turns out to be less than the 875. So, yes, there are cases where automatic actuation could result in a safety injection transient if you don't have worst case decay heat loads, but it is an operational problem.

MR. HOEFERT: In the majority of cases, you can live with the exceptions, perhaps, but during most of these aux feed-water system actuations, is operator action required to prevent getting a safety injection signal?

MR. TURK: I have no way of answering that. I don't

know what most of the cases are and I don't know what the answer is, and I don't know what the answer is with a 100% power case offhand. I believe that the answer, though, is that the 100% power case does result in a safety injection.

MR. VAN BRUNT: Norm, are you satisfied or do you want to raise an open item here on that?

MR. HOEFERT: I would like to receive more information on this.

MR. VAN BRUNT: Would you phrase the question so we can put it on the record here?

MR. HOEFERT: I think just the way I stated it originally might do. Is there a possibility of getting a safety injection signal after auxiliary feedwater is automatically initiated and, if so, when will we get those safety injection signals, and along with that what operator action is required to prevent a safety injection signal from occurring?

MR. VAN BRUNT: Okay, we will mark that as an open item to get Bechtel and/or CE to respond to.

Are there some other questions? I've got a couple.

MR. TURK: I have one more real quick. Criterion No. 7) was that the system should include one 100% capacity turbine pump and one 100% capacity motor pump and one startup pump. What was the sizing criteria for the startup pump?

MR. KEITH: The startup pump is almost identical.

However, it is sized for 875 GPM at a lower pressure, at normal operating pressure for zero power rather than at the accumulation of the lowest safety valve.

MR. TURK: Do you know what that pump delivers at the safety valve set point offhand?

MR. KEITH: Seven hundred forty GPM.

MR. VAN BRUNT: Rick, does that take care of you?

MR. TURK: Fine.

MR. VAN BRUNT: Could we go back to Figure 2? Dennis, getting back to our friend here, on the reactor makeup tank, you show the valve on the suction of the emergency feed pump there, the motor-driven, as being normally closed. Under what circumstances is that valve opened? Is it opened manually? Is that the only way it is opened, or can it be opened automatically? Under what circumstances would it be opened?

MR. KEITH: On a low level condition in the condensate storage tank is the only circumstance under which you would open it, and it is a manual valve.

MR. VAN BRUNT: Let me hypothesize here then an operator inappropriate action that with the condensate storage tank probably full or very close to full that somebody somehow opens that. Can you get yourself in a situation now where you have really two water supplies where you could pressurize the condensate storage tank?

MR. KEITH: We have these two checkvalves in the recirc

line. You are postulating operating this pump (indicating) and these valves (indicating) shut and you are taking recirc water from the reactor.

MR. VAN BRUNT: Is there a reasonable situation you can get into where that might happen through the operator inappropriate action of opening that reactor makeup tank valve on a suction, because as I see it, those motor-operated valves are always normally closed.

MR. KEITH: Ed, on our condensate storage tank, we have a six-inch overflow line with a loop seal to maintain the nitrogen pressure in the tank and that overflow line would take care of that.

MR. VAN BRUNT: Okay, fine. Let's go back to Exhibit 2. I guess it doesn't show on this drawing, but I am looking at the detailed P&ID, you have two potential sources of steam supply for the auxiliary feedwater pump steam turbine. You have the line from the two steam generators and then you also have a line that comes from the auxiliary boiler, is that correct?

MR. KEITH: Yes.

MR. VAN BRUNT: What steps or what inherent designs in the system are there to ensure that somehow if I've got some primary to secondary leakage which is within limits to continue to operate that I don't back contaminate that auxiliary steam supply system? I think this is a situation

that has occurred not necessarily from the aux feedwater system, but where an auxiliary steam supply system has been contaminated in another plant. I don't remember which one.

MR. KEITH: Yes, I recall there has been that case in some of the recent I&E bulletins. We have a checkvalve in that line plus that valve is normally closed.

MR. VAN BRUNT: Again we are in a situation here somehow where that auxiliary feedwater turbine is running as it should be and maybe I've got some primary to secondary leakage, but it is within limits, so I can continue to operate. Through some inappropriate operator action, could I get that system messed up?

MR. KEITH: Well, you would have to postulate leakage of the checkvalve as well as the inappropriate operator action.

MR. VAN BRUNT: Checkvalves do leak.

MR. KEITH: That's true. It is unlikely.

MR. VAN BRUNT: Following along the same line, since there is a possibility that the steam that is provided directly to the steam turbine-driven pump off of the main steam lines could be contaminated, should there not be some kind of radiation monitor on the atmospheric discharge?

MR. KEITH: We have radiation monitors elsewhere in the system to give us an indication of radioactivity in the steam generator.

MR. VAN BRUNT: I believe you have monitors on the

atmospheric dumps themselves, is that correct? I am talking about the main atmospheric dumps.

MR. KEITH: All we have right now on the steam generator as far as radiation monitors are a blowdown line and the condenser air ejector exhaust. As a result of the Three Mile Island accident, we are looking at putting more radiation monitors on the system, specifically on the safety valves to monitor the safety valves and the atmospheric dump valve discharge. That would be sufficient. You would be getting the same activity out of this pipe as you would out of those.

MR. VAN BRUNT: But if you didn't have an atmospheric dump, would they be before the discharge or after on the atmospheric dump valve?

Well, rather than get into designing the plant right now, let me ask that an item be put on the list here to look at whether there should be a radiation monitor on that particular discharge.

Let me pursue that a little bit further. Are there floor drains at the aux feedwater pump rooms?

MR. KEITH: Yes.

MR. VAN BRUNT: Where do those floor drains go?

MR. BINGHAM: Ed, we are going to be covering that under the layout section later on.

MR. VAN BRUNT: All right, fine. I'll lay off of that.

MR. ORTIZ: A question, Dennis, a similar question to Ed's. On the steam side of the steam turbine, you answered earlier that there is the possibility of makeup water from the reactor refueling water storage tank or the reactor makeup tank may recirculate through the minimum flow recirculation line back to the condensate tank. It is along the same lines as Ed is talking now to prevent radioactivity contamination. Might you also consider a radiation monitor at the discharge of the recirculation line to prevent contamination of the condensate storage tank?

MR. KEITH: The reactor makeup water tank, the only contaminant in there would be tritium. We know what is in that tank and adding a monitor I don't think would tell you any more than we already know about what we have in that reactor makeup water tank.

MR. VAN BRUNT: Angie, could I suggest maybe like we did just a minute ago, maybe we ought to take a look at that as part of the question of the atmospheric contamination. I think this whole area of looking at contamination and where it goes, it is one of the concerns that came out of Three Mile Island, is something we ought to take a look at.

MR. BINGHAM: Well, Ed, I think, as Dennis indicated earlier, we are taking a look at some of those particular items and the presentation today may be a little premature for us picking up all the things that will eventually be dealt

with.

MR. VAN BRUNT: I have one other question. I will go to a little different area. Could you go to Exhibit 1A-6? Up at the top, you talk about the turbine-driven pump and then the fact that the control system is connected to the Class IE DC power system. As I remember that system, it has two DC supplies associated with it and the battery chargers come off of different generators in two separate trains. Is the diesel generator that charges this particular DC power supply the same one that powers the motor-driven auxiliary feedwater pump or is it the other one?

MR. KEITH: It is the other one, the A diesel generator.

MR. BINGHAM: Are there other questions from the board?

MR. VAN BRUNT: Are there any other questions on this presentation?

MR. ALLEN: Dennis, we take credit for the level indicator low level alarm on that condensate storage tank to transfer over to the alternate water source. Right?

MR. KEITH: That's correct.

MR. ALLEN: A question I asked earlier indicated it was nonsafety related, so how can we assure ourselves it will be available when we need it? If it is not available, you might cavitate your pumps and you wouldn't be aware that the level was sufficiently low and you wouldn't have the necessary time to switch over to your alternate water source.

MR. KEITH: John, I think the original thinking on that was that, since we did have a Seismic Category I tank and we had enough water to give us eight hours of hot standby and then enough to cool down and get us onto the shutdown cooling system, that that was enough and that the alarm was kind of a backup. I think it would be appropriate to leave this as an item for us to look into further at this point in time. I think we need to reexamine that.

MR. VAN BRUNT: Dennis, could I go to Exhibit 1A-8? Item 18) says in the event the control room must be evacuated, instrumentation and controls necessary for system operation shall be provided on the remote shutdown panel. I am maybe getting ahead of your presentation. I was curious as to the specific location of that panel. Then I was interested in what kind of security, if you like, is provided such that somebody couldn't just go down there and upset your whole system without anybody knowing about it and operate independent in the control room. Now, maybe you are going to deal with that later, or if you would like to, you could.

MR. BINGHAM: Ed, I notice that the time is running out to start another presentation. I think we could deal with this right now perhaps.

MR. VAN BRUNT: That's fine, go ahead and deal with it now. I didn't know whether it was part of your coming presentation or not.

MR. BINGHAM: We will touch on it, but let's go ahead and deal with it now and then we can end Criteria 1A and start after the lunch break with 1B.

MR. VAN BRUNT: Okay, go ahead.

MR. KEITH: The remote shutdown panel is located in the 100-foot level of the control building. Our control room is on the 140-foot level of the control building. There are two doors into that room. Both of those doors are monitored on the security system and are normally shut.

MR. VAN BRUNT: Just as a followup, if somehow somebody could breach that security, is that panel operable at all times or does there have to be some action taken by the control room operator to switch control capability over to that shutdown panel?

MR. BINGHAM: Ed, that particular issue is one that we have under review right now, particularly as it affects transfer switches. What I suggest that we do is give you the facts later on during this meeting to give you the status of where that is.

MR. VAN BRUNT: Okay, fine, we will address that a little bit later on.

Bill, you might make a separate note so we will be sure to pick that up.

That's all the questions I have. Does anybody else have any questions before we take a break for lunch?

MR. ALLEN: Are you going to go into the HVAC systems for these pumps at all in your presentation?

MR. KEITH: I hadn't planned on it, but I can.

MR. ALLEN: I would just like to verify what type of HVAC we have in each room and if they are on essential cooling or normal cooling.

MR. VAN BRUNT: Why don't you, Dennis, as part of your general presentation and description of facilities deal with that?

MR. KEITH: Okay, fine.

MR. VAN BRUNT: Rather than take it as an independent item, I think it fits better there.

Any other questions?

MR. ROGERS: I want to go back to the very beginning, I think. You talked about the design of the turbine for the turbine-driven feedwater pump and you said that this turbine is designed specifically for a wet steam condition or slugs of water, and so forth. Our plant is a larger plant than many plants before us and I am sure that our auxiliary or emergency feedwater requirements are greater than many of the plants in existence. Has this turbine been used on other plants and has it been tested or is this a new version of the turbine?

MR. BINGHAM: I can answer that generally. If you are interested in the specifics, we can get those later, Carter.

In general, the pump has been tested. The turbine driver has been tested. In this particular case, it is provided by Terry Turbine, who I believe provides the bulk of the turbines to this application. It is a design that has all the latest problems incorporated into it such as cold slugs --

MR. VAN BRUNT: Solutions to those problems.

MR. BINGHAM: Solutions, sorry about that, solutions to the latest problems. I don't believe that it is significantly larger than one at an Arkansas plant, because there we are talking I believe about a nominal 900 megawatt plant compared to a 1,270 here. There may be some escalation, but I don't believe it is a substantial escalation in size. However, if you desire more information, we can provide that.

MR. ROGERS: I would like to get a specific answer on this particular one if possible.

MR. BINGHAM: Okay. If I recall, the question was has it been type tested.

MR. ROGERS: Has it been type tested in this model, because one could presume --

MR. KEITH: In this specific size.

MR. ROGERS: Yes, in this specific size. One could presume that the driver has to get 875, and that is based on the heat requirements out of the reactor directly related to megawatts, so you could have a ratio problem there.

MR. BINGHAM: We could answer that question. As I

recall from other discussion, I think on the AC system, we indicated that there will be a functional test in the field during startup that will confirm that it can deliver the proper flow and pressure and temperature, so there will be a field confirmation.

MR. VAN BRUNT: Are there any other items?

MR. ALLEN: Dennis, are you going to go into more detail on which valves in the aux feedwater system are indicated on this safety equipment status panel?

MR. KEITH: Yes, we will be discussing those.

MR. VAN BRUNT: Seeing no more hands, why don't we break for lunch. It is going to be in the next room. We have enough planned for everybody that is here if you so desire. Why don't we plan to reconvene at 1:15.

(Thereupon the meeting was at recess.)

