INDEPENDENT DESIGN REVIEW
of the
PALO VERDE NUCLEAR GENERATING STATION
CONTAINMENT SYSTEMS

Before the

CONTAINMENT SYSTEMS REVIEW BOARD

VOLUME I of II

Pages 1 - 214

Phoenix, Arizona
May 21, 1981.

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INDEX

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The Containment Systems Independent Design Review Board of the Palo Verde Nuclear Generating Station convened in Navajo Room A, Adams Hilton Hotel, Phoenix, Arizona, on the 21st day of May, 1981, Mr. Edwin E. Van Brunt, Jr., Vice-President, Nuclear Projects Management, Arizona Public Service Company, presiding.

MR. VAN BRUNT: My name is Ed Van Brunt. I am Vice-President, Nuclear Projects Management, for Arizona Public Service Company and 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 an Independent Design Review of the Palo Verde Nuclear Generating Station's Containment Systems. For those of you who have not attended a previous IDR, basically what we do is take the design of a specific plant system, structure or a specific program and review it for adequacy of design and compliance with regulations. This presentation is made by Bechtel personnel involved in that system, structure or program. This formal presentation by Bechtel to a review board consisting of experts from APS, other utilities, our Nuclear Steam Supply System vendor, Combustion Engineering, and the Nuclear Regulatory Commission aids in the understanding of the design basis, construction, and operation of those systems,

structures or programs under review. This in turn minimizes, if not eliminates, the time required for the NRC to review that portion of our Final Safety Analysis Report

For today, the Bechtel project staff will present a review of the Containment Systems. They will cover the following specific areas: Containment Heat Removal System, Containment Isolation System, and Combustible Gas Control. Bechtel will present a system overview for each area including conformance to regulatory requirements.

Bechtel or other organizations, as designated, will prepare formal responses to any open issues defined by the Review Board during this review. These responses will be reviewed by the Review Board for concurrence. When final satisfactory resolution of these items is accomplished, they will be provided to the Nuclear Regulatory Commission.

For today's review, we have assembled a review board with a varied background. Since the responsibility for an adequate review lies with the applicant, that is, Arizona Public Service Company, the Board's basic formation starts with APS personnel, complemented with personnel from other groups who have expertise and experience on the system or program being reviewed not necessarily available within Arizona Public Service Company. Board members were provided with appropriate sections of several documents to familiarize them with the Palo Verde Containment Systems in question.

These included sections from the Palo Verde Final Safety Analysis Report, the appropriate Standard Review Plans, along with sections from the Palo Verde Systems Description Manual.

At this time, I would like to introduce the members of the Board and then I will have Dennis Keith, Assistant Project Engineer for Bechtel, introduce the Bechtel project representatives who are here today.

John Allen, sitting here on my right, 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, here on 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.

Mike Hodge, sitting down here a little bit, is an APS Nuclear Engineering Department Supervising Mechanical Engineer and reports directly to Carter. Mike is responsible for the review of the Palo Verde Mechanical Systems and the day-to-day interface with Bechtel and Combustion personnel for these systems.

Ed Sterling, down here at the end of the table, is

an APS Nuclear Engineering Department Supervising Instrumentation and Controls Engineer and reports to John Allen. Ed is responsible for the review of the electrical and instrument and controls portion of the auxiliary systems.

Marty Raines is an APS Electrical Engineer who reports to John Allen. He is responsible for the review of the Palo Verde electrical systems, including those electrical systems related to containment systems, and the day-to-day interface with Bechtel and Combustion Engineering personnel for those systems.

Bill Simko, across the table, is a Palo Verde Senior Mechanical Engineer in the Operations Engineering Section. Bill reports to the Operations Engineering Supervisor for Mechanical Engineering Support. His responsibilities include review of plant systems for operability and balance of plant performance calculations.

Two Board members are from Bechtel and have not been directly involved in the detailed design and engineering of Palo Verde. However, they may have from time to time consulted with the project team on various specific issues. These representatives are Feng Ku, Engineering Supervisor, Los Angeles Power Division, and Mr. Richard Tosetti, Chief Nuclear Engineer, Nuclear Fuel Operations, Bechtel National, Inc. Mr. Ku has worked as a technical member of the Bechtel Mechanical Engineering staff for 18 years. As a staff member,

he has assisted various nuclear projects in the design and analysis of containment and balance of plant related systems. Mr. Tosetti has been responsible for analyses for hydrogen generation rates and for hydrogen explosion pressures and temperatures following a loss of coolant accident for the Bechtel staff.

Representing Combustion Engineering, the Nuclear Steam Supply System supplier for Palo Verde, is Phil Hepner, Supervisor, Safeguard Systems. Phil is across the table here. He is responsible for directing the Combustion safeguard systems group in the development of safety injection systems, residual heat removal systems, containment spray systems and iodine removal systems for nuclear power plants.

From Southern California Edison, we have asked Pete Penseyres to participate in this review as a Board member. Pete is a Supervising Engineer at San Onofre Units 2 and 3, and is responsible for supervising the reactor engineering group in charge of physics testing, core analysis, and fuel handling. He is also responsible for mechanical and electrical engineering groups involved in review of system designs and in-service inspection.

The Nuclear Regulatory Commission has sent representatives to observe and participate in this system review as well. They are sitting across the table here. They are John Huong and John Held. We appreciate your

appearance here and we invite you to take active participation in this review.

In the last few days, we have received a set of informal questions, or two sets of informal questions, I guess, from the Nuclear Regulatory Commission. The Bechtel staff has not had the opportunity to build those questions directly into their presentation. However, at the end of each section of the presentation, we will attempt to deal with as many of these questions as we can. We will reference the specific question and then Dennis will have some of his people answer the question. That way we will be able to get those answers into the record. Additionally, we will append to the transcript of the record a copy of the questions that we have received from NRC so that whoever reads the record will have a copy of the questions and then can look at the answer. We will try and deal with as many of those as we can. Those that we cannot deal with, we will deal with in a supplementary letter to the review so we will have a nice, clean package for the whole works.

We will provide a transcript of this review to the Nuclear Regulatory Commission as soon as we have received it from the court report and proofed it. I have designated Bill Quinn from my staff and Gerry Kopchinski from Bechtel to review the transcript and develop a joint list of the open items for the court reporter to append to the transcript

of the meeting. We found at the last meeting this works a little better than trying to read them all into the record and it gives my friend here a break. He doesn't have to type so much.

The Board is instructed to review the open items to ensure they reflect the issues that were raised upon receipt of the transcript. For the benefit of the court reporter, I ask that the Review Board members or anyone else who makes a statement to please clearly identify himself before making any statement and state the specific exhibit number or figure number, if you are referring to one, so that we can get it into the record so that somebody that reads it has a better way of knowing what the question is and what the response is.

To assure that these indepedent design reviews are completed in a timely manner that will not impact the Palo Verde licensing review, we have prepared in conjunction with Bechtel a schedule that calls for completion of this review in ten weeks. We have put the schedule up here on the board and, as you can see, it is a rather ambitious schedule. In Week 9, the Board will comment on the Bechtel responses and will reconvene, if necessary, with the objective of resolving all comments and finalize the responses. Now, when I say reconvene, we may just have a conference phone call or I may call you individually and resolve some issue,

but any issues that the Board members have open will be specifically resolved with them and we will have some documentation that these items are complete as far as the Board is concerned.

Do any of the Board members have any questions before we proceed? I am going to turn the meeting over to Dennis here in just a minute.

Seeing no questions, Dennis, if you would introduce the fellows that are going to participate today and get on with your presentation.

MR. KEITH: Thank you, Ed.