August 21, 1980
1:25 p.m.

MR. VAN BRUNT: Bill, you're back on.

MR. BINGHAM: At this time, Ed, we would like to continue with Section 1B in our system overview, which discusses the operation of the aux feedwater system.

MR. KEITH: Exhibit 1B-1. We will now discuss operation of the auxiliary feedwater system. Some of this will be going

over stuff you have seen. We will try and go through it fairly quickly. We have seen that we do need auxiliary feedwater for startup, shutdown, hot standby, and for some of the design basis accidents. We have three independent trains for auxiliary feedwater. We have our two emergency trains, which you see right here (indicating), steam turbine driven, motor driven. They take suction from our reserve inventory in the condensate storage tank. They have interties between the two with redundant isolation so that each pump can feed both steam generators. The motor-driven pump feeding generator two, we have one for that path (indicating) and one for that path (indicating), and similarly for the turbine-driven pump. We also have an alternate source of condensate to tie in, which we will discuss, coming from the reactor water makeup tank, and the turbine-driven pump, as we have also stated, which receives steam from either of the steam generators.

We have both mini-flow and full-flow recirculation lines. The mini-flow has a locked open valve to prevent overheating, as we discussed earlier. The full-flow lines which are used for testing have a normally shut valve so that we can feed the steam generators.

We also have our motor-driven startup auxiliary feedwater pump shown down here (indicating). We have mini-flow on it, and, of course, the capability to feed either

steam generator.

Exhibit 1B-2. As we have seen we have multiple flowpaths.

We talked some about the class breaks, but let's just quickly go through them. This we have talked about being Section II up to here (indicating) -- Section III, Class 2, excuse me, up to this point (indicating) and Section III, Class 3, beyond. The emergency trains are all Section III, Class 3, up to these valves (indicating), which serve as containment isolation valves, showing the class break going to Class 2 beyond there. Our startup pump, Section III, Class 3, up to this valve (indicating). Then we go to B31.1 up to this valve here (indicating), and then we go to Section III, Class 2, beyond that point, and similarly on the other tie-ins. This (indicating) is part of the main feedwater system, and then we have the main feedwater system coming in making the same class break there to Section III, Class 2, from ANSI B31.1.

Exhibit 1B-3. As we said, the startup feedwater pump and its train is manually actuated. Emergency feedwater trains respond to an auxiliary feedwater actuation signal and they get an emergency feedwater actuation signal. The emergency feedwater actuation signals, there are two of them, an AFAS 1 and an AFAS 2. The first would be to feed steam generator number 1 and the second would be to feed steam

generator number 2, so there are two separate signals. We get an AFAS to steam generator number 1 upon receipt of a low steam level in generator number 1 and a non-ruptured signal in steam generator number 1. We generate a ruptured signal in steam generator number 1 by once again having a low steam generator level in number 1 by having a differential by steam generator number 2 being the 120 psi higher in pressure than steam generator number 1 and also upon receipt of a not-ruptured signal from steam generator number 2. We have the capability, also, of manual initiation of the emergency feedwater trains.

Exhibit 1B-4. This is another slide showing a little bit more of the relationship between the feedpaths, the main steam isolation valves, the main feedwater isolation valves. This is Figure 3. Here we show the emergency feedwater tapping into the downcomer feedwater lines. Normally, with the plant in operation, the plant producing power, the normal feedwater comes in through this line (indicating) to the economizer nozzles and through this line (indicating) to the downcomer nozzles on the steam generator. The emergency feedwater line ties into this line (indicating). The startup auxiliary feedwater pump ties in right here (indicating) as shown. Coming off of each steam generator, we have two main steam lines. On each steam line, we have five safety valves and one atmospheric dump valve, and then

here (indicating) we have the main steam isolation valves on each of the four lines, a bypass valve around two of the main steam isolation valves, one on each steam generator, and here (indicating) are lines coming off of the main steam line to feed the emergency feed pump turbine.

Here we have the condensate storage tank, Figure 4. As I stated earlier, this is a concrete tank with a stainless steel liner, a steel top which is insulated, supplied by nitrogen as a cover gas to minimize oxygen in the condensate. We discussed the overflow line. This is normally fed from the demineralized water storage tank, and we have an automatic fill to the tank that maintains it at a level between 530,000 and 550,000 gallons in the tank normally, so we have considerable leeway above our required 300,000 gallons.

We show here (indicating) the three feedwater pump recirc lines coming in. We also show here the three suction lines to the auxiliary feedwater pumps. This (indicating) is the class break between the Section III, Class 3, and the B31.1 piping that we have discussed going to the startup feedwater pump. Condensate makeup, which is what this tank is used for most of the time, comes in above -- the makeup to the condenser hotwell comes in above our 330,000 gallon level.

We show two other condensate transfer pumps, which are used to make up to the condenser, are also used to

make up to some of our essential tanks, our diesel generator cooling water surge tank, our essential chilled water surge tank, and essential cooling water surge tank. All of the piping of these condensate transfer pumps is AMSE Section III, Class 3.

MR. BINGHAM: Are there any questions, Ed, from the board at this point?

MR. VAN BRUNT: Does anybody have any questions on this? Mike.

MR. BARNOSKI: I have two questions. One is on that figure that is up there right now. Is the suction part to the condensate transfer pumps missile protected?

MR. KEITH: Yes.

MR. BARNOSKI: The second question I had is on Exhibit 1B-3. I was wondering if your statement that the automatic initiation of emergency feedwater precludes ruptured steam generators is technically correct. It is my understanding that for small breaks, the logic cannot distinguish which is intact and which is the ruptured generator and for those you have to wait awhile, but feed does continue in both generators.

MR. KEITH: That's correct. I explained how the logic works and you do need that 120 psi differential to sense the ruptured steam generator. So you're right and CE has done analysis on this to determine what operator action is required in the event of small breaks.

MR. VAN BRUNT: Okay, Mike?

MR. BARNOSKI: Yes.

MR. VAN BRUNT: Shelley.

MR. FREID: I am back on Figure 4. I guess I am still concerned about the level. We have had a lot of trouble in other tanks in terms of adequate volume of safety related water, and in this case, we talked about other reserves. Do you have a reserve for vortex formation in that tank and instrument error? Are those all calculated into that 330,000 gallon?

MR. BINGHAM: Ed, I think this ties in with a previous question that Shelley asked about that. Why don't we have that as an item that we can give a complete response to?

MR. VAN BRUNT: Okay. Ralph.

MR. PHELPS: I still have a question on the fact that you don't have a relief valve on this tank. Have you looked at all credible ways that you might over pressurize that tank in some way? For example, is that a high pressure nitrogen supply line that may be regulated somewhere upstream where you can overpressurize with nitrogen?

MR. BINGHAM: Let me say, Ed, we believe that everything is in order, but what we would like to do is have a little time to call back and make absolutely sure.

MR. VAN BRUNT: Okay, Bill. Why don't you put this on the list of items that Bechtel will deal with and then we

will either take care of it later on in the proceedings or it can be one of the follow-up items that has to be taken care of.

MR. QUINN: Will you restate that question one time?

MR. VAN BRUNT: Ralph, will you please restate the question?

MR. PHELPS: Yes. I had a concern that, since there was no safety relief valve on the condensate storage tank, had Bechtel looked at the credible ways that it might be overpressurized, for example, from the nitrogen supply line?

MR. KEITH: Ralph, let me tell you that this is simplified. We were just looking at the P&ID. This is a simplification of that, and there are two safety valves plus a pressure control valve that bleeds off to atmosphere the nitrogen pressure to maintain it at one psi.

MR. PHELPS: You had mentioned earlier that there were no relief valves, but you say that there are some relief valves?

MR. KEITH: Yes. I was mistaken if that's what I said earlier.

MR. PHELPS: Only they are not just vacuum breakers?

MR. HODGE: Dennis, would the overflow line also serve as a relief valve?

MR. KEITH: Yes. It would blow the loop seal out. What I am not sure about is is there a calc done to --

MR. VAN BRUNT: I was going to follow up. I guess the question I would ask as a follow-up then on Ralph's question would be what is the basis for the sizing of those valves?

MR. KEITH: Fine.

MR. BINGHAM: That is really what I wanted to give you a complete answer on, Ed.

MR. VAN BRUNT: Any other questions? Rick.

MR. TURK: If there is isolation of the regulating valve in a regulating condition and subsequently there is an actuation, will those valves reopen to the full position, full open position?

MR. KEITH: You are talking on the emergency feedwater lines?

MR. TURK: Correct. In other words, the system is being actuated and the valves have been turned to a regulating position and then maybe the heat load has been increased because the reactor coolant pumps have been restarted and the water level goes down and you would get another actuation signal, will those valves open to the full open position?

MR. KEITH: Yes.

MR. VAN BRUNT: Angie, you had a question.

MR. ORTIZ: Yes. Have you assured by analysis or some other means that a failure of the blowdown line either by a pipe break or a failure of the blowdown valves remaining open after an initiation of the aux feedwater system will not cause

an accelerated drain of the aux feedwater through the blowdown and thereby reduce your heat removal capacity.

MR. KEITH: Well, a main feedwater line break, which this would fall into that category as far as the auxiliary feedwater system is concerned, has been analyzed by Combustion Engineering and the system does respond adequately. You know, we get back into the question earlier on the accident analysis, but the auxiliary feedwater system will take care of it. I am not sure if I --

MR. TURK: The question was is the steam generator blowdown line, both blowdown lines, isolated automatically on an emergency feedwater actuation signal. I think you said earlier it was.

MR. KEITH: Oh, yes. Yes, I'm sorry, I thought we were getting into the breaks. As far as the actuation for normal operations, yes, an AFAS shuts the steam generator blowdown line.

MR. FREID: I think the question is is it single failure proof, though. If you have one steam generator down because of a break, main feed break, and you've got pumps trying to feed one steam generator and that other steam generator's blowdown line does not isolate with a single failure, do you have enough aux flow going to the steam generator? In other words, are you single failure proof on the second steam generator blowdown?

MR. KEITH: We do have two isolation valves in those blowdown lines, so we are protected against a single failure in that event.

MR. VAN BRUNT: Did I see somebody else over here had a question?

MR. HOEFERT: It is my understanding that the regulating and the isolation valves in the auxiliary feedwater line both open and close as the auxiliary feedwater signal is initiated and terminated, is that correct?

MR. KEITH: That's correct.

MR. HOEFERT: Can you explain why you cycle both of the valves instead of just one? It seems to me that it might increase the probability of a failure.

MR. KEITH: Well, I think you would get into some difficulties in the logic, because you are concerned, also, about terminating feed to a faulted steam generator. You want the signal to go into both of them to shut, so you also need it to go to both of them to get it open when you need it open.

MR. HOEFERT: Isn't that a different signal, though?

MR. KEITH: The same signal.

MR. HOEFERT: The same signal?

MR. KEITH: Yes, the AFAS. It is just the AFAS is what you get.

MR. VAN BRUNT: Okay, Norm?

MR. HOEFERT: Another concern on that same line is the

ones in the turbine-driven feedwater pump line are battery operated, and doesn't it add an extra load on the batteries that possibly could be done away with.

MR. KEITH: The batteries are sized such that we can operate that turbine-driven pump for two hours, and I have forgotten the exact number of cycles that is assumed for the auxiliary feedwater actuation. As I recall, the difference in the set point allows for 20 minutes between cycles on those valves.

MR. HOEFERT: Has this really been looked at? In my initial question, you said the logic went into the problem. Is that really the case? Has it been looked at?

MR. KEITH: You mean have we specifically looked at just actuating one valve instead of two?

MR. HOEFERT: Yes.

MR. KEITH: I don't know, Norm. We could. Do you want to hold that?

MR. VAN BRUNT: Yes. Bill, why don't you put it on the list as an item that can be verified.

MR. KEITH: I don't know if Combustion Engineering has any --

MR. TURK: The isolation function action is required to be single failure proof, so I don't see how you can do it without requiring both valves to be shut.

MR. HOEFERT: Well, you could shut one valve and one

would still be there available to close. You don't have to close it. It would still be a single failure proof system.

MR. KEITH: I think you would get into difficulties really implementing that. It sounds nice.

MR. VAN BRUNT: Herm, do you have a question?

MR. LaGOW: On the condensate storage tank, as you pump the water out, how do you maintain the pressure inside?

MR. KEITH: This line (indicating) has a regulator. This is a normally open line from our nitrogen supply.

MR. LaGOW: Oh, you have a large supply?

MR. KEITH: Yes. So that regulator tries to maintain the one psi.