My name is Dennis Keith. I am an Assistant Project Engineer for Bechtel Power Corporation assigned to the Palo Verde project. As Ed Van Brunt indicated, we are here today to present a review of the Containment Systems at the Palo Verde Nuclear Generating Station facility. This is the seventh in a series of Independent Design Reviews for the Palo Verde Project. I have the following people with me today to assist in the presentation: Gerry Kopchinski, Nuclear Group Supervisor; John Schuh, Mechanical Group Supervisor; Nick Baldasari, Nuclear Engineer; Bill Boles, Mechanical Engineering Group Leader; Paul Biba, Senior Mechanical Engineer; Dan Jensen, Nuclear Engineer; and Mary Moreton, Controls Systems Group Leader.

Containment Systems include the Containment Spray

System, referred to as the Containment Heat Removal System in Standard Review Plan 6.2.2.; Containment Isolation System, discussed in Standard Review Plan 6.2.4; and Combustible Gas Control in Containment, as discussed in Standard Review Plan 6.2.5.

In previous System Review Board meetings, we have discussed how the Design Criteria which are approved by APS and are the basis of the plant design are dealt with. In particular, we discussed how the final design was achieved using the Design Criteria as the starting point and, as part of these discussions, we reviewed the various project procedures which guide the design process and the documentation of the design process. In addition, we have discussed our procedures for assuring interface data are properly included in the design and procurement for the various components. Since this material has been discussed at previous System Review Boards, we propose to refer the Board to Section V of the handout package for a more detailed presentation of the design method, and I would ask, Ed, at this time if that is an acceptable way to cover these issues.

MR. VAN BRUNT: As far as I am concerned and I think as far as most of the Board members are concerned, also. If someone has a question about it, that's satisfactory. I believe it was in the first two Independent Design Reviews, if someone wants to refer to it, and we can provide a

transcript of that if necessary, that these items that Dennis talked about were dealt with in significant detail, the whole matter of quality assurance, how we transfer information, and this sort of thing. If during your presentation, some specific issue comes to somebody's mind and you want to check it out, certainly feel free to, but as a general matter, I think we will not include that unless somebody has a problem.

MR. KEITH: Section V does present a condensation of our earlier discussions.

Our presentation today will follow the agenda shown in Exhibit i. For each of the systems described, we will provide an introduction, system overview, and summary of conformance with regulatory requirements to familiarize the Board with our design.

I plan to ask for questions at the following points: first following the General Introduction; then following CESSAR Interfaces in the System Overview; then following Operation in the System Overview, which is in the Containment Spray System section; then following Conformance With Regulatory Requirements for the Containment Spray System. At that point, we will try to address as many of the NRC questions on the Containment Spray System as we can. We will then have questions on the Containment Isolation Systems following the System Overview, then following Conformance

With Regulatory Requirements, and then once again we will address the NRC questions on Containment Isolation Systems. Then for the Combustible Gas Control System, we will ask for questions following the System Overview and following the Conformance With Regulatory Requirements, and then once again we will address the NRC questions on Combustible Gas Control.

With that, we will get into the General Introduction.

As we stated, the systems we will be talking about are the Containment Spray System, the Containment Isolation Systems, and the Combustible Gas Control System. We have Figure 1-1 shown here to show the basic components of each of these systems. First let's acquaint you with the slide. This is a plan view showing the containment here (indicating), the auxiliary building at this point (indicating), the fuel building here (indicating), and the refueling water tank, which is in the outside area.

Let me take just a second to talk about Palo Verde. At Palo Verde, we have three units which are all identical. Since we have one set of drawings for all the units and the units are not at precisely the same elevation, we have a reference elevation of grade for each unit at 100 feet, so when you see a designation on here of 120 feet, that, for example, is 20 feet above grade for that unit.

Getting to the Containment Spray System, we have the containment spray pumps located in the bottom level of the auxiliary building at elevation 40 feet. That is 60 feet below grade. Those pumps pump water through the shutdown cooling heat exchangers located here (indicating) in the auxiliary building at elevation 70 feet. They pump into the containment through penetrations located in this area (indicating) and up into the dome of the containment, and this shows the three rings of the containment spray headers. There are three rings per train located up in the dome. The spray pumps initially following an accident take suction from the refueling water tank, and that is shown here (indicating), as I stated, in the outside areas.

The Containment Isolation System consists of a number of valves and penetrations, and for our mechanical and electrical penetrations, they are all located in this area (indicating). As we say, the piping penetrations, most of them, are in the elevation 88 to 95 feet inside containment, and then, of course, outside containment in these two areas (indicating).

Our Combustible Gas Control System consists of two hydrogen recombiners for the site. For all three units, we have two recombiners, which, of course, are portable, and we have one hydrogen purge exhaust unit, which, of course, is also portable. The recombiners are Seismic Category I,

Quality Class Q. These terms I will define later in the presentation. The hydrogen purge exhaust unit is not a safety grade component. In each of the units, the hydrogen recombiners will be located at these points (indicating), and these are at the 100-foot level in the auxiliary building. The recombiner control panels are located right here (indicating) in the auxiliary building. The hydrogen purge exhaust unit is located at this point (indicating) once again on the 100-foot level, and then we have two post-LOCA hydrogen analyzers. We have two in each unit. These are permanently installed. These are located here (indicating) and here (indicating), the second one being at the 120-foot level.

Figure 1-2 shows these same components in elevation, once again the containment spray pump down at the bottom level of the auxiliary building, the shutdown cooling heat exchanger at the 70-foot level, the containment spray risers and spray headers in the dome of the containment. We also have some auxiliary spray nozzles underneath slabs at these levels (indicating) inside containment. The containment isolation valves, of course, are located, the bulk of them, at about this level (indicating) in the containment and auxiliary building. The only component of the Combustible Gas Control System which shows on this is one of the hydrogen analyzers.

Exhibit 1-1 shows the PVNGS Classifications. We wanted to give you a brief introduction to this. I have already used a couple of terms which we use to describe our components. All components which are safety-related, such as all Engineered Safety Features components, are all ASME Section III components and all Class IE components, are all classified as Quality Class Q, and this means we provide a quality assurance program for these components which meets all the requirements of 10CFR50, Appendix B.

On the Palo Verde project, we also have another formal quality assurance program, and this we have designated Quality Class R. The quality assurance program we apply is similar to the requirements of 10CFR50, Appendix B, but with less documentation, particularly in the area of material traceability. The equipment we designate as Quality Class R is all equipment required for power generation and any equipment required for personnel safety which is not already designated Q.

The remainder of the equipment in the plant is industry standard equipment, off-the-shelf items, if you will, and that we have designated as Quality Class S.

In the area of seismic design, corresponding to all of our equipment which we have designated Quality Class Q, all of that equipment will be designed as Seismic Category I, which means that it will remain functional during

a Safe Shutdown Earthquake and remain in the elastic range, this is for mechanical equipment, during an Operating Basis Earthquake.

Corresponding to Quality Class R equipment, we have designated that those equipments which are Quality Class R will be designed to Seismic Category II, and this design will assure that they will not malfunction given an equivalent static load of 0.13G horizontal and 0.09G vertical accelerations.

The Quality Class S equipment we have designated Seismic Category III and designed for an equivalent static load of 0.05G or UBC Seismic Zone 2.

Some of the R and S equipment may be located in areas such that in the event of a Safe Shutdown Earthquake, it could collapse or fall down such that it could damage Quality Class Q equipment. If we have any equipment that falls into that category, it will be designated Seismic Category IX rather than Seismic Category II or III and they will then be designed such that it does not collapse in the event of a Safe Shutdown Earthquake.

This concludes the General Introduction. Are there any questions at this point in time?