MR. VAN BRUNT: Ralph, you had a question.

MR. PHELPS: I just had a comment on a previous statement. One reason why you want both of those valves to be cycling is with a single failure, if one was not cycling, if one locked open and you had a single failure in the other, you might have an overcooling problem.

MR. VAN BRUNT: John, you had a question.

MR. ALLEN: Dennis, that lock closed valve that goes to the turbine building drain system, is that protected against missiles and tornadoes and all that?

MR. KEITH: Yes, it is.

MR. ALLEN: Is it in the same structure as the condensate?

MR. KEITH: Yes.

MR. ROGERS: The drawing that you have on, Figure 4, shows two lines to the emergency feedwater pumps. Those lines serve a redundant function. Are those lines separated by separation criteria?

MR. KEITH: They are in the same tornado protected Seismic Category I pipe tunnel. There is no separation criteria as such applicable to them. I mean we are protecting them. They don't need to be separated from each other. Even were you to assume a crack in one, there is no way it can hurt the other line.

MR. ROGERS: All right. What about the drains from the tank? Are they separated inside the tank or is it a single drain?

MR. KEITH: It is a single drain from the tank. I am not sure I am understanding your question.

MR. ROGERS: It shows two lines coming from the tank. I guess you could call it a suction line from the tank to the feedwater pumps. Are those indeed two separate nozzles on the tank?

MR. KEITH: Yes, they are.

MR. ROGERS: The lines do not meet separation criteria, though, because they are low pressure?

MR. KEITH: Yes.

MR. VAN BRUNT: Are there any other questions on this

part of the presentation? Norm.

MR. HOEFERT: I guess just for my information, I note on the P&ID showing the steam supply valves, one has two control switches and one has four. Could you just explain why that is? I am talking about Valves 134 and 138.

MR. KEITH: We will have to get back to you on that, Norm.

MR. VAN BRUNT: Okay. Bill, would you put --

MR. KOPCHINSKI: I didn't quite understand the question.

MR. KEITH: On the steam supply valves to the turbine-driven aux feedwater pump, one valve has four hand switches and another valve has two hand switches. I don't know the reason.

MR. VAN BRUNT: Bill, if you would put that on the list, then, Dennis, you can either deal with it later on today or tomorrow or in the written responses.

MR. PHELPS: Dennis, would you be able to tell me the assumptions that you used for your design basis scenario to come up with your 300,000 gallons for your condensate storage?

MR. KEITH: That, as I said, was an interface requirement from CE, and I see by the shake of the head at the end of the table that we are not ready to do that right now.

MR. VAN BRUNT: Bill, why don't you put that on the list and we'll get that information for you. Let's repeat that question again.

MR. KEITH: I think the question was basically the basis for the 300,000 gallons.

MR. PHELPS: That's right.

MR. VAN BRUNT: Are there any other questions on this part of the presentation?

Seeing none, go ahead.

MR. BINGHAM: Let's move then to 1C, which is the layout of the system.

MR. KEITH: Exhibit 1C-1, Figure 5. The three units at Palo Verde are identical units. This shows one of the units. To give you a quick run-through, they are the containment building, the fuel building, the main steam support structure where the auxiliary feedwater pumps are -- we will go into that in more detail -- the turbine building where the startup auxiliary feedwater pump is, the auxiliary building -- it is wrapped around the containment building -- the radwaste building, the control building, the diesel generator building, and this (indicating) is the reactor water makeup tank here and the condensate storage tank on the other side. We were just looking at Figure 5. This is Figure 6 showing a plan view of the same things. Here (indicating) we have the condensate storage tank and the reactor makeup water tank.

Figure 7. Going on to the main steam support structure, this is the connection between the containment building and the turbine building. This is a cross-section

through the structure. We are looking toward the turbine building on this cross-section. We have four main steam lines shown here, two main feedwater lines. Here (indicating) we have the motor-driven pump and here (indicating) we have the turbine-driven pump. These two pumps are in a part of the structure that is basically separated from the rest of the structure. We do have to assume a main steam line break in this structure, but the hatches and all that we have for entry down into this lower level are sealed such that a main steam line break in the structure will not affect these lower compartments. Similarly, these compartments are separated from each other. We have a watertight door shown here (indicating) to separate the two trains. We also have indicated essential air conditioning units, which are powered off the diesels. They are Class IE motors on the units and the piping and all to them is Section III, Class 3, so they are completely safety grade air conditioning units. This was Figure 7 we were looking at.

Here is Figure 8 showing a plan view of the lower level where we have the emergency feedwater pumps, the motor-driven pump here, the watertight door, as we said, turbine-driven pump, essential air conditioning units shown here (indicating). We have a door to the outside, missile protected. This (indicating) is the pipe tunnel we have been talking about which comes from the condensate storage tank.

Exhibit 1C-2. These are the two feedwater lines shown here with the two feedwater isolation valves. We have this slide, Figure 9, to show the startup feedwater pump on the grade level in the turbine building.

Bill Bingham mentioned earlier our model that we have, which is three-quarters inch to a foot, and we have some shots of the model to show the main steam support structure. This Slide 1 is looking from the containment building at the main steam support structure similar to the cross-sectional drawing we saw earlier. First, let me take a minute to explain a little bit about some of the color coding we have here. Yellow piping indicates B31.1 piping. Orange indicates ASME Section III, Class 2. We will see on some of the others a lot more of a dark green, which is ASME Section III, Class 3. This blue that you see here (indicating) is all ventilation system ducting. This lighter shade of green is all for electrical. We will see it on the motor for the motor-driven pump. This is conduit here (indicating). Those are the major color coding which you see here.

This (indicating) is the motor-driven pump here down in our lower bunker, which, as I said, is separated from the upper portion of the main steam support structure. The turbine-driven compartment here (indicating), main steam lines going through here (indicating). These (indicating) are the main steam safeties. These (indicating) are the lines from

the atmospheric dump valve that tie in and go through a single exhaust. Main feedwater lines here (indicating). The slides are not numbered, so you will just have to bear with us on that as far as going back over the transcript.

Here (Slide 2) we have a cross-section or closer view of the lower level of the main steam support structure. That last slide we were looking at, the model you saw there was pretty close to six feet tall. We have some later pictures which show a figure in there which kind of gives you a perspective on just the size of the model. Here (indicating) is the motor-driven pump again, the turbine-driven pump here (indicating). These (indicating) are the feedwater lines going from the emergency feedwater pumps and entering the containment.

Here (Slide 3) is a plan view of the pumps. The containment is that way (indicating). We were looking from the containment before. Here (indicating) we have the turbine and here (indicating) is the motor, the two pumps. You can see how much of this color green piping is on this. This is all the Section III, Class 3, piping, this type color.

Another view (Slide 4) getting a little bit closer look at the emergency feedwater line. This (indicating) is the isolation valve from the turbine-driven pump and then going over. It goes over to get to the other steam generator. These are the lines here (indicating) with the containment penetration shown feeding this steam generator. It shows

another one of our color codings which I neglected. This kind of coral color is instrumentation.

MR. BINGHAM: Dennis, I think what we ought to do is provide some black and white shots for the transcript and perhaps we can just go through the sequence. I believe this is Slide No. 5 that is shown now that we have up here, and we will label those so that we have them in the transcript to be looked at at a later time, so we will show it as Slide 5.

MR. VAN BRUNT: Bill, when you proof the transcript, I think that you could dub in the first four to be sure that they are in the right place.

MR. BINGHAM: We will make sure that that is done.

MR. KEITH: Yes, we'll do that.

Slide 5 shows a shot of the motor-driven pump with the feedwater lines coming from it.

Slide 6 is a plan view of the turbine-driven pump. We've got the turbine exhaust line here (indicating), the turbine steam supply coming down here (indicating) and coming under, and the pump discharge line coming out from the pump and up here and around and over. Here (indicating) is the first isolation valve and then the second and then branching off where it changes in class break from the Section III, Class 3, to Section III, Class 2.

Slide 7 shows a plan view of the motor-driven pump, similiar arrangements here, containment penetration, with the

steam generator on this side (indicating).

Here (Slide 8) is a section view of the turbine-driven pump. Here (indicating) are the figures, giving you perspective on just how big the model is, and you get a better view here of the complexity.

Slide 9, another one, this one showing a plan view of the turbine-driven pump similar to the one we saw previously.

Another plan view (Slide 10) of the motor-driven pump.

Here (Slide 11) we have the turbine building pump. We are into the turbine building now. You can tell by all the yellow piping that we get, because we do not have any Section III piping in the turbine building. This (indicating) is our startup feedwater pump.

Another view (Slide 12) of that pump here in the turbine building. Another (Slide 13) pump and motor.

MR. BINGHAM: That completes the presentation of the layout. Are there any questions, Ed, that the board has?

MR. VAN BRUNT: I had one as a follow-up on a question I had before. Is this the place where you were going to talk about where the drains in the various rooms go?

MR. KEITH: We can. Yes, this would be. Those drain lines both go to the auxiliary building sump.

MR. VAN BRUNT: They go to the auxiliary building and they go into the radwaste system, also, for processing?

MR. KEITH: Let us check on whether that one goes into the radwaste system or not.

MR. VAN BRUNT: My question is if you end up with some primary or secondary leakage and then you get some steam leakage into the room and that condenses and goes out, where does that go. That is what I am really after.

MR. KEITH: I understand your concern. We will verify whether the radwaste system does process the water in that sump.

MR. VAN BRUNT: Dale.

MR. THORNBURG: Maybe a related question. Is it possible that those drains can get plugged up and flood back into the pump enclosure? You said they go to the auxiliary building. What happens to them over there?

MR. KEITH: Well, that is part of Ed Van Brunt's question that we are going to check on, you know, where we drain that sump to.

MR. VAN BRUNT: I guess just as a follow-up I would ask for the design basis for the drain system. You know, what is it sized for, fire protection or a break of a line in there or exactly what. That is kind of a corollary to what I was after.

I think Olan had a question.

MR. PARR: This morning you asked that one of the questions be delayed until now on that crossover pipe, steam

pipe, going into the electric pump area.

MR. KEITH: We would like to delay that until a little later, basically until we get into the discussion of the high energy line break area.

MR. VAN BRUNT: Mike.

MR. HODGE: A little earlier, you said you had two air conditioning units that run off of AC power, I assume.

MR. KEITH: Yes.

MR. HODGE: What type of problem will we have if we lose onsite AC power on a turbine pump? Would we have any problems?

MR. KEITH: To get into the background on this, at one time in the past, we did not have an essential air conditioning unit in the turbine-driven pump room. We have done a calc showing that when that pump is running, the room will not heat up to a point where any of the components will be affected. However, ACRS asked well, what if you have a steam leak in that room? Well, if you have a steam leak, then eventually you are going to heat up. So, as a result of that, we decided to put in an essential air conditioning unit in that room to take care of that. If we had a loss of all offsite and onsite AC power and you had a steam leak, too,-- Well, it depends once again on the size of the steam leak.

MR. VAN BRUNT: Shelley.

MR. FREID: On Figure 7, you show that watertight

door between the compartment and the steam admission valves in that room to the turbine-driven pump. The question I have is are there any high energy lines normally in that room from the main steam system?

MR. KEITH: That is what I would like to respond to later. We will get into which part of the system is high energy and which is not.

MR. FREID: But the question I have is is the door watertight? Is it designed for the pressurization of a break in there? Will you go into that later?

MR. KEITH: That's what I want to do later.

MR. VAN BRUNT: Angie.

MR. ORTIZ: I notice on the turbine-driven pump compartment a B31.1 line going over the turbine, or at least I believe I saw a yellow line going over it. Have you conducted a Seismic II over I review to see that Seismic II components will not affect Seismic I components?

MR. KEITH: Yes, we have. Well, we are still in the process in some areas. As far as piping, all of our piping in Seismic Category I structures is classified as Seismic Category IX, which means it is hung to Seismic Category I requirements so that it will not fall. That particular line which you saw going over the turbine it turns out is a startup spool. It was a blue and gold line, I believe, and that particular one will be removed when we are in plant

operation, but just in general, that answers that.

MR. THORNBURG: How do you provide the necessary net positive suction head at those pumps?

MR. KEITH: We have done calculations all the way down to the condensate storage tank being empty. It is the head on the condensate storage tank, of course, that is providing that.

MR. THORNBURG: What elevation is it in that drawing?

MR. KEITH: The condensate storage tank is at grade, which is right here (indicating).

MR. VAN BRUNT: Are there any other questions? Norm.

MR. HOEFERT: I noticed that entrance to the motor-driven pump room is through the turbine-driven pump room, so in the event of a fire or flooding or anything else, you could not access the motor-driven pump room or exit it if you happened to be in there. I am concerned about two areas. One is this violating the OSHA requirements for personnel exit, and, two, it just seems inconsistent to have redundant trains and then require going through one pump room to get to the other pump room in case you have to manually operate a valve or check the operation of the pump. Can you explain the basis for your design?

MR. KEITH: To take care of your OSHA concerns, there are hatches in both rooms for somebody to get out in the event of a problem in the other room.

MR. HOEFERT: Are you talking about the hatches for equipment access which require a crane to be removed? That is the only hatch I have seen in there.

MR. KEITH: We will check and get the details. There are ladders there and our understanding is that those are such that a person can get out in the event of an emergency.

MR. HOEFERT: Well, if that's the case, I don't have any problem.

MR. KEITH: For normal operation, it is not a frequent thing that somebody has to get down there for manual operation, so going through one room to the other seems like a reasonable way to do it.

MR. HOEFERT: Does this violate any of the separation criteria that you know of?

MR. KEITH: No, there is no requirement that the watertight door has to be shut all the time, which is really what we are talking about, so somebody going in there for normal inspection or even maintenance would not violate any criteria.

MR. FREID: To follow up on that, since I seem to be asking most of the door questions, how do you know that the door is closed after these maintenance operations are performed or that it isn't propped open full time?

MR. KEITH: We will check if it is on the security system. It probably is.

MR. VAN BRUNT: Are there any other questions? Bill

Quinn.

MR. QUINN: You mentioned you were going to check to see if there was access through the hatches. You also said that the hatches were to be sealed shut in case of a main feedwater line break. Could you clarify how the hatches are sealed shut in particular?

MR. KEITH: I am not familiar with all the design details, Bill. I expect some rubber gasketing type material or something to make them reasonably tight.

MR. QUINN: Would it be something with an opening handle that you would open it up or bolted down?

MR. KEITH: As I said, I don't know the details.

MR. QUINN: Also, did your design take into account any leakage of water through the hatch?

MR. KEITH: Well, our drains are four-inch drains, which would be more than adequate to take care of any leakage through the hatch.

MR. QUINN: Would you clarify for me then the design of the particular hatch in each room?

MR. VAN BRUNT: Dennis, I have a follow-up question on that. If I heard right, that hatch that goes down into those rooms is watertight, is that correct?

MR. KEITH: Yes.

MR. VAN BRUNT: What happens if you get a feedwater line break up above? How does that water get out?

MR. KEITH: There is a door at grade level in the main steam support structure.

MR. VAN BRUNT: Are there any other questions?

MR. ALLEN: Dennis, what type of fire protection do they have down in there?

MR. KEITH: Sprinklers.

MR. ALLEN: Dry pipe or --

MR. KEITH: We'll check that, John, to confirm what we have.

MR. VAN BRUNT: Any other questions?

Seeing none, go ahead with the next part of your presentation.

MR. BINGHAM: That brings us to the Standard Review Plan Acceptance Criteria, General Design Criteria.

MR. KEITH: Before we go on, to answer the last question, we did confirm on the P&ID that that is a dry pipe system for the auxiliary feedwater pump.

Exhibit 2A-1. We are going into the Standard Review Plan Acceptance Criteria. We split it into three different sections to give ourselves a break at some point, our general design criteria, the reg guides, and then the branch technical positions. Here is Figure 10 showing how we split it into the general design criteria, reg guides, and branch technical positions. Going through these general design criteria, these regulatory guides, and these branch

technical positions, Exhibit 2A-1, General Design Criterion 2, Natural Phenomena, basically requires that structures and systems and components important to safety be protected from natural phenomena. We have gone through and talked about tornado missile protection and seismic classifications, and one thing we haven't talked about is flood protection. Our site is located such that in the event of a design basis flood, we do not get water in the power block area, so that we are protected from floods, also.

Exhibit 2A-2. General Design Criterion 4, Environmental and Missile Design, this basically requires that we have redundant trains separated such that environmental effects cannot affect both trains. You have seen a lot of the separation that we do have in the previous slides. As we say here, the redundant emergency pumps are separated by missle proof and watertight wall. Startup pump is separated from the other two, though it is not protected from the tornado.

Exhibit 2A-3. General Design Criterion 5 talks about shared systems between units. None of the safety systems at Palo Verde are shared between any of the units. That applies to all safety systems, not just the auxiliary feedwater system.

Exhibit 2A-4. General Design Criterion 19 requires that we have a control room to operate the plant and to control

it and maintain it in safe shutdown condition. The emergency feedwater system and the startup feedwater system can be operated from the main control room and locally. The emergency feedwater system can also be operated from a remote shutdown panel.

Exhibit 2A-5. This next part of General Design Criterion 19, this is Exhibit 2A-5, this part gets into the requirement of being able to maintain the plant in a hot shutdown condition at a remote location. On the next slide we will show the indication and controls we have relative to the auxiliary feedwater system at the remote shutdown panel. Once again, the remote shutdown panel is located in the 100-foot level of the control building.

Exhibit 2A-6. We are also showing on this Exhibit 2A-6 whether it is indicated in the main control room in addition to what is on the remote shutdown panel. Our low pump pressure alarm is only indicated in the main control room. Our flow indication also in the main control room. Discharge pressure indication, main control room and locally. Flow isolation valve control is in the main control room and the remote shutdown panel. Similarly, position indication on the main control room and shutdown panel.

Exhibit 2A-7 shows more of the items. All the items on this slide are in the remote shutdown panel as well as the main control room where we have flow control valve control,

steam turbine inlet valve control, steam turbine speed indication, steam turbine speed control, and the main steam valve control, and this is really closed only for that main steam isolation valve. It goes from open to closed only I guess is the way to interpret that. Let me correct. This last item here on Exhibit 2A-7, main steam valve control, I was interpreting it to be the MSIV's, which we can close from the remote shutdown panel. However, what is meant here is the main steam valve control to the turbine, and that we can open and close.

General Design Criterion 44, Cooling Water. This is Exhibit 2A-8. This criterion requires that we have a cooling system sufficient to cool down the reactor and maintain it in a safe shutdown condition and still meet single failure with or without a loss of offsite power. Our auxiliary feedwater system, of course, is an essential portion of this train of cooling water systems we have to get us down to a safe shutdown or a cold shutdown condition, and we have seen that the emergency feedwater system can get us there assuming a single failure and loss of offsite power. Similiarly, our other cooling water systems are so designed so that they will also function in the event of a single failure and loss of offsite power.

This is Exhibit 2A-9, General Design Criterion 45, Inspection. This requires that we have capability to inspect

our safety systems so that we can determine that the piping and the other components are maintaining their integrity. As we have said earlier, we do meet the requirements of Section XI for all our Section III piping. Similarly, our ANSI piping which is not embedded can be periodically inspected, also.

This is Exhibit 2A-10, General Design Criterion 46 on Testing. This is similar to the last one, a requirement that all components important to safety have the capability of being tested periodically. We once again have the capability to perform all the tests required by ASME Section XI and Section III components. We can also test the startup auxiliary feedwater train.

MR.BINGHAM: Are there any questions, Ed, from the board on the general design criteria?

MR. ALLEN: Dennis, on your list of instrumentation back there, I didn't see any indication of flow so you can verify you do have auxiliary feedwater flow to your steam generators.

MR. KEITH: At the remote shutdown panel? Yes, that's correct, John. We do not have flow indication at the remote shutdown panel. We do have position indication on the flow control valves, on the isolation valves, and we also have the turbine speed indication for the turbine-driven pump. The electric motor-driven pump will have indication at the

switch gear, which is very close to the remote shutdown panel, that that is running. Also, there is a number of other instruments which are on the remote shutdown panel among which are steam generator level and reactor coolant temperature, and from that you can infer whether the auxiliary feedwater system is operating.

MR. VAN BRUNT: Jerry you had a question?

MR. WERMIEL: Yes. In connection with GDC-44, the requirement for capability to provide heat removal in the event of loss of offsite power, when I am using my auxiliary feedwater system and I don't have offsite power, my decay heat removal path is through the atmospheric dump valve, I believe. In what position does the atmospheric dump valve fail on the loss of offsite power? I think I know the answer to my own question. I think it fails closed. Do you have provision to remotely automatically open that valve to complete the decay heat removal path or must this be done manually?

MR. KEITH: No, we do have on the remote shutdown panel as well as in the control room, of course, we do have controls for the atmospheric dump valves. Maybe a couple of years ago, we added Seismic Category I accumulator tanks so that we can control the atmospheric dump valves in the event of a loss of offsite power, so we have the controls for those at the remote shutdown panel.

MR. BARNOSKI: I have a question back on the table of

instrumentation. You said that you don't have the low aux feedwater pump pressure alarm on the remote shutdown panel. I think from what you said before that is the only protection you have against runout destruction of the pump. I wonder what your logic was for excluding that from the remote shutdown panel.

MR. KEITH: Mike, we had only been using the remote shutdown panel -- well, presumably we had only been using it when the reactor was in a hot condition, so you would have the pressure in the steam generator so that you wouldn't have the potential for runout conditions on those pumps.

MR. BARNOSKI: You are assuming that by the time you got down to the point where you are going to have low temperature pressure in the generator that you are back in the control room.

MR. KEITH: Or onto shutdown cooling.

MR. TURK: When they get onto shutdown cooling, have they passed through that pressure in the generator?

MR. KEITH: We have to get down to what, 400 psi?

MR. TURK: The generator pressure is lower than that if you are down to 400 degrees.

MR. KEITH: Well, 350 degrees, and I think the pressure is up to 300 or 400 psi as I remember it.

MR. TURK: That back pressure doesn't present a runout problem?

MR. KEITH: Rick, to answer your question, yes, there would be the potential for runout at that temperature. By the time you get down there, hopefully you are going to be in good control. You are going to have the flow control valve, the valve we talked about that you can jog, you are going to have that in a position such that a runout would not be a problem.

MR. TURK: Let me ask it this way. Have you evaluated the possibility of adding a flow limiting orifice in the original design, some feature, either a cavitating Venturi or some feature that would inherently provide runout protection, and what was your reason for not including something like that?

MR. KEITH: Neither one of us were in on all the design details way back, whether that was really ever looked at. I believe in large part we started out with a Combustion Engineering P&ID as a starter.

MR. BINGHAM: For clarification so that the board at least understands, the AE will take the preliminary P&ID's that come from the NSSS manufacturer and use those as a starting point rather than going back with a clean piece of paper and trying to redesign or restructure the whole system, so when Dennis indicated that the reason you see the system the way it is is because we start at a fairly complete point as far as input from the particular manufacturer.

MR. BARNOSKI: I think we were on a little bit different tack and I think there is an interface that we talked about earlier to provide runout protection for the pump. The question is why don't you need that protection during the events when you are required to use the remote shutdown panel as opposed to staying in the main control room.

MR. KEITH: Mike, I think the answer I gave is that whenever you are in a remote shutdown panel situation, you are going to be in a pretty tight control and have a lot of communications and everything else. It is not a condition where everything is on automatic by any means, which is I think the type of condition where you have the potential for a pump running out and you not knowing about it.

MR. VAN BRUNT: Dennis, without belaboring the point further, I think I would like to go back and take a look at the particular criterion that Mike is talking about in the context of the question that was asked to be sure that we have in fact taken an adequate look at it and that the system as designed is proper for the situation.

MR. KEITH: Fine.

MR. ROGERS: That should include information as to the instrumentation readouts that are available to tell you where you are.

MR. FREID: On the same line, are a lot of these functions going to be supplied in the technical support center?

That will be an additional place where a lot of these readouts are going to be supplied.

MR. BINGHAM: We are studying that at the present time, Shelley, and when we discuss how we meet the requirements for technical support centers, and so forth, we will be dealing with that, but we have not yet made any recommendations to the utility nor have had any final review of how we are going to approach the particular problem.

MR. VAN BRUNT: That whole design for Palo Verde is right in the process of evolving, so I don't think any of us are really in a position to answer your question specifically.

Angie, did I see you had a question down there?

MR. ORTIZ: A quick one. On General Design Criterion 2, Natural Phenomena, you stated that all the important structures are located above the flood design level. These compartments are below grade if I remember correctly.

MR. KEITH: What I should have stated was that we do not get water from a flood in the vicinity of the power blocks. Just by the contour of the land around and where the water is coming from and all, you do not get floodwaters from the design basis there in the vicinity of the power blocks.

MR. VAN BRUNT: Shelley, you had a question?