MR. VAN BRUNT: Dennis, I've got one just for clarification. When you were presenting Figure 1-1, I think you mentioned there were three containment spray headers.

Both this drawing and 1-2 show four. I just wanted for the record to clarify which one, three or four, is correct?

MR. KEITH: Four is correct.

MR. VAN BRUNT: Carter.

MR. ROGERS: Figure 1-1, also. I think for the record it might be good to point out on Figure 1-1 where the safeguard sumps are located inside the containment and what elevation they are.

MR. KEITH: We will be getting into this in some detail later. They are located roughly in these two areas (indicating) and the top of the sump is elevation 80.

MR. ROGERS: Thank you.

MR. HELD: I am wondering where the NRC Quality Group B fits into your definition of Quality Groups Q, R, and S?

MR. KEITH: All ASME Section III components are Quality Class Q, so A, B, and C are all Quality Q and Seismic Category I.

MR. HELD: Thank you.

MR. VAN BRUNT: Any other questions at this point?

Dennis, continue.

MR. KEITH: With that, I will turn the presentation over to Paul Biba, who will present the Containment Spray System.

MR. BIBA: Figure 2-1 shows a schematic of the Containment Spray System and the main components of the

system: The containment recirculation pumps, which are located in the containment building; the refueling water tank, which is located in the yard area; the containment spray pumps, which are located in the auxiliary building; the shutdown cooling heat exchangers, which are in the auxiliary building, also; and two trains of spray headers, which are in the containment building. The basic function of the system is that the water is transferred from the refueling water tank during the injection part of the operation, which is the initial mode of the operation of the system, and is pumped by the containment spray pumps to the shutdown cooling heat exchangers and into the containment. Later on, the suction is transferred to the recirculation sumps in the containment and the water is transferred to the shutdown cooling heat exchangers where the heat load is removed and discharged into the containment spray headers. The alignment of the valves which will be necessary for aligning the suction will be explained later on in the presentation.

Exhibit 2-1 shows the design criteria that are used for designing the system. Basically, the Containment Spray System is designed to reduce the pressure and temperature in the containment following a loss of coolant accident or main steam line break and maintain these parameters at acceptably low levels as required by General Design Criteria

38.

The Containment Spray System consists of two redundant and independent trains each of which will provide 100% of the required heat removal capability.

The heat removal capacity is such to keep the pressure and temperature in the containment below design conditions for any size break in the reactor coolant system piping up to and including a double-ended break of the largest reactor coolant pipe. The system is also designed for mitigating the consequences of any size break in the main steam line piping up to and including a double-ended break of the main steam line from a single steam generator. During the recirculation mode of the operation, the system will continue to recirculate the water through the shutdown cooling heat exchangers and remove the heat and therefore maintain the pressure and temperature in the containment at acceptable levels. For the containment design basis accident, the containment spray system shall be designed to reduce containment pressure from the peak value to one-half of the peak value in less than 24 hours.

Exhibit 2-2. The portions of the Containment Spray System that are located in the containment building shall be designed to remain operable in the containment accident environment.

The system shall be designed such that a single

failure of any active component will not degrade the system ability to function.

Each train of the Containment Spray System shall receive power from a separate emergency diesel generator in the event of offsite power failure, and the two trains shall be physically separated from each other so that a failure in one train will not result in a failure of the other train due to fire, flooding, jet impingement, or missiles.

Each train receives separate actuation signals. Critical parameters are monitored and actuation signals are produced in the engineered safety features actuation system.

The Containment Spray System shall be designed to Seismic Category I requirements.

The Containment Spray System shall be protected against the dynamic effects associated with the postulated rupture of piping.

Exhibit 2-3 shows the remaining design criteria that are used. The Containment Spray System shall be designed to permit periodic inspection and testing, it shall be designed to accommodate the addition of hydrazine to the spray water to rapidly reduce fission product iodine concentration in the containment building, and the system sizing shall be based on the long-term heat rejection function of

the system. For that purpose, the shutdown cooling heat exchangers of the shutdown cooling system are equalized to reject heat from the containment.

Exhibit 2-4 shows the design codes and standards which are used for designing the piping and valves, the pumps, and the heat exchangers.

Exhibit 2-5 shows the interface requirements from CESSAR Appendix 6A, Section 7, that relate to this Containment Spray System.

On the requirement for power, the Containment Spray System pumps, valves, and instrumentation shall be capable of being powered from three power sources: the plant turbine generator, the plant startup power source, which is the offsite power, and the emergency generators. PVNGS is in compliance with that.

Requirement that the power connections shall be through a minimum of two independent buses so that in the event of a LOCA in conjunction with a single failure in the electrical supply, the flow from one containment spray train shall be available. PVNGS is in compliance.

Exhibit 2-6 continues with the power requirements of CESSAR that each electrical bus shall be connected to one containment spray pump and associated valves and instrumentation. In compliance.

Each emergency generator and automatic sequencers

necessary for generator loading shall be designed such that flow to the containment atmosphere is attained within a maximum of 58 seconds after a containment spray actuation signal. The full containment spray flow will be attained within 90 seconds after a containment spray actuation signal. Calculations verify the containment heat removal requirements are met.

The requirement for instrument power supplies to be provided as stated in CESSAR Section 8.3.1. In compliance.

Exhibit 2-7 shows requirements for the protection from natural phenomena, specifically that Containment Spray System components shall be capable of functioning in the event of maximum probable flood or other natural phenomena as defined in GDC 2. In compliance.

Protection from pipe failure. The maximum expected leakage from a moderate energy pipe rupture postulated during normal plant conditions in the Containment Spray System shall be as defined by the methods of CESSAR Section 3.6.1. In compliance.

Exhibit 2-8, the requirement that no limited leakage passive failure or the effects thereof shall preclude the availability of at least one CSS train to the operation. In compliance.

The Containment Spray System shall be protected from the effects of pipe whip or pipe rupture. In compliance.

Exhibit 2-9, the requirement for protection from missiles. The Containment Spray System shall be protected from effects of missiles. In compliance.

Requirements for separation. Adequate physical separation shall be maintained between redundant piping paths and containment penetrations of the Containment Spray System such that the Containment Spray System will meet its functional requirements during a single active failure during the injection mode, or with a single active failure or limited leakage passive failure during the recirculation mode. In compliance.

Exhibit 2-10, requirement that the cabling which is associated with the Containment Spray System will be physically separated to preserve redundancy and prevent a single event from causing multiple channel malfunctions. In compliance.

Exhibit 2-11, requirement that in the routing of the Containment Spray System Class IE circuits and additional equipment that these circuits are serving, consideration shall be given to their exposure to potential hazards such as postulated ruptures of piping, flammable material, flooding, and so on. In compliance.

The failures of nonsafety grade systems shall not compromise redundancy of the Containment Spray System. In compliance.

Exhibit 2-12, requirement that each Containment Spray System train shall be provided with an independent environmental control system. In compliance.

The power connections for Containment Spray System components shall be from a minimum of two independent electrical buses. In compliance.

There shall be two independent vital instrument power sources available for the Containment Spray System instrumentation. In compliance.

Exhibit 2-13, Thermal Limitations. Each Contain - ment Spray System train shall be provided with an independent environmental control system that is specified in CESSAR Section 3.11. In compliance.

Requirement for monitoring. Provisions shall be made for the detection, containment, and isolation of the maximum expected leakage from a moderate energy pipe rupture in one train. In compliance.

Exhibit 2-14, requirement for inspection and testing, relates to the inspection and testing of the Containment Spray System which is described in CESSAR Appendix 6A, Section 8, CESSAR Section 16, and CESSAR Appendix 6A, Section 9. In compliance.