MR. FREID: Yes, I have a few small ones.

MR. BINGHAM: Shelley, excuse me.

I'm sorry, Ed. We wanted to clarify a point that

was previously asked from CE about the instrumentation on the remote shutdown panel.

MR. VAN BRUNT: Go right ahead.

MR. KEITH: As far as the instrumentation, I know you recall, Mike, the interfaces for what goes on in the remote shutdown panel. That was a P&ID from CE, some of it was interface documents, some of it joint CE-Bechtel decisions.

MR. BARNOSKI: It is not my intent that I was bound by previous agreements for something that was overlooked and we intended to look at it.

MR. VAN BRUNT: Shelley, go ahead.

MR. FREID: A quick one on General Design Criterion 4, Exhibit 2A-2. I presume that the wall separating the motor-driven from the turbine-driven pump, you have looked at them as a failure of that turbine producing an internal missile in that room and that the wall is adequate to handle those missiles?

MR. KEITH: Yes.

MR. FREID: On 2A-7, I think you confused me with your answer and I changed what you thought the open and closed was, because your clarification indicated it was the main steam line to the turbine, which seems to be the second item on that list. Didn't you indicate that it was really the steam turbine in that valve control, and now you seem to indicate that that main steam valve control is the same one.

I guess I am confused.

MR. KEITH: The main steam valve is the one that we have been showing on these P&ID's whereas the inlet valve control is right at the turbine.

MR. FREID: I have one other last question. We did not talk at all about this. This has to do with cooling water, which made me think of it, even though it is not Seismic Category I. We did not talk about any support systems for the auxiliary feedwater. Are there component cooling water systems for the pumps that we have not addressed to assure ourselves it is single failure proof and other support systems? Nowhere in the design criteria or anything else have we talked about those kind of support systems.

MR. KEITH: Well, the only support systems as such are the HVAC, which we have discussed.

MR. FREID: There are no other secondary cooling water systems for this?

MR. KEITH: No. You need cooling water for the HVAC, that's all.

MR. FREID: No, I mean for the turbine pumps or any of those, there is no additional cooling water systems?

MR. ORTIZ: Turbine lube oil cooling.

MR. KEITH: The turbine lube oil cooking comes off the discharge of the turbine-driven pump.

MR. ORTIZ: A question on your emergency shutdown panel.

Have you included in your fire hazard analysis to show that the operator would be able to function properly at that location as far as fire is concerned or maybe radiation exposure?

MR. BINGHAM: Ed, as you know, we have a presentation that we are going to have on fire protection. If it is pertinent to the particular understanding of this system, of course we can get into describing it. We are in the process of reviewing and rereviewing our fire protection criteria and we will be presenting that probably in November. It will be October or November. So if there is a particular concern as it relates to this system, Angie, maybe specifically you could tell us what it is and we can deal with that today. Otherwise, I would suggest that these issues on fire protection be discussed in detail at the next system review we have on that subject.

MR. ORTIZ: My only question is since the location of the remote shutdown panel is vital to the operation of the aux feedwater system, perhaps it is premature to have it here, would the operator be able to be there or act at that location in the event of a fire either in that same compartment or in any other adjacent compartment?

MR. BINGHAM: The intent is yes and the answer is yes to that question.

MR. PARR: I guess I am not sure of the question. How

do you leave the control room if the fire is at the --

MR. KEITH: The design basis is that the remote shutdown panel is only used if for some reason we have to evacuate the control room. It is not designed to take another accident in addition to the event which caused you to evacuate the control room. So there is a limited scope there. We are really designed to maintain the plant in a hot shutdown condition at that panel. It is not designed for a post-accident other than just the fact that you had to leave the control room for some reason.

MR. VAN BRUNT: Any other questions? Norm.

MR. HOEFERT: You've got the steam turbine speed control at three locations, the control room, shutdown panel, and local. Which one overrides the other and does the setting override even when you have an auxiliary feedwater actuation signal?

MR. KEITH: I can answer the second part of your question. Yes, it is overriden for an auxiliary feedwater actuation signal. The first part of your question gets back to an earlier one which we have left open on the priority between the control room and the remote shutdown panel and the use of transfer switches and things like that. We do not have transfer switches. We will get back on the priority, too.

MR. PARR: As far as the other question, then regardless of what the speed control setting is at the three locations,

an AFAS signal overrides any one of those and the pump goes the full normal speed?

MR. KEITH: Yes.

MR. VAN BRUNT: Are there any other questions in this area?

Seeing none, why don't you go ahead. Bill, how long do you think the next section is going to take?

MR. BINGHAM: Were you planning a break at 3:00?

MR. VAN BRUNT: About 3:00.

MR. BINGHAM: It depends on the questions. Why don't we go through and do 2B, regulatory guides, and ask questions. Then you can have your break.

MR. VAN BRUNT: If we go too long, we can break and then do the questions when we come back. Go ahead, Dennis.

MR. KEITH: Going through the regulatory guides, the exhibit applicable to this is Exhibit 2B-1. The first one is Reg Guide 1.26, and it basically tells you that the auxiliary feedwater system has to be ASME Section III, Class 3, that is the emergency portion of the auxiliary feedwater system, and then other parts of the system which form part of the containment pressure boundary and are tied into the steam generator all have to be ASME Section III, Class 2, and we meet that requirement, as we have seen previously. That is Exhibit 2B-1 and Exhibit 2B-2.

Exhibit 2B-3. Going on to Reg Guide 1.29, which

gives the seismic design requirements, it basically requires that all the emergency portions of the auxiliary feedwater system be designed as Seismic Category I requirement. In addition, all supporting systems required for that system be designed to Seismic Category I. As we discussed previously, we do meet that requirement.

Exhibit 2B-4, Regulatory Guide 1.62, Manual Initiation. The first requirement of this reg guide is that manual initiation of the system should be possible at system level from the control room and all actions which are performed by the automatic signal should be performed when you initiate the system from the control room, and we do meet this requirement. We can initiate an auxiliary feedwater actuation signal and it is just as if it were initiated automatically.

The next requirement is that equipment common to manual and automatic initiation be kept to a minimum. The only equipment which is common are the signal cabinet actuation relays. The manual system does not get into the AFAS logic at all. That is down at the relay level.

Next, Exhibit 2B-5. The requirement per Reg Guide 1.62 is that manual initiation actions be kept to a minimum. An operator in order to initiate auxiliary feedwater to one steam generator just has to turn two switches. There are two actions required.

Exhibit 2B-6, Regulatory Guide 1.102, we have

already discussed this. This is flood protection. We have discussed it in relation to General Design Criterion 2 stating that the design basis floodwaters do not reach any of the three power blocks.

Exhibit 2B-7 on Regulatory Guide 1.117, Tornado Design Classification, which requires that our safety systems be protected from a tornado. As we have discussed earlier, we are protected from the tornado, and once again the startup feedwater train does not have tornado protection, being in the turbine building, which is a metal-sided building.

MR. BINGHAM: Any questions, Ed?

MR. VAN BRUNT: Are there any questions? Shelley.

MR. FREID: You said on the manual startup, I am referring to Exhibit 2B-4, how do you protect against unintended initiation of the auxiliary feedwater system? What protection do you have on the switches, for instance?

MR. KEITH: You have to turn two of them. That is the way it is with most of the safety things in the control room. You have to do two separate actions, so that an operator has that protection against just bumping against something or doing one thing without thinking. Presumably, hopefully he wouldn't do two things without giving it the proper attention.

MR. VAN BRUNT: Do you have more, Shelley?

MR. FREID: No.

MR. VAN BRUNT: Are there any other questions on this

particular item? John.

MR. ALLEN: Dennis, what is the tornado philosophy that we are designing against?

MR. KEITH: We are Region 2, I think it is a 240 translational and 60 rotational for a total of 300 miles per hour.

MR. VAN BRUNT: Are there any other questions?

Okay, why don't we take about a 10- to 15-minute break to about 3:00 or shortly thereafter, and we will come back and finish up the last section.

(Thereupon a brief recess was taken, after which proceedings were resumed as follows:)

MR. VAN BRUNT: Bill, go ahead.

MR. BINGHAM: Let's go on to 2C, the Branch Technical Positions.

MR. KEITH: Exhibit 2C-1. As you see from the slide over here, we are going to be discussing Branch Technical Positions MEB 3-1, ASB 3-1, and ASB 10-1. The first two branch technical positions deal with high energy line breaks, and this topic is one of the most difficult to deal with in the design of a power plant. I know there are loads of us who have been reading these two branch technical positions for years and you still have to go back and reread them to make sure you got all the new answers correct and everything else. So we are going to try and present a simplified version of these two

and how they apply to the auxiliary feedwater system.

First, I have to apologize for a little confusion we are generating on the slides. This is Exhibit 2C-1 and the headings are all reversed from what they should be. Where it says ASB 3-1, it should be MEB 3-1 and vice versa with the exception of this first item under here on Exhibit 2C-1. This first item under Definitions, all the definitions are in an appendix to ASB 3-1, so this Item No. (1) happens to be correct, but everything else should be reversed. We have just repeated selected portions of these.

MR. VAN BRUNT: Dennis, excuse me, could I ask that when the transcript goes out, when you send it back that we could give to the court reporter a corrected version of this to attach to the transcript.

MR. KEITH: Fine. I will confuse the transcript readers with what I have just said.

MR. VAN BRUNT: They will know what they got from what I just said.

MR. KEITH: As I said, we are just taking selected portions of these branch technical positions. Each one of them goes on for five to ten pages. The technical positions themselves are found as attachments to Standard Review Plans 3.6.1 and 3.6.2 for those of you who are interested in more detail. So with that, we will begin.

The first definition we are interested in is the

moderate-energy fluid systems, and we don't have it on the slide, but by inference you also get the definition of a high-energy fluid system. A moderate-energy fluid system is one in which the maximum operating temperature is 200 degrees or less and the maximum operating pressure is 275 pounds or less. So, conversely, a high-energy system is any one in which the operating temperature is greater than 200 degrees or the pressure is greater than 275 pounds.

Now we come to an important point which really isn't a definition, but it is part of the actual MEB 3-1 where we talk about fluid systems which can qualify as either high-energy or moderate-energy systems. In those systems which can qualify as either, we don't need to postulate breaks, but instead can postulate through-wall cracks.

If we can go to the next exhibit, Exhibit 2C-2, we will talk about what an operational short period is. These words are repeated from MEB 3-1 and it says, "An operational period is considered 'short' if the fraction of time that the system operates within the pressure-temperature conditions specified for high-energy fluid systems is about 2 percent of the time that the system operates as a moderate-energy fluid system," and, as an example, systems that qualify as a high-energy system are auxiliary feedwater systems operated during reactor startup, hot standby, or shutdown. From that statement, we are inferring that most portions of our emergency

feedwater system are not high energy.

If we could have Figure 2, please. As we stated, these (indicating) two trains do not operate during startup, hot standby, and shutdown, and, therefore, the pressurized portion of the system, if we assume no checkvalve leakage, would just be this portion (indicating), and this portion (indicating) would all be unpressurized. However, we will discuss breaks as we get into this thing more, if we assume leakage in the checkvalve, then we would say that the high energy portion is from these valves (indicating) onward to the steam generator.

Exhibit 2C-3. This is a definition of through-wall leakage cracks. You postulate cracks in any piping system and branch runs which exceed the nominal pipe size of one inch. We comply with that.

Exhibit 2C-4. This is more on the definition of a crack and then we get into if we do have a crack, we have to assume that all the components in the compartment are wetted, and as you saw from our arrangement in the lower level of the main steam support structure where we have a watertight door, we are separating the trains so that we can assume a moderate-energy pipe break and still meet the requirement.

Let me just point out at this time if we could go back -- This is Exhibit 2C-4. Let me go back to Exhibit 2C-1. The actual words here say, "during normal plant conditions, are either in operation or maintained pressurized," and

actually our systems, as you know, are not in operation and the only pressure is the one psi plus the head on the condensate storage tank, so there is some discussion there on whether it really qualifies as a moderate-energy system under that particular case.

Let's go to Exhibit 2C-5. Now we are getting into ASB 3-1. The first requirement is that plant arrangements should separate fluid system piping from essential systems and components, and you have seen the separation we have. We have also kept any piping such as blowdown piping, for example -- Steam generator blowdown piping and all have been kept out of the rooms where we have the emergency feedwater pumps, and we are in a compartment and we are designed to withstand the effects of postulated piping failures. We have mentioned our bunkered concept. That slab separating the emergency feedwater pump rooms from the rest of the main steam support structure is designed to withstand the pressure which we would see during a main steam line break.