Exhibit 2-15 shows the requirement for the chemistry and sampling. The chemistry of the water shall be as shown on Paragraph 1). In compliance. Requirement for

sampling, the sampling system shall provide means to obtain remote liquid samples for laboratory analysis. In compliance.

Exhibit 2-16 is a continuation of the sampling requirements. The sample lines in contact with the reactor coolant shall be austenitic stainless steel. In compliance.

The fluid velocity in the sample lines should be selected to obtain representative samples. In compliance.

The sample taps should be located on vertical runs of pipe whenever possible. In compliance.

Exhibit 2-17, requirements for materials. The Containment Spray System piping and fittings shall be Seismic Category I. In compliance.

The design and fabrication of the Containment Spray System piping and fittings shall conform to ASME Section III, Class 2. In compliance.

Pipes and all parts in contact with the system fluid shall be of austenitic stainless steel. In compliance.

Exhibit 2-18 continues with the requirements for materials. Care shall be taken to prevent sensitization of stainless steel and to control the delta ferrite content of the welds. In compliance.

Controls shall be exercised to assure that contaminants do not significantly contribute to stress corrosion of stainless steel. In compliance.

Materials used for the containment and its internal

structures shall withstand exposure to all post-accident conditions without causing undesirable reactions or significantly altering the recirculating water chemistry. In compliance.

Exhibit 2-19 continues with the requirements for the materials. If the Containment Spray System utilizes a common suction with the safety injection system, then the materials used for the piping and fittings shall be austenitic stainless steel. In compliance.

Exhibit 2-20, requirements for physical arrangement. To assure that Containment Spray System flow requirements are met, maximum and minimum acceptable head losses for the piping and fittings as they are given in CESSAR Appendix 6A, Table 7-13, should be met. PVNGS is in compliance inasmuch as the Containment Spray System is designed to meet the flow and pressure requirements of the containment spray nozzles.

Requirement for flow measurement devices to be provided on the containment spray pump discharge lines, and the piping on the upstream and downstream side of the orifices shall meet the recommendations of "ASME Fluid Meters: Their Theory and Application, Parts 1 and 2." In compliance.

Exhibit 2-21, continuation of the requirements for physical arrangement. For each spray train, there shall be a distance of 16 feet between the minimum water level in the

containment and the junction point from the refueling water tank discharge piping and the containment sump suction piping. That junction point will be shown here on Figure 2-1. The 16-feet requirement is associated with the normal pressure in the containment. If the containment should go sub-atmospheric by values greater than 3 psig below the atmospheric pressure, there shall be an additional 2.31 feet additional submergence for the minimum water level in the containment for every one foot of sub-atmospheric pressure. In compliance.

Exhibit 2-22, requirement for frictional losses in the Containment Spray System piping. The suction between the containment sump and the junction point that was discussed a little earlier should not exceed 7 feet unless the elevation of the top of the junction is lowered an additional foot for each foot of head loss. PVNGS is in compliance. The frictional losses are approximately 10 feet. However, the junction point is 22 feet lower than the minimum required distance of 16 feet, and that leads to an acceptable head loss.

Requirement for the Containment Spray System pumps to be located in the auxiliary building as close as possible to the containment structure. This is met by PVNGS and PVNGS is in compliance.

The elevation of these pumps shall be low enough

to provide adequate NPSH to the containment spray pumps. In compliance.

Exhibit 2-23, continuation of the physical arrangement. The available NPSH shall be calculated at the pump impeller eye. In compliance.

The calculation of NPSH shall consider the concurrent operation of the high pressure safety injection pump, the low pressure safety injection pump, and the containment spray pump. In compliance.

Requirement that in the event of a limited leakage passive failure in one Containment Spray System train during recirculation, there shall be personnel access available to the intact train. In compliance.

Exhibit 2-24, continuation of the physical arrangement requirements. There are two Containment Spray System check valves in each of the spray header lines and they shall be located as close to the containment penetration as possible. In compliance.

Allowance shall be made for valve accessibility for maintenance. In compliance.

The total volume of the spray header piping shall be kept to a minimum to minimize the spray delay time. In compliance.

Requirement for manually operated valves to be provided with locking provisions. In compliance.

Exhibit 2-25, continuation of physical arrangement requirements. Physical identification of safety-related equipment and cabling for safety status shall be recognized by the plant personnel. In compliance.

In routing of the Containment Spray System Class IE circuits and location of the equipment which is served by these circuits, consideration shall be given to their exposure to potential hazards. In compliance.

Requirement that the Containment Spray System penetrations not to be subject to loss of function from dynamic effects such as missiles, pipe reactions, fluid reaction forces. In compliance.

Exhibit 2-26, continuation of the physical arrangement requirements. Bellows will be required between the piping and the containment wall to prevent excessive forces on the piping. Those shall be utilized. In compliance.

Each Containment Spray System pump bypass line shall be capable of passing 150 gallons per minute during the pump's operating at design operating conditions. In compliance.

The design of the Containment Spray System piping and spray headers shall consider the effects of water hammer. In compliance.

Exhibit 2-27, continuation of the physical

arrangement requirements. The maximum spray header elevation above the refueling water tank outlet nozzles shall not exceed 185 feet. There is a partial compliance here. The maximum spray header elevation above the refueling water tank outlet nozzles is 192 feet. However, the Containment Spray System analysis has shown that the system performs adequately with this 192 feet.

Requirement for the refueling water tank lines to be resistance tested periodically for each pump at near the design conditions, and also a requirement for pre-operational testing of the system should be provided at full flow. There is partial compliance. Provision is made for approximately one-half of the normal flow to be recirculated to the refueling water tank during preoperational and periodic testing.

Exhibit 2-28, continuation of the physical arrangement requirements. Access to system components that are not designed to ASME Section III shall be provided to permit visual inspection. In compliance.

There shall be a minimum free fall height of 90 feet between the nozzle headers in the upper part of the containment and the operating deck. In compliance.

Exhibit 2-29 shows the CESSAR interface requirements from CESSAR Appendix 6B, Section 7, which actually is an appendix relating to the iodine removal capability as it

relates to the physical arrangement of the Containment Spray System.

Requirement for the spray nozzle headers to be located as high as practical in the containment dome. In compliance.

Requirement for the region defined as the sprayed volume to be at more than 90% spray area coverage at the operating deck level. In compliance.

The spray nozzles shall be selected on the basis of droplet size. They shall be of non-clogging design, have a nominal diameter of 3/8 inch, with a pressure differential of 40 psid, and there shall be 230 nozzles per train to achieve the required containment coverage and drop size distribution. In compliance.

Exhibit 2-30. We are going back into the CESSAR Appendix 6A, Section 7.

Requirement for radiological waste collection. The exhibit shows the leakages for pump seals, valves, across the valve seats, and requirements to have these leakages drained to the sump in the room and to have them treated as radioactive waste with a low dissolved solids and organic content. In compliance.

Exhibit 2-31, requirement for overpressure protection. There shall be relief valves provided for overpressure protection. In compliance.

Requirements for related services. The refueling water tank shall have 100% of the capacity required to operate the Containment Spray System pumps at 4,400 gallons per minute with the other pumps operating at the runout flows in the same time for a minimum injection period of. 20 minutes. In compliance.

Requirement that the maximum particle size in the water exiting from the refueling water tank shall be 0.09 inches in diameter to preclude flow blockage in the ESF components. In compliance.

Requirement that the contents of the refueling water tank and piping which is associated with the Containment Spray System to be kept at a minimum of 60 degrees Fahrenheit to preclude possible boron precipitation. In compliance.

Exhibit 2-32, continuation of the requirements for related services.

Requirement for the design of the containment spray sump to meet Regulatory Guide 1.82, to meet the particle size of 0.09 inches in diameter, to preclude the entrainment of air into the sump suction lines, and to have the pressure drop across the screen adequately low to provide adequate NPSH, and also to be able to work in the post-accident environment with a pH of 7.0 within four hours post-accident, and a maximum pH of 8.5. PVNGS is in

compliance. Screening to 0.09 inches diameter is used. The sump is built to Reg. Guide 1.82 requirements, and the pH of the sump water will be between 7 and 7.5.

Exhibit 2-33, continuation of the requirements for related services.

Requirement for shutdown cooling heat exchanger. Cooling water to be provided to transfer the heat from the sump during the recirculation mode. In compliance.

Requirement for the cooling water to be provided at 11,000 gallons per minute flow rate. In compliance. The PVNGS flow rate is 14,000 gallons per minute because of the larger shutdown cooling heat exchangers that are employed at PVNGS.

Requirement for the cooling water to be established to the shutdown cooling heat exchanger prior to or simultaneously with the start of recirculation. In compliance.

Requirement for the cooling water temperature to the inlet of the shutdown cooling heat exchanger to be between 65 and 120 degrees Fahrenheit during LOCA. In compliance.

Exhibit 2-34 shows the requirement for fire protection. A fire protection system shall be provided for the Containment Spray System consistent with the requirements of GDC 3 and include as a minimum facilities for fire detection and alarming, facilities or methods to minimize the

probability of fire, facilities for fire extinguishment, and methods of fire prevention. All of these are in compliance.

Exhibit 2-35 is a continuation of the fire protection requirements. Assurance that fire protection systems do not adversely affect the functional and structural integrity of safety-related structures. In compliance.

Care should be exercised to ensure that rupture or inadvertent operation of the system would not impair the capability of safety-related systems and components. In compliance.

Exhibit 2-36, requirement for mechanical inter-action. The Containment Spray System components shall be properly supported such that pipe stresses and support reactions are within allowable limits as defined in CESSAR Section 3.9.2. In compliance.

MR. KEITH: That concludes that section. Let me just state for the record, I don't know if everybody is aware of it, CESSAR is the Combustion Engineering Safety Analysis Report, which is incorporated by reference in the Palo Verde FSAR. CESSAR has many interface requirements, and that is what we have been going through for the last half hour.

Are there any questions on that section?

MR. HEPNER: I would like to make a comment about Figure 2-1 that there is a bypass around the shutdown cooling

heat exchangers which primarily serves a spray function. Perhaps that should be included on the figure. I think it is discussed in the functional aspects later on.

MR. KEITH: Yes. This is a simplified drawing. Paul, if you want to show everybody where it is, but this is a simplified drawing.

MR. BIBA: This is a simplified drawing. During the shutdown cooling, the Containment Spray System will be aligned around the shutdown cooling heat exchangers by using a bypass line around the shutdown cooling heat exchangers.

MR. VAN BRUNT: Dennis, I think if I understand the figure right, that later on you utilize this in an explanation. If that is the case, even though I recognize this is a simplified drawing, I think probably you ought to add it to the drawing.

MR. KEITH: Fine. We will correct that and include it in the documents that get included with the transcript. We will revise that plan.

MR. VAN BRUNT: Simplified drawings are fine, but they at least ought to show the functional aspects you are trying to explain.

Some other questions? I've got a bunch myself. You go ahead, Ed.

MR. STERLING: On Exhibit 2-19, I had a couple of clarifications on some of these exhibits, but in some of the

cases, the CESSAR requirements are an if/and type of thing and I guess on this one, you say, "In compliance," but is it a common suction or is it a separate suction? I think this type of clarification might be needed. If it is common, you are using that particular type of steel, but is it common or is it separate? On the drawing, it is shown separate.

MR. KEITH: It is common. There is one suction line for each train from the refueling water tank.

MR. STERLING: On Exhibit 2-26, Item No. 15), do we use bellows?

MR. KEITH: Your point is well taken. We do not use bellows. It does say where required, and in our stress analyses that we have done on the piping and all, it is not required and we do not use bellows.

MR. STERLING: Then on 17), do you use a fill and drain connection for the riser piping inside?

MR. KEITH: Yes, we do.

MR. VAN BRUNT: Any other questions?

MR. STERLING: No, go ahead.

MR. KEITH: I think we ought to maybe take that down, Bill and Gerry, as an item to clarify.

MR. VAN BRUNT: Well, I think, Dennis, as long as it is in the record, that is probably clarification enough. I am not sure that you need to modify the slides in these two cases as long as there is explanation.

MR. KEITH: Fine.

MR. VAN BRUNT: Rich, I think you had your hand up.

MR. TOSETTI: Yes, a question on Exhibit 2-15. It is regarding the sampling system, and you indicate that the sampling system shall provide means of obtaining remote liquid samples for a laboratory analysis. As that system was designed, did it have the post-TMI requirements?

MR. KEITH: Rich, we are in the process of procuring a sampling system which meets the post-TMI requirements. I don't think it samples the Containment Spray System is why I am hesitating.

MR. TOSETTI: This is just on the spray system itself, then?

MR. KEITH: Yes. This is referring just to the spray system itself, yes, this requirement here.

MR. TOSETTI: The intent then is to just sample during normal operation or testing?

MR. KEITH: When we are in normal operation and the system is not operating, we can just take a grab sample at some periodic basis, but the system we are going to have for post-TMI will as part of the requirements for it, have the capability of taking a sample from the containment sump. That is, of course, the fluid that will be going through the system.

MR. TOSETTI: A question on Exhibit 2-23, Item 9).

There is an indication there that in the event of a limited leakage passive failure, personnel access to the intact train shall be possible. I guess again is that during normal operation conditions and operation or is that proposed during post-LOCA?

MR. KEITH: That is referring to post-LOCA. We have -- Well, I am getting ahead of myself, because we are going to show the compartments where the containment spray pumps are, and there is sufficient shielding between the two trains for somebody to get down there for a limited period of time even post-LOCA and do some maintenance work.

MR. VAN BRUNT: Dennis, I would suggest that when you get to that point of your presentation that you point that out for Rich's benefit. Then if he has any further questions on it, he can raise them at that point.

MR. TOSETTI: I guess my main concern, and we can probably discuss that later, is the activity level that may be in the intact system.

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

MR. TOSETTI: Yes, just one more on Exhibit 2-30. In looking at the radiological waste collection, is there a consideration in there for a pump seal failure?

MR. KEITH: Yes, the sumps which collect leakage from our ESF pumps are designed for a 50 gpm leak, so, although we don't really expect leakage more than this -- Well, this

is the CESSAR interface, but actually the radwaste system is designed for a 50 gpm leak.

MR. TOSETTI: The radwaste system or the sump collection?

MR. KEITH: The collection system, yes.

MR. TOSETTI: Thank you.

MR. VAN BRUNT: Mr. Ku, you had a question.

MR. KU: I have a question in relation to the term "requirement." I am wondering whether you can tell me about the pump material. You said quite a bit about the pipe material and valves and things of this nature, but how about consideration of the pump material?

MR. KEITH: The reason you don't see anything on here for the pump material is because the pumps are provided by Combustion Engineering and these are interface requirements for the balance of plant. The pump is stainless steel, it is the same as the piping, but the reason you don't see anything here and we don't talk about it is because that is all in the Combustion Engineering document.

MR. VAN BRUNT: I think further on that, Mr. Ku, the regulatory aspects of those pump materials are covered in CESSAR. In other words, Combustion covers the details of these particular pumps in the CESSAR application, and if you wanted to find out about the materials or whatever, you would go to CESSAR and could find that out. These are only the

interfaces that CE provides to us and we reference CESSAR. That is being reviewed under their separate documents.