This is Exhibit 2C-6. This is only included for completeness. We already meet the requirements of the previous slide, so this particular requirement does not apply.

Exhibit 2C-7, various design features which were required for our systems to meet. The first one is that we have to meet the seismic design requirements of Reg Guide 1.29 We have already gone over that. The second one refers to

separations, and those compartments needed to implement separations should also be designed to Seismic Category I requirements. We meet that.

This is Exhibit 2C-8 referring to in-service examination. We have already stated that we meet the requirements of ASME Section XI.

This is Exhibit 2C-9 referring more to ASME Section XI, which we are in compliance with. Then in Item 3) on this exhibit, we get into what has to be assumed with a postulated piping failure. Let me just say that each pipe break or leakage crack in a moderate-energy or high-energy system should be considered separately as a single postulated initial event occurring during normal plant conditions, and normal plant conditions are defined as normal reactor operation of power and reactor startup, hot standby, and shutdown.

Exhibit 2C-10 giving a requirement on analyzing the effects of postulated piping ruptures. The following assumptions should be made. The first one is that offsite power should be assumed to be unavailable if a trip of the turbine generator or the reactor protection system is a direct consequence of the postulated piping failure.

Exhibit 2C-11, a single active component failure should be assumed in systems used to mitigate the consequences of the postulated piping failure and to shut down the reactor. The single active component failure needs to be assumed in

addition to the postulated piping failure and any direct consequences of that piping failure.

Exhibit 2C-12, where the postulated piping failure is assumed -- This particular requirement is included for completeness. It does not apply to the auxiliary feedwater system.

Exhibit 2C-13, Item (4). As part of this program, all available systems, including those actuated by operator actions, may be employed to mitigate the consequences of a postulated piping failure. Another requirement, the effects of a postulated piping failure should not preclude habitability of the control room or access to other areas needed to cope with the consequences of the piping failure. The control room, as you have seen from the location on our plan, is not affected by this, any breaks in the aux feedwater system.

This is Exhibit 2C-14. This applies to piping not designed to Seismic Category I. It should not result in any damage to a system such that the system could still not take a single active failure and function to bring the reactor to a safe shutdown condition.

Let's talk about now our auxiliary feedwater system. I mentioned first the 2% rule, which I said was high-energy only up to this point (indicating), but going through the requirements that we went through, under those requirements we can take a line break anywhere in our emergency feedwater

train, and let me just amplify on that. The reason we can do that is that the postulated piping failure, as you saw, is assumed during normal plant conditions, so these pumps are not operating and these valves are shut, so were we to assume a pipe break in here (indicating), we would begin to drain the condensate storage tank, we would receive a level alarm in the sumps in our auxiliary feedwater pump rooms, the emergency feedwater pump rooms, so that the operator would be alerted. We could then go and isolate the leak, and this leakage obviously would not cause a reactor trip or turbine trip, so there is no consequence as such, and we would still have the startup feedwater pump available. So we could take a single failure in either one of the trains, depending upon where you assume the break. The key points are for this particular requirement that the break is assumed during normal plant conditions when we do not have our pumps operating; it is not assumed during another event which would require that our emergency feedwater pumps be operating.

Let me now go on to ASB 10-1 and cover the points there. This is Exhibit 2C-15. The first requirement is that the auxiliary feedwater system should consist of at least two full-capacity, independent systems that include diverse power sources. This is a key requirement -- well, this combined with another requirement which we will get to in a minute requires that the turbine-driven train be completely

divorced from the onsite AC power sources and, as I have said, everything in this train is powered off the DC sources, so that we are diverse, and this train with the motor-driven pump is powered off the AC sources off the Train B diesel generator.

Exhibit 2C-16. This is a requirement which I just stated that the two auxiliary feedwater trains be completely diverse in terms of their power sources and, as I stated, we do comply with that requirement.

This is Exhibit 2C-17. This states first that we need to take into account component failure, pipe failure, power supply failure, and as we have gone through, we have considered all those things. Also, all the valves that are required to operate, we need to have the ability to operate them from the control room and from a remote control station, and the power diversity principle must be applied to all valve operators, and, as I have stated, we meet that requirement.

Exhibit 2C-18, (Item 4), the auxiliary feedwater system should be designed with suitable redundancy to offset the consequences of any single active component failure, and we meet that requirement, as I have stated. Then we come to the last requirement, (Item 5), and there are some key words in here. When considering a high energy line break, the system should be so arranged as to permit the capability of supplying

necessary feedwater to the steam generators, despite the postulated rupture of any high-energy section of the system, assuming a concurrent single active failure.

(Thereupon a brief off-the-record discussion ensued, after which proceedings were resumed as follows:)

MR. KEITH: I am just confirming my memory. A key word was left out of Item 5) here. It should state "with the capability of supplying the necessary emergency feedwater," which is what is stated in the branch technical position. That word "emergency" is put in. That is where the rub comes. We have shown how we meet the ASB 3-1 requirements by stating during normal conditions. However, if we were to take a line break anywhere in this system and the single active failure, as you can see, we would wipe out both trains of our emergency feedwater system as stated here. So I am not sure if it is really intended that we -- With the word "emergency" in here, what this is really doing is making us take a pipe break and a single active failure and an event which would cause you to need emergency feedwater. With that type of requirement, we cannot take a high energy line break anywhere in the system. However, with the high energy line break definition which I stated earlier of just this portion (indicating) being a high energy line, I think we are okay, and we will talk about that. First taking it down here (indicating), we basically have a feedwater line break, and we

have seen with that we can fail one of the feed pumps and the other feed pump will feed the other steam generator. With our AFAS operating properly, it will just affect the one steam generator, and we can take that action. If I have a break here (indicating) and I am not operating, I will discover that and then, knowing that the break is here (indicating), I could take manual control of these valves (indicating) and these valves (indicating) and I would have the capability of feeding the other steam generator with either pump, so I could take a single active failure. Similarly, if I am running, I know about the break here (indicating), because I would get a no-flow indication on that steam generator, so that indication would tell me to isolate these four valves (indicating).

So with that, as I stated, to meet the letter of this, which once again says "necessary emergency feedwater," I do need to take just this portion (indicating) of the emergency feedwater lines as being high energy, which under the inference which we draw from MEB 3-1 that these pumps are not operated more than 2% of the time, that we can do that.

So there it is. I will entertain questions.

MR. VAN BRUNT: Shelley.

MR. FREID: I wanted to take up the question I asked previously before we get into this part of the system, a pipe break in the turbine-driven auxiliary feedwater pump room. You said that it was a watertight door. Was the door also designed to be able to take the pressure resulting from that steam line break there or do we have a potential for a common failure?

MR. KEITH: Well, let me tackle this and the question about the steam line that we have entering the motor-driven pump room. Just as this portion of the line (indicating) is the only high energy portion, we needed to assume that -- I think that is the reason I was not happy about finding that steam line going through our motor-driven pump room, but I am sure the rationale was that this portion of the line (indicating) is all low energy, that it is not high energy for the same reason that the portion back here (indicating) we have taken as not high energy, just because of the 2% rule.

MR. FREID: Where are those valves located? I guess if they aren't in the main steam support structure, what room are they located in?

MR. KEITH: Above the feed pump rooms.

MR. FREID: Okay, they are in the feedwater area or the steam line area?

MR. KEITH: Yes.

MR. FREID: If there is a problem with the other, there

is a problem with this.

MR. KEITH: Correct.

MR. VAN BRUNT: Are you all set, Shelley?

MR. FREID: Yes.

MR. VAN BRUNT: Rick.

MR. TURK: I would just like to focus a minute on the one break that you said can be taken, say at the intersection between the two trains on the downstream side -- yes, just a break right there -- you are saying that the break occurs there and the system is called to actuate, is that what you are saying?

MR. KEITH: Yes.

MR. TURK: And all four valves, all eight valves, actually, open wide and begin to feed the break. Since both pumps are essentially seeing the same backpressure and since both flow indicators are essentially seeing zero flow, how does the operator know which side the break is on? What indication does he have of which side the break is and can switch valves to shut.

MR. KEITH: What we would have the operator do, to get into an emergency procedures area -- you're right, I wasn't complete in this description there. What we recommend is shutting all four of the cross-over valves. Assuming you have both pumps running, shut all of the cross-over valves, and you would then see where the break was and you could then

take the appropriate action.

MR. TURK: If that pump was the single failure, then how do you get your feed?

MR. KEITH: If this pump were the single failure --

MR. TURK: You would now shut the center four valves, the four cross-connect valves.

MR. KEITH: Yes.

MR. TURK: He then sees that the single failure is in the motor-driven pump. I guess what you are saying is he now has to reopen the cross-connect from the turbine-driven pump to the other generator. Is that what you are saying?

MR. KEITH: Yes. You know, if you would shut these valves (indicating) for this pump (indicating), you would shut these (indicating), and then you are postulating this pump fails.

MR. TURK: So he's got some kind of a fault tree that he is going by, see this, do this, see this, do that.

MR. KEITH: That's right.

MR. TURK: Would he have the ability to do that within the time frame? Let's say steam generator boil dry time.

MR. KEITH: We think it is reasonable to do it in 20 minutes. In 45 seconds, it is not.

MR. TURK: Where is 20 minutes coming from?

MR. KEITH: Boil dry time. That is assumed in 0635 for a boil dry time, and I think your calculations --

MR. TURK: 0635 is a boil dry time for CE's operating generators, which, of course, take their low level trip off a narrow range indicator. In other words, the trip and the actuation come with a lot more inventory left in the generator than your plant. Where the reactor trip comes off a steam generator wide range level, it occurs with much less inventory and your boil dry time is considerably less than 20 minutes.

MR. KEITH: I think you have done a calculation -- Well, I know you have done a calculation. I don't recall the exact number.

MR. TURK: The one done for the owner's group?

MR. KEITH: Yes.

MR. TURK: 7.5 minutes. Now, there were a lot of assumptions, and I don't remember offhand what they all were, but on the assumption that the steam bypass control system is not available, which would be a controlled rate system, the boil dry time was 7.5 minutes.

MR. KEITH: I think we would have to look at all those assumptions.

MR. VAN BRUNT: Let me say for the record I think that you ought to go back to Combustion and ask them exactly what the boil dry time is for a System 80 under the circumstances we are talking about and then, having got that, and I don't know whether it is 7 or 20 or whatever it is, then take a look at whether taking operator action is prudent and proper within

that band of time. I would add that to the list of items.

MR. TURK: I have one more I would like to follow up. Not to beat a dead horse, but have you looked at the pump response with both pumps coming on both feeding to that break to atmosphere in terms of running out, damaging the pumps, that kind of thing?

MR. KEITH: Well, the pumps would be run out. We have talked about that earlier.

MR. TURK: In other words, that might be a more limiting time frame with regard to the time frame that you have to take operator action than generator dry out?

MR. KEITH: I think with the alarm you get on the pump in the runout condition --

MR. TURK: Well, they are both alarmed.

MR. KEITH: Well, you would be forcing the operator to do something quickly anyhow, so, I don't know, it could enhance the possibility of doing it fairly quickly.

MR. TURK: Or incorrectly.

MR. VAN BRUNT: Again, I think there needs to be some information exchanged and the area needs to be looked at to be sure in fact that we do have an adequate situation.

Jerry, go ahead.

MR. WERMIEL: I am not following something, first of all. If I break the top emergency feed line to the steam

generator just downstream of the isolation valves -- there, yes -- and I postulate a single failure in the other emergency feedpump, I don't see how I get emergency feedwater to either steam generator.

MR. KEITH: With a break here (indicating), you have to shut these valves (indicating).

MR. WERMIEL: Well, not if I single failed the other pump. How am I getting flow there?

MR.KEITH: Through here (indicating).

MR. WERMIEL: I see.

MR. KEITH: You close these valves (indicating) and then go down here (indicating).

MR. WERMIEL: Oh, I see. I close the valves. Then generally you are saying to meet the full intent of this position, if we just eliminated the words "emergency feedwater," the third train would be available?

MR. KEITH: Yes.

MR. WERMIEL: You are aware, of course, that our interpretation of 10-1, Position 5), has been that all three trains be safety grade to assure we can meet this position in the event of a loss of offsite power, and that is the interpretation we have applied to all plants up to this point.

MR. BINGHAM: Didn't we become aware of that when we sat down a few weeks ago with you?

MR. WERMIEL: That's right.