Do you have further questions, sir?

MR. KU: No.

MR. VAN BRUNT: Marty.

MR. RAINES: Exhibit 2-5. On Item No. 1), we are talking about the Containment Spray System pumps being capable of being powered from the turbine generator, start-up transformer, or the diesels. Offhand, it seems like it is misleading, because I think if the operator, in the absence of the diesel generators or the startup transformers, I don't think he would be able to power the containment spray pumps for their intended purpose off the turbine generator. You seem to imply that the turbine generator exists as a viable source of power as the diesels and the startup transformers.

MR. KEITH: Let us check on that, Marty, and get back to you.

MR. VAN BRUNT: I think your problem, Dennis, with this may be that the CESSAR interface may be not quite properly stated. I am sure it is quoted from CESSAR, but that would infer that there is a direct tie from the turbine generator to those pumps. At least, that is what I have inferred, and I do think that is what they intended with that.

MR. KEITH: Wait a minute. No, but we can provide

power from the turbine generator to the 13.6 .1B buses.

MR. VAN BRUNT: Yes, but you've got to come around through your transformers to get there.

MR. KEITH: But we don't need offsite power. I guess that --

MR. ALLEN: Marty is saying you can't power them from the aux transformers. Right, Marty?

MR. RAINES: Right. They have already listed the startup transformers as one option, the diesel generator is another option, and the turbine generator is a third option.

MR. KEITH: They say startup power source (offsite power), and I guess that is how we had interpreted it, that they are really just talking about offsite power, not the startup transformer as such.

MR. VAN BRUNT: I think what you need to do, Dennis, is get a clarification from CE on that particular item.

Marty, let me butt in here. Let me ask a general question, which may help with this. All the way through here, you talk about in compliance with the CESSAR requirements. Is there specific documentation from Combustion that they concur with you that you are in compliance? I am not talking about the procedure to get there, but either through the vendor prints that you get or the drawings review that they do or through their criteria review or whatever, do they in fact in this particular case, as an example, indicate that

the design you have meets that criteria? Somewhere is that documented?

MR. KEITH: Yes, that is documented in our four-party reviews that we do for the FSAR where we go through all the CESSAR interfaces. There is always a Combustion Engineering representative there who signs off on the four-party review sign-off form, so that "In compliance" does have documentation.

MR. VAN BRUNT: I think, therefore, they probably agree with the way you have interpreted this, but I think we ought to get that clarified.

MR. KEITH: We will clarify that particular point; namely, that they are referring to offsite power and not to the startup transformers as such.

MR. VAN BRUNT: Marty, do you have anything more?

MR. RAINES: That was the only one.

MR. VAN BRUNT: Mike.

MR. HODGE: I have a couple of questions, Dennis. On 2-19, how has your design criteria taken care of galvonic corrosion for the piping from the refueling water tank to the containment spray pumps?

MR. BIBA: Can you repeat the question, please?

MR. HODGE: How have you allowed for preventing galvonic corrosion? Is it adequately protected? Is it removed from the soil in a tunnel?

MR. KEITH: The piping from the refueling water tank

is all in a pipe tunnel. It is not buried.

MR. HODGE: I have a question on 2-31. You say you have a relief valve for overpressure protection. Where do those relief valves discharge to?

MR. KEITH: We'll check that, Mike.

MR. HODGE: Then I have one last question that we may want to handle under the Operation section. I wanted to have a little discussion on how trisodium phosphates are dispersed into the sumps, but maybe we can handle that under the Operation section.

MR. KEITH: Yes, why don't you ask that in that section. We did check the P&ID.

MR. BIBA: The relief valves discharge into the radioactive collection system or to the equipment drain tank depending on the location of the relief valve.

MR. VAN BRUNT: Are they piped directly or do they go through some system?

MR. BIBA: In some cases, they are going through the sumps and in some cases they are going directly into the piping.

MR. HODGE: The one that goes to the radioactive system, is that isolated by any chance? Is it isolated during containment isolation? In other words, does that relief valve path become locked on the one that goes to the radioactive system?

MR. KEITH: Any relief valves which relieve inside containment will be isolated on a containment isolation signal.

MR. HODGE: They do relieve into containment. They don't relieve to the outside. They will be isolated.

MR. KEITH: That's right.

MR. VAN BRUNT: Do they go into the sump in the containment?

MR. KEITH: Yes.

MR. HODGE: The ones that are outside relieve into the drain tank radioactive material?

MR. KEITH: Well, there is at least one outside on the suction line from the sump that relieves to a sump in the auxiliary building.

MR. HODGE: Then, in summary, there aren't any relief valves that are required to reject pressure that relieve outside containment that are isolated. In other words, they wouldn't provide their own protection, because they get isolated from overpressure.

MR. KEITH: There is one relief valve in the suction line that relieves to the sump. That relief valve is there just to protect from thermal expansion when you have the two containment isolation valves shut, so during system operation, that relief valve should not lift, but that relief valve does go to a sump in the auxiliary builidng.

MR. VAN BRUNT: And it is located outside of containment?

MR. KEITH: It is located outside the containment.

MR. HODGE: I can clarify that with a question, but --

MR. VAN BRUNT: Are you satisfied with the answer?

MR. HODGE: Yes.

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

MR. PENSEYRES: The system description Section 2.2.1.3 states that the containment spray pump mechanical fields are cooled by the pumped water. Exhibits 2-31 and 2-32 state that the suction screening is provided to limit the particle size to .09 inches. Is the screening adequate to prevent pluggage of the pump seal throttle bushing and the mechanical fuel passages?

MR. BIBA: There is an additional screen in the filter provided on the cooling water pumping within the pump itself that is satisfying the requirements for the cooling water.

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

MR. PENSEYRES: No.

MR. VAN BRUNT: John.

MR. ALLEN: Dennis, on Exhibit 2-6, there is some question regarding the time it takes to bring up the containment spray. Are the containment spray pumps

immediately sequenced on or are they sequenced on in twenty seconds? Thirty seconds?

MR. KEITH: They sequenced on at 15 seconds.

MR. ALLEN: At the same time, does your chemical addition come on or is there delay on chemical addition? I guess my point is with inadvertent actuation, does the operator have time to turn it off before he floods the whole containment down with chemical?

MR. KEITH: John, the chemical we add, hydrazine, is a rather benign chemical, but the hydrazine pumps come on immediately, so when the spray pumps come on, you will be injecting hydrazine as well as the boric acid into the spray system.

MR. ALLEN: What is the time differential between a containment spray actuation signal and the time he would get discharge out of the spray headers? Is there ample time for the operator to take action and turn it off if it is an inadvertent actuation?

MR. KEITH: No. All he has is the 15 seconds on the sequencer, so he has that 15-second period if he can determine it is inadvertent. We do have the set point of the spray system set up at 10 pounds to avoid inadvertent actuations to any kind of pressure transient you might have. Also, of course, in the logic in the system, it is a two-out-four system and you need to have two signals in order to

actuate the signal. So in these ways, we hope to avoid an inadvertent actuation.

MR. VAN BRUNT: John's got some other questions. Let me ask a follow-on question on this 2-6. The CESSAR requirement indicates a 58-second requirement. You indicate that you have 90 seconds. Then you go on to say calculations verify containment heat removal requirements are met. Specifically, what requirements are you talking about? In other words, I am not sure I understand what that last statement infers or what additional requirement that is supposed to be satisfying.

MR. KOPCHINSKI: Ed, that is covered in our CESSAR deviation and is discussed in Section 1.9. We had reviewed that with CE and their concern in setting that time was for equipment qualification purposes, the peak temperature you would get in the containment. Our analyses with the 90 seconds, which were more a main steam line break, which was the worst case, gave a peak temperature of 370 degrees, which CE said was acceptable to them.

MR. VAN BRUNT: John.

MR. ALLEN: Dennis, are you going to get into any testing and operation of the Containment Spray System?

MR. KEITH: We will get into operation of the system.

MR. ALLEN: How you check your headers out?

MR. KEITH: Let us do that portion. If you still

have a question at that point, then we can answer it.

MR. VAN BRUNT: Carter, you've got some questions.

MR. ROGERS: Exhibit 2-23. The three items on that exhibit discuss NPSH. At least, two of them do. I have some questions pertaining to the NPSH calculations. In particular, in 8), the CESSAR requirement is that the calculation of the NPSH shall consider concurrent high pressure safety injection, low pressure safety injection, and containment spray pump operation. Did Combustion Engineering specifically identify the conditions of those pump operations as to whether those pumps are operating at their design head or runout head?

MR. KEITH: Our calculations assumed runout head.

MR. ROGERS: As a correlation of that particular thing, will you address in your presentation the possible vortexing of water in the sump later on?

MR. KEITH: Yes.

MR. ROGERS: Another question on Exhibit 2-26. Item 16) talks about the bypass flow line and its capability of passing 150 gallons per minute with the pump operating at design operating conditions. Is it true that there is an orifice in that line to limit the flow rate?

MR. KEITH: Yes.

MR. ROGERS: Who sized the orifice? Is that Bechtel-supplied or Combustion-supplied?

MR. KEITH: CE provided the orifice size.

MR. ROGERS: So there is a sufficient discussion between Bechtel and Combustion Engineering to assure that with the orifice sizing by Combustion Engineering and the pipe line sizing and routing by Bechtel that that particular requirement is met?

MR. KEITH: That's correct.

MR. ROGERS: Exhibit 2-33, Item 3) B). There is also a previous reference that talks about a flow rate of 4,400 gpm. Here we are talking about quite a bit higher flow rates through the shutdown cooling heat exchanger. What is the size of the containment spray pumps? There are two pumps, and what are they sized at?

MR. BIBA: The containment spray pumps are sized to operate at a flow rate of 3,890 gallons per minute. The flow rate of 4,400 gallons per minute includes the runout conditions. The 11,000 gallons per minute flow rate on Exhibit 2-33 is the cooling water flow rate in the shutdown cooling heat exchangers.

MR. ROGERS: On the cooling water side?

MR. BIBA: Yes.

MR. ROGERS: I see that. I'm sorry, I missed it.

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

MR. TOSETTI: Yes, I wanted to ask regarding the leakage relief valve which discharges into the auxiliary

building. Those are routed to some sump, I assume, in the auxiliary building. How is the pump on the sump controlled, is it a manual or automatic actuation, and where does it route to?

MR. KEITH: It is automatic operation which goes to the liquid radwaste system.

MR. TOSETTI: Have you looked into the potential transfer of the activity in those sumps to the radwaste systems post-LOCA?

MR. KEITH: Once again, because of what that relief valve is set for, the one we are talking about, we don't expect that to relieve, so as far as where the pipe is routed, we could transfer that water to the liquid radwaste system, but we are not planning on having post-LOCA fluids go through the liquid radwaste system.

MR. VAN BRUNT: Rich, is your concern the activity in the area or what is in the pipe?

MR. TOSETTI: It is more the activity in the pipe as it leaks, either seal leakage or passive failure, pump seal failure, and then transferring that into other buildings at the plant.

MR. KEITH: We will leave that question open, Ed.

MR. VAN BRUNT: Do you want to come back to it later?

MR. KEITH: If we can.

MR. VAN BRUNT: Okay, very good.

MR. TOSETTI: That's all I had.

MR. VAN BRUNT: I've got a couple of questions I would like to pursue. One is just kind of general. We have covered it previously, but in this whole area of the containment related systems, of which the Containment Spray System is one, there is very integrated design activity between Bechtel and Combustion. I don't want to get into the QA aspects, that is not my intention, but would you explain to me in a general way how you go about the iterations necessary to transfer transient data back and forth between your design engineering organizations to come up with a final design that is satisfactory? It is not a cut and dried activity. I understand that. I would like to understand a little bit how the heat transfer data gets converted into flow data, and so forth, the iteration that occurs.

MR. KEITH: Basically, when we started off the project we received a great quantity of data from Combustion Engineering explaining their design and giving us numerous interface requirements that our design had to meet in order for Combustion Engineering's design to function properly. Our engineers then converted all these interface requirements into our design, and our basic design documents, in particular our piping and instrumentation diagrams, which show various materials, line sizes, and all, have all been transmitted to Combustion Engineering and they have reviewed them and given

us comments back to us. That is the basic process. Any of our design documents, I am sure there are a number in addition to the piping and instrumentation diagrams, have gone to Combustion Engineering for their review and comments.

MR. VAN BRUNT: I would like to go to Exhibit 2-2. You may deal with this later. Under Item 6) there, it says that two trains shall be physically separated from each other so that failure of one train will not result in failure of the other train due to fire, flooding, jet impingement, or missiles. As I say, you may be going to cover this later, but I would like as you go through the presentation of the system layout to indicate how you are separating both mechanical and electrical and control aspects of Train A and Train B within those buildings. Because the containment is on the west side of the auxiliary building more or less, the spray ponds, which are the ultimate heat sink for discharge of this heat, are to the south, you've got to transfer mechanical systems across electrical systems by train. I would like to understand how you physically separate those to ensure you don't have any interactions between them. I am looking ahead. It looks like you've got some drawings where you do that. I would like you to do that as you go along, if you could.

MR. HODGE: Ed, I had a question in this same light as to the plumbing systems or drain systems, which is how

you prevent those two from communicating.

MR. VAN BRUNT: The whole matter of physical separation.

MR. KEITH: Let's go through that portion of the presentation and see if that doesn't respond to the question.

MR. VAN BRUNT: I would like to go to Exhibit 2-20.

With regard to Item 1) here, it says to assure that Containment Spray System flow requirements are met, maximum and minimum acceptable head losses for the piping and fittings are given, and along with that, the required NPSH shall be met. Then you say you are in compliance. Also the Containment Spray System is designed to meet the flow/pressure requirements of the containment spray nozzles. It wasn't clear to me what that was implying relative to the compliance set down there with regard to NPSH.

MR. KEITH: Ed, because our spray pumps are larger than the standard System 80 spray pumps and due to the fact that we have auxiliary spray nozzles underneath some of the slabs in the containment building, the maximum head losses given in that table are exceeded. However, we still meet the NPSH requirements and, as important, we meet the design flow and pressure at the spray nozzles inside containment.

MR. VAN BRUNT: I would like to go to Exhibit 2-27. It says the maximum spray header elevation above the RWT outlet nozzles shall not exceed 185 feet. You indicated

partial compliance, that the nozzles don't exceed 192 feet, and you go on to say, "However, the system analysis has shown the system performs adequately." I am not quite sure what the inference of that last statement is.

MR. KEITH: It is the same calculation I was referring to in response to the last question.

MR. VAN BRUNT: Oh, I see. Then, lastly, Exhibit 2-31, Item 1) C. under Related Services. You have a requirement there that a minimum temperature of 60 degrees will be established to preclude possible boron precipitation. I was interested in how that compliance was accomplished. Are those lines heat traced or exactly what is the situation and how is the tank handled?

MR. KEITH: All the lines outside, which are in a pipe tunnel, as we discussed earlier, are heat traced. The tank itself is a concrete tank with a stainless steel liner and an insulated top. The concrete is on the sides and then it has a metal top that is insulated. We do have a heater in that tank, also, to maintain 60 degrees.