MR. BINGHAM: That was the first time we really had become aware of that interpretation of the criterion. We do understand that and I tried to indicate earlier that we wanted to deal with that particular issue, because we thought that the system was satisfactory for the intended purposes, and tomorrow when we get into the reliability assessment based on NUREG 0635, it is our intent to present the facts and how this system stacks up to, say, a three or four safety or five safety train kind of system.

MR. WERMIEL: Does anything that Mr. Turk has said affect that reliability study? I believe the reliability study assumes throughout that there is a 20-minute boil dry time, and I am not sure how that is going to impact on tomorrow's presentation; but I think we should all be aware that that is the basis for it now and that it is our assumption that there is a 20-minute boil dry time.

MR. BINGHAM: I wasn't under the understanding that the boil dry time of 7.5 minutes was submitted to NRC.

ME. TURK: The 7.5 minutes was a number in response to a CE TMI owner's group report that was done and it was done with some basic assumptions and premises, and I don't recall what those were, so I am not saying that there is a 7-minute boil dry time in all cases. I don't remember what the particular constraints were on that calculation, but that was the same calculation that came up with numbers like 20 minutes

for the operating plants. It is basically a different generator.

MR. VAN BRUNT: Jerry, I would say as far as the analysis tomorrow is concerned, that would be an accident mode analysis, and certainly if the analysis is incorrect, that analysis would certainly have to be qualified, and if the conclusions changed, then we would have to do whatever was appropriate with those conclusions, but I don't think that will interfere with the presentation tomorrow as far as the procedures that were used and that kind of thing. If we can agree on that, then it is just a matter of cranking in some different numbers.

MR. WERMIEL: My concern I think most of all was that the study itself was now not going to be negated.

MR. VAN BRUNT: No. I think we can go through the whole study and all those things and come to an agreement or at least get any issues out on the table relative to how it is done. Then if we have to run it with 7.5 or 20 or 100 or whatever the numbers are, we could all agree whatever the answer was. So I think that, if you like, there will be that little cloud over that analysis tomorrow until it is clarified what the boil dry time is.

MR. BARNOSKI: We in the interim will also try to get some additional information and try to shed some light on that.

MR. VAN BRUNT: Okay, Mike. Thank you.

Are there some other questions? Ralph.

MR. PHELPS: I have one hypothetical question. If you consider an initiating event that requires emergency feedwater, let's take, for example, a total loss of main feedwater event, and your emergency feedwater system comes into operation, all the valves open, and then you consider a single failure that is of relatively low probability, for example, loss of your DC bus, where your DC operated valves fail, that is a potential for overcooling, because they won't cycle closed when you hit the low level reset point. Are you going to consider events like that when you look at potential for overcooling?

MR. KEITH: Yes. We have discussed this, Ralph, and these valves here (indicating) are off different DC buses. We have four Class IE DC buses and these (indicating) are off different ones and these (indicating) are off different ones because of that concern.

MR. VAN BRUNT: John. Excuse me, Ralph, are you satisfied?

MR. PHELPS: Yes.

MR. VAN BRUNT: Okay, John, go ahead.

MR. ALLEN: Dennis, you indicated a moment ago if we would have a pipe leak or a rupture in the auxiliary feedwater pump rooms that it would be alarmed in the sumps. I thought that is what you said.

MR. KEITH: Yes.

MR. ALLEN: I didn't know there were sumps in those rooms.

MR. BOLES: There is a level switch in each of the pump rooms to alert the operator in the control room by an alarm that there has been a leakage in the pump room, and postulated piping failure would probably be the first thing that would be alarmed as well as potential low pressure on the one pump discharge.

MR. BINGHAM: Any other questions, Ed?

MR. VAN BRUNT: Olan was just talking to me on the side. On that one, that's right. On the last page, 2C-18, that correction to add the word "emergency" ought to be made on that one as well just to be sure. Since that is a very critical point in this whole discussion, I think that that chart needs to be fixed as well as the others.

MR. BINGHAM: That should be corrected.

MR. VAN BRUNT: Are there any other questions?

MR. PARR: Let me ask one question. Do you interpret that word "emergency" to negate the 2% rule?

MR. KEITH: No. "Supplying necessary emergency feed-water" I interpret to be your safety grade pumps is really all it is referring to. But then you say "postulated rupture of any high-energy section of the system," and we would assume high energy there was defined as it is in MEB 3-1 and ASB 3-1

and that the 2% rule was applicable.

MR. WERMIEL: The interpretation as we understand it is that the emergency feedwater system is high energy throughout whether it is used for startup and shutdown or not, and that has been the interpretation of late. I was informed, and as I believe I informed you people, the 2% rule originally was not intended to encompass the aux feedwater system even though the words got in to the branch position that way. The original intent was to only include the RHR system, and now my understanding is that we honestly are trying to correct that.

MR. BINGHAM: Yes, Jerry, we do understand the difference and we are not trying to do any more today than to present the bases that we have been using for so many years on this particular system not only going through the licensing for Units 1, 2, and 3, but not so long ago the licensing of Units 4 and 5. So this foggy interpretation of the requirement is new to us, but today we wanted to present to you the bases and demonstrate why we believe that the system is adequate as we knew and understood the criteria up until a few weeks ago. That is our intent today. What we are hoping to do tomorrow is to provide some more facts on how the system looks from overall reliability viewpointwise to us. We understand, not really perhaps necessarily related to the branch positions, but I think important in demonstrating and

comparing perhaps this plant with other work that has been done by NRC on presently operating plants to show how the system falls in overall reliability, and, further, we thought it very important because of the concerns that you have expressed and Ed and others have expressed that we try to look at some modifications to the system to demonstrate the order of improvement from making certain modifications, and we will present those tomorrow so that you may have some better understanding for all of the boards on what they mean in overall gain as far as the modifications. So with that, we will finally I think be able to address the issue that you have brought up as a concern of whether safety grade or not. I think that is a very important issue that we will talk about tomorrow in some detail.

MR. VAN BRUNT: Are there any other questions?

Let me then ask that we take just a couple minute break. I want to talk to the board for a second and see if there is anything else that we want to raise, and then we will come back and go over the open items to be sure that we've got them all listed.

(Thereupon a brief recess was taken, after which proceedings were resumed as follows:)

MR. VAN BRUNT: Let's go back on the record.

Bill, would you please go down the list of items that you have identified and read them off one at a time, be

sure everybody agrees that they describe in enough detail the issues so that we can deal with them at a future time.

MR. QUINN: Yes, Ed. As I read one question, if Bechtel wants to answer that, will they be able to answer it at that time?

MR. VAN BRUNT: They can do it right now. I think that would be the easiest way to do it. Then we will give them another opportunity tomorrow morning.

MR. QUINN: Fine. The first open item I have is to verify the results of Bechtel's pipe analysis showing that the auxiliary feedwater piping can withstand a thermal shock of introducing the 40 degree F to 180 degree F water into the hot feedwater line.

MR. BINGHAM: Later, Ed.

MR. QUINN: The second open item: Is there a steam line going through the motor-driven pump room and does this violate the separation criteria?

MR. BINGHAM: I would like to clarify that. The answer to the question is there is a steam line in there. We don't believe it violates the criteria, but we will respond either tomorrow or later.

MR. HOEFERT: I just might add that, based on the previous discussion, this is being considered a moderate-energy line, is that correct?

MR. BINGHAM: Norm, the intent is that in that aux

feedwater system that there be no high energy line breaks, and that has been our criterion, the reason we bunkered it, protected it, so that we had really a very safe configuration. That always has been our criterion.

MR. WERMIEL: Well, even a crack in that line will induce an unacceptable environment to the motor-driven pump, won't it?

MR. BINGHAM: Well, let us take that under consideration.

MR. VAN BRUNT: That whole area is going to be looked at, Jerry.

MR. BINGHAM: Let me add one point here. When I say we have exempted it from high energy line breaks, I believe you said well, what about moderate, and then we have the interpretation of whether one psi is moderate or not, and we will have to come to a point where we present our rationale on that. We believe that we are exempt in that particular area.

MR. ALLEN: I would like to add one thing to it, to add, also, to make sure and follow up on what Jerry said, the environmental qualifications program for that electric-driven motor or pump and make sure that it is covered in case they do get a steam leak, what temperature can it see and not violate a qualifications program?

MR. BINGHAM: That has been considered and we can give

you the information.

MR. VAN BRUNT: Any other comments on this particular item? Bill.

MR. QUINN: The third open item I have: Is there an interface requirement to have a checkvalve to prevent cold condensate water from entering the economizer box on the steam generator. That was from the aux feed pump.

MR. VAN BRUNT: I think that one will have to be answered later, because there will have to be some verification on that. Go ahead.

MR. QUINN: The fourth open item was to clarify the testing plans to identify potential for waterhammer within the auxiliary feedwater system, and also to verify whether there are any plans to throttle back on the valves to prevent waterhammer. That refers to a NUREG 0635 item.

MR. VAN BRUNT: I think in addition to that we asked if Olan or Jerry could provide us with any additional information or criteria that they have developed recently that would assist us in evaluating that situation.

MR. QUINN: The fifth open item, and Mike Hodge may be able to help a little bit on this, but he asked, was there any HIS standard that allows the reducer to have the flat area installed on the bottom.

MR. KEITH: That was responded to.

MR. VAN BRUNT: I think Mike wanted to get a copy.

MR. KEITH: The open item is to provide him a copy of the standard.

MR. VAN BRUNT: We have not been able to get hold of that standard. That is really the open item.

MR. KEITH: I just wanted to clarify the open item.

MR. VAN BRUNT: Go ahead, Bill.

MR. QUINN: The sixth open item that I have was to clarify how you prevent feeding the isolated steam generator with water from the startup pump when the plant is at zero power.

MR. TURK: That was Ralph Phelp's question.

MR. QUINN: Yes, Ralph Phelps.

MR. PHELPS: I discussed it with Rick Turk and I think it has been answered, but I would still like Bechtel to respond to that, and there is a correction in the way the question was worded. It should be to the intact steam generator, not the isolated.

MR. KOPCHINSKI: Could you clarify the whole question, because I had problems with it.

MR. PHELPS: Let me restate it. Originally, from the information that I had available to me, it appeared that when you were in hot standby and operating on your startup pump that if you had a steam line break in one steam generator, you would continue to feed that steam generator, it wouldn't be isolated, but Rick pointed out that there were valves down-stream of the startup pump that did receive main steam

isolation signals, so that would answer my question, but I would like Bechtel to just verify that particular scenario.

MR. KEITH: That there are main steam isolation signals to valves downstream?

MR. PHELPS: Yes, of the startup pump.

MR. KEITH: Yes, we can verify that right now, Ralph. That is correct.

MR. KOPCHINSKI: Is that item closed, then?

MR. VAN BRUNT: Go ahead, Bill.

MR. BINGHAM: We have a point, Ed.

MR. VAN BRUNT: Excuse me, I'm sorry.

MR. BINGHAM: We believe this item is closed.

MR. VAN BRUNT: If Ralph is satisfied, then I'm satisfied. He was the one that originated the question.

MR. PHELPS: I am satisfied.

MR. VAN BRUNT: Okay, fine. Then consider it closed.
Bill, go ahead.

MR. QUINN: The seventh open item was to clarify that the Tech Specs will be clear to show that when the B diesel is out and the turbine driver is out that that would be an unacceptable Tech Spec condition.

MR. KEITH: I don't know that that is open. That is an action item for APS. I think you made the commitment to do that.

MR. ALLEN: What's that, Dennis?

MR. KEITH: The Tech Spec where we have the steam-driven auxiliary feedwater pump out and somebody wants to take a B diesel generator out, the question was could that happen, and we need to make sure that the Tech Specs cover that kind of situation.

MR. VAN BRUNT: As I remember, I requested that we put an item on to verify that the Tech Specs were adequate to deal with that situation or were properly worded so that there wouldn't be any misinterpretation.

MR. KEITH: Well, I think there probably is the possibility of misinterpretation now. I think we ought to just make the commitment now to make sure that the Tech Spec --

MR. VAN BRUNT: I thought that is what we did.

MR. KEITH: I don't know if you want to leave it as an open item.

MR. VAN BRUNT: Well, I think the open item will be how it is written to be sure that it is satisfactory, and I think probably we ought to do that when we close the item.

MR. KEITH: Fine.

MR. VAN BRUNT: Okay, Bill.

MR. QUINN: The eighth open item was to clarify how the Tech Spec requirements and CESSAR will be applied specifically to Palo Verde so that the Palo Verde Plant has its own set of Tech Specs with no cross-references.

The ninth open item was the question: If the 135 GPM recirculation line is broken, does Bechtel's

condensate tank design volume meet the interface requirements of having 300,000 gallons available to the intact steam generators?