MR. VAN BRUNT: I don't have any more questions. Does anybody else have a question? Ed.

MR. STERLING: Figure 1-1. Earlier, in response to a question Mike Hodge had, you indicated that the piping from the refueling water tank to the main structure is in a pipe tunnel. Is that pipe tunnel exposed to heavy ground loads?

If so, is there a maximum load above that pipe tunnel that is allowed and how are you restricting heavy loads?

MR. VAN BRUNT: Are you worried about future loads or buildings over the area?

MR. STERLING: Cranes or dump trucks or whatever.

MR. KEITH: That is designed to take construction loads.

MR. STERLING: Is there a load that we could possibly put on that that would cause some problem with a normal type of vehicle that you operate in a plant of this type?

MR. KEITH: Not normally. It is designed to take all the normal loads you could expect.

MR. STERLING: Should there be a restriction in that area as to the type of load that is there like, I don't know what size vehicle it might be, would there be a restriction there we might want?

MR. KEITH: We will check into that, Ed. Let's hold that as an open item and we will check and see if there is anything that you could reasonably expect at the power plant that you would want to restrict access to that area.

MR. STERLING: One additional to that. You show the two hydrogen recombiners. I was going to ask this earlier. Is that the operating location or is that the storage location?

MR. KEITH: Both, except, of course, you are not going

to have them stored in all three units.

MR. VAN BRUNT: Ed, are you finished?

MR. STERLING: Yes.

MR. VAN BRUNT: John, do you have another question?

MR. ALLEN: I've got a couple. What did we finally arrive at on total unsprayed volume in the containment?

MR. KEITH: Unsprayed volume of 4%.

MR. ALLEN: Then along the same lines, what was our maximum temperature for transients?

MR. KEITH: In the containment?

MR. ALLEN: Yes.

MR. KOPCHINSKI: The maximum pressure is 49 pounds, and that is unless due to a LOCA. The maximum temperature for a main steam line break is about 401 degrees. However, for equipment qualification, you do a different type of calculation. The NRC asks you to take a count of reevaporation, and then that is when you get the 370 degrees I mentioned earlier.

MR. ALLEN: Just one more. You may cover it when you get into design of the sumps. That one interface criterion up there that you had was .09 inches diameter particle, and my concern there is plugging up of those screens. Are you going to touch on that?

MR. KEITH: Yes, the sump design will.

MR. VAN BRUNT: Any other questions anybody has

before we go on? Bill.

MR. SIMKO: Back on Exhibit 2-31, Ed asked a question about the minimum 60-degree temperature for the refueling water tank. Is there any requirement for the heat tracing itself to be powered by two separate buses in case you lose one?

MR. KEITH: The heat tracing is redundant.

MR. VAN BRUNT: Is that all? Anybody else have any questions?

MR. VREELAND: Is the 90-second spray time the time used for a full spray, full flow?

MR. KEITH: Yes.

MR. VREELAND: And do you assume an initial flow or just take zero and then full flow it in 90 seconds?

MR. KEITH: It is a step function. In the 90 seconds, we don't take credit for the ramping up of the flow.

MR. COOK: Is that also considering loss of offsite power? That is using the diesels?

MR. KEITH: Yes, that 90-second number is our loss of offsite power number, which has an additional 10 seconds due to diesel startup.

MR. VAN BRUNT: Any other questions?

Seeing none, Dennis, go ahead.

Let me ask you a question. Excuse me. Go off the record.

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

MR. VAN BRUNT: Okay, you are on.

MR. KEITH: We will continue with System Description and Operation.

MR. BIBA: Exhibit 2-37 shows the system description for the Containment Spray System in conjunction with Figure 2-1, which shows the basic components.

The Containment Spray System makes use of the refueling water tank, two containment recirculation sumps, two containment spray pumps, two shutdown cooling heat exchangers, and two sets of spray headers in containment, and associated valves, piping and instrumentation necessary for making a complete system.

The Containment Spray System provides cooling sprays of borated cooled water from the upper regions of the containment to reduce containment pressure and temperature in the containment after either a major LOCA or major steam line break incident inside containment. The spray flow is provided by the containment spray pumps, which take suction initially from the refueling water tank and, after a minimum of about 20 minutes, which is the minimum duration of the safe injection mode of the operation, the suction is transferred to the recirculation sumps.

The pumps discharge into the containment

atmosphere through two shutdown cooling heat exchangers, where the heat is removed. During the first mode of operation, the injection mode, there is no heat transfer taking place in the heat exchangers, because the temperature of the refueling water tank water is ambient temperature. During the recirculation mode of the operation, there is actually a heat transfer through the essential cooling water system and then through the shutdown heat exchangers into the ultimate heat sink. At PVNGS, there are additional spray headers that are located underneath the concrete decks at elevation 140 and 120 and those spray headers provide additional spray coverage to facilitate the more than 90% spray coverage in the containment.

In the main headers, there are 230 nozzles per train. They are hollow cone ramp bottom, Spraco No. 17071417. That is the model number of the model. Those are one-inch connection size, three-eighths inch orifice nozzles that work at 14 psid pressure across the nozzle, flow rate 14.2 gallons per minute at that pressure, and they provide the coverage in the main spray headers.

The auxiliary spray headers utilize 80 spray nozzles that are also hollow cone ramp bottom, Spraco No. 17651308, and, as we said, they are located underneath the concrete levels 140 and 120.

Exhibit 2-38. The Containment Spray System is

initiated by a containment spray actuation signal that is 10 psig in the containment. This signal starts the containment spray pumps and opens the containment spray control valves, and if offsite power is not available or is lost, the shutdown cooling system is shed from the normal power supply and it is then connected to the diesel generator emergency power supply in accordance with the ESF actuation system load sequencing. One pump and its spray control valve is connected to each diesel generator.

When a low level is reached in the refueling water tank, a recirculation actuation signal is generated and the suction of the pumps is transferred from the refueling water tank into the containment sumps. This transfer is an automatic transfer by means of automatic opening of these valves on the recirculation actuation signal. The operator manually remotely from the control room has to close the isolation valves on the refueling water tank. When the system is aligned in that manner, the recirculation spray continues indefinitely until it is modified by the operator.

Figure 2-2 shows a schematic of the Containment Spray System. It should be noted that this is only a schematic. It does not show the actual physical locations of these components, the refueling tank being in the yard, the shutdown cooling heat exchangers and containment spray pumps being in the auxiliary building, and recirculation

sumps and the spray headers are in the containment building. There are four main spray headers in the upper portion of the containment and each train has two auxiliary headers below elevation 140 and 120.

Figure 2-3 shows the plan of the auxiliary building elevation 40 and, as was mentioned before, there should be pointed out the physical separation by concrete compartments and distance of the containment spray pumps for Train A and for Train B. Also, the piping which is associated with these trains is separated by distance as they are coming into these compartments from completely different opposite directions.

Figure 2-4 shows the elevation of the auxiliary building elevation 70 showing the location of the shutdown cooling heat exchangers, the separation of them by concrete walls and distance, and also the location of the piping penetration for Train A and for Train B and their separations. In addition to that, on elevation 100 above these piping penetrations, there are electrical penetrations that are also separated by concrete walls and by distance.

Figure 2-5 shows a plan of the containment building at elevation 80 showing the two recirculation sumps for Train A and Train B, their separation by distance, and their location relative to the containment internal walls and showing the suction piping in these sumps.

Figure 2-6 shows the elevation of the recirculation sump screens. As is shown here, the screen is composed of three layers. The first layer is acting like a trash rack. It is composed of stainless steel 2-1/4 inch by 3/16 inch grating. The second layer is a coarse screen which is composed of half inch openings of stainless steel