MR. KEITH: Well, I think I was the one that brought up the recirculation line, because I had apparently a misunderstanding on the sizing criteria. I think it was just kind of a general thing on whether we can take a line break and still meet the eight hours, and I think what we will do is respond to determine just what all went into the sizing criteria, or sizing calculations, excuse me.

MR. QUINN: The tenth open item was to clarify whether there was a possibility of getting a safety injection signal after aux feed flow is automatically initiated and, if so, what operator action is required to prevent a safety injection signal. That was Norm's question.

MR. HOEFERT: I think along with this is more of a generic question, and that is is it acceptable for the actuation of one safety system to cause the actuation of another.

MR. BINGHAM: I am not sure, Ed, how we can respond to that particular issue, and I suggest maybe the board either exempt us from responding to that or rethink the best way to handle the issue at hand.

MR. HOEFERT: I understood CE was going to provide some response to that.

MR. VAN BRUNT: I think we would have to go back and look at the transcript.

MR. TURK: That was the safety injection?

MR. HOEFERT: Yes.

MR. TURK: If it is worded is it possible, there is no doubt that it is possible. There are cases where automatic actuation of the aux feed system, if manual action is not taken to regulate it, will cause safety injection. There certainly can be cases where that is going to happen if the initial conditions are such. Now, if the question was under a specific set of criteria, yes, we can go back and analyze and determine for a specific instance whether or not it will.

MR. HOEFERT: I think what we need is CE to tell us when to expect this to happen so we can write our operating procedures accordingly, or if it is acceptable to even have a situation like this.

MR. KEITH: Would it make sense to just look at -- It seems to me like the loss of feedwater flow, if we just looked at that accident -- I mean a main steam line break, you are going to get both, for example, regardless of what you do with it.

MR. TURK: The point I am making is that we can take -- In fact, we have done it. It was done in the TMI owner's group, CEN-128, although it wasn't done for a System 80 plant. That was a best estimate analysis, so it did actuate all of

the available emergency feed pumps, and it did it for fuel decay, heat load, and the other basic assumptions.

MR. KEITH: On a loss of main feedwater?

MR. TURK: On a loss of main feedwater, and in that particular case, it showed the safety injection was not actuated. My point being that for the whole spectrum of conditions the plant can be operating, Ed, with very low decay heat or if reactor cooling pumps are lost simultaneously or if the loss of feed is due to the loss of offsite power and you don't have pump heat, there are certainly cases where they are not going to be actuated.

MR. KEITH: But somehow we've got to define the question such that it is answerable.

MR. TURK: I don't know what the answer gains you, meaning we can go back and say you're right, we'll take the Chapter 15 loss of feedwater and say we used two aux feed pumps instead of one and see if you get safety injection and there is a yes or no answer, but I am not sure what that tells you.

MR. VAN BRUNT: Let's go off the record for a minute.

(Thereupon a brief off-the-record discussion ensued, after which proceedings were resumed as follows:)

MR. VAN BRUNT: Norm, why don't you go ahead and reframe your question so that we can deal with it properly.

MR. HOEFERT: I would just request the criteria or guidelines be provided as to when the operators can expect to

have to take manual action to limit cooldown by the auxiliary feedwater system.

MR. VAN BRUNT: Go ahead, Bill.

MR. QUINN: Open item eleven was to determine if a radiation monitor should be placed in the turbine aux feed pump steam exhaust line.

MR. ROGERS: Or is being.

MR. QUINN: Open item number twelve was to determine if a radiation monitor should be placed in the recirculation line to the condensate tank.

MR. KOPCHINSKI: I would like to say that I do not think you need a radiation monitor on the recirculation line. I think that the reactor makeup water tank, if it has any activity in it at all, it will be tritium of such a low level that its introduction into the secondary system would have no effect. I just can't think of any reason why you would worry about that water being introduced into the secondary side.

MR. VAN BRUNT: Gerry, I don't necessarily disagree with you, but I think that we ought to verify for the record that that is in fact the case.

MR. BINGHAM: May I have a clarification, Ed?

MR. VAN BRUNT: Sure, Bill.

MR. BINGHAM: We are trying to deal with these particular issues, and in order to look at it, we would want to be comparing it with some criteria. Have we agreed upon the

criteria that you will be comparing this to as far as the need to have a monitor?

MR. KOPCHINSKI: If you want to compare, I think our design criterion allows operation with some small amount of steam generator tube leakage, and you could compare the introduction of this water to that kind of operation.

MR. BINGHAM: Well, I believe what I heard was that it is intuitive that that ratio would be insignificant in the overall, but we can confirm that point.

MR. VAN BRUNT: Go ahead, Bill.

MR. QUINN: Open item thirteen was to evaluate whether the low level alarm on the condensate storage tank should be a Class IE safety-related alarm.

MR. WERMIEL: Could I raise a point on that? That is one of the concerns, very specifically, as a matter of fact, in a March 10th letter on feedwater. I believe it is Item GL1, where we state pretty much categorically that redundant safety grade level indications should be IE on the condensate storage tank, and I think you will be addressing that tomorrow if I am not mistaken.

MR. BINGHAM: That's correct.

MR. WERMIEL: So if you would like, we can defer that until tomorrow's discussion, I think.

MR. VAN BRUNT: Well, I think we can leave it as an open item. We will have to take it up.

MR. BINGHAM: We will answer that probably tomorrow.

MR. VAN BRUNT: Go ahead, Bill.

MR. QUINN: Open item fourteen, if security was breached to the remote shutdown panel doors, is it possible that somebody could enter the remote shutdown panel area and take control from the control room?

MR. BINGHAM: We will answer that tomorrow.

MR. VAN BRUNT: Go ahead, Bill.

MR. QUINN: Open item fifteen, clarify whether the aux feed turbine driver has been or will be type tested.

Open item sixteen, determine what inputs were made to arrive at the 330,000 gallon condensate storage tank reserve. This was really the same question that we had earlier.

MR. BINGHAM: What was our earlier question?

MR. KOPCHINSKI: It is basically the same as item nine.

MR. BINGHAM: Could we hear nine again to see if we can eliminate this question, Ed?

MR. VAN BRUNT: Bill, would you read nine again, please?

MR. QUINN: Before I do that, there was a qualifier on this question. It was Shelley Freid's question. He wanted also to clarify such things as whether the level instrument errors are taken into account and was vortex formation taken into account.

MR. VAN BRUNT: Bill, I would suggest that we leave them as two separate questions for the moment and we can consolidate the answer if necessary.

MR. KEITH: Well, it sounds like one is related to the CE calculation on the 300,000, the other is related to our 330,000.

MR. VAN BRUNT: I think that is part of it.

Go ahead, Bill.

MR. QUINN: Open item seventeen was to clarify whether there was safety relief valves on the condensate storage tank. Bechtel did clarify that earlier.

MR. VAN BRUNT: I think we added to that.

MR. QUINN: There was an addition to provide information as to whether the tank could be overpressurized, clarification also as to what was the basis for the sizing of the relief valve.

MR. BINGHAM: We will provide that.

MR. QUINN: Open item eighteen was to clarify whether both the regulating valve and the isolation valve need to be stroked since both the valves were powered off the DC battery system and stroking both of the valves provides an extra drain to the DC battery system.

MR. KOPCHINSKI: I thought that was answered.

MR. KEITH: I'm sorry, would you repeat that again, Bill?

MR. QUINN: Norm's question was, there was the isolation valve and the regulating valve both powered from the DC system, and why do you have to stroke both of them, since that provides an additional drain off the DC battery system?

MR. KEITH: And we did say we would look into it further to see. We don't think it is a good idea, but we'll check and confirm.

MR. QUINN: That's correct.

Open item nineteen was to clarify why, on the P&ID for the steam supply valve for the turbine, one valve had two hand switches, that was Valve 134, and the other valve had four hand switches, that was Valve 138.

Open item number twenty was to clarify where the floor drains in the auxiliary feedwater pump rooms flow to and what was the design basis for that floor drain system.

MR. KEITH: We confirmed where they flow to. I think the question is just the design basis.

MR. QUINN: Open item twenty-one was: Does having access to the motor-driven pump room through the turbine pump room violate any OSHA or NRC separation criteria?

MR. KEITH: We responded to that. What we committed to do was look at the emergency hatches going out from both rooms.

MR. HOEFERT: Right.

MR. KEITH: We may have a later one on that looking at their leak tightness as well as just the capability to use them.

MR. QUINN: Open item twenty-two was to clarify --

MR. KOPCHINSKI: Bill, did you miss twenty-one or was that twenty-one?

MR. QUINN: That was twenty-one. Open item twenty-two was to clarify why a low flow indication on auxiliary feed-water pumps is not required to provide runout protection for those pumps when the plant is in a condition where the remote shutdown panel is required.

Open item twenty-three was to clarify the steam generator boil dry time for a System 80 steam generator to determine if required operator action can be accomplished for a pipe break downstream of the isolation valves with an aux feed pump failure.

Open item twenty-four was to make a correction to Exhibit 2C-18. That was adding the word "emergency."

Open item twenty-five was to make the correction to Exhibits 2C-1 through 2C-14 where the MEB versus the ASB was reversed.

MR. BINGHAM: May I make a comment, Ed? I think we agreed for the record that we would make that change. I don't believe that really falls as an open item to respond to.

MR. VAN BRUNT: I guess you are probably right, except

we've got to be sure that we do in fact fix it. We have to change the attachment that will go with the transcript.

MR. BINGHAM: That applies also to the error in the other slide where there was a word left out.

MR. VAN BRUNT: That's right.

MR. BINGHAM: It was not intentional to leave the word out.

MR. QUINN: That was the extent of the open items that I had listed.

MR. KOPCHINSKI: I have one or two that you missed. One of them was CE provide the limiting events in the criteria for the 300,000 gallons. That again relates back to a similar question that was more specific, perhaps.

MR. KEITH: I think that is encompassed in the other question.

MR. VAN BRUNT: I think you can consolidate that part along with I think it is question nine. I forget what the other number was.

MR. KOPCHINSKI: Yes, it relates to question nine.

The only other one I had was the turbine driver speed control. Which has priority, the control room, the remote shutdown panel, or the local control? Why don't we call that twenty-six.

MR. VAN BRUNT: Do you have any others, Gerry?

MR. KOPCHINSKI: No.

MR. ROGERS: Bill, did you have the one on the operating experience with the feed pump turbine driver? Was that in your list?

MR. QUINN: Yes.

MR. BINGHAM: Could we get a clarification on Jerry's comment on the IE classification or requirement for the level indicators on the tank?

MR. WERMIEL: I was just looking at this. On the level indicators on the condensate storage tank, it is not GL1. At least, not as presented in the letter. I can recall in our reviews of the operating plants specifically as an outgrowth of NUREG 0635 and 0611 requiring redundant safety grade level indication for the condensate storage tank, and I have been trying to put a handle on where this is coming from, and I haven't yet.

MR. TURK: I know for CE plants, it was listed as specific requirements on the plants that didn't have it.

MR. WERMIEL: This may be where it is coming from. I know on Westinghouse plants, they required the same thing. I am told that it was a separate requirement that never really had a label one way or the other, but we have applied it to operating plants and I would assume we are going to apply it to OL's as well.

MR. KEITH: We covered it in the additional short term for indication, but nothing about whether it is Class IE or

not.

MR. WERMIEL: That's right. The wording there is not the same as we have been applying. I think the words there are merely redundant.

MR. BINGHAM: That's right. We were just looking at the paragraph here and we wanted to find out where he was coming from.

MR. WERMIEL: It is listed here as additional.

MR. VAN BRUNT: Are you satisfied with that clarification?

MR. BINGHAM: Well, I am not sure.

MR. KEITH: I think Jerry wants to get back and confirm that it is.

MR. VAN BRUNT: Maybe I could ask you if you could clarify this for us.

MR. WERMIEL: We have expanded the interpretation presented in the March 10th letter to go beyond the words here to require that the indication not only be merely redundant, but safety grade as well with the redundant IE power circuits.

MR. PHELPS: It does show up in the Proposed Draft 2 of Reg Guide 1.97 that they want that indication to be Class IE.

MR. VAN BRUNT: Are there any other items that you want to raise, Bill? Dennis?

MR. BINGHAM: No items.

MR. VAN BRUNT: Anybody on the board have any other items they want to raise?

(No response.)

MR. VAN BRUNT: Then I declare this meeting closed. We will get back here tomorrow morning at 9:00, the same room, and we will have the same arrangements tomorrow.

(Thereupon the meeting was at recess.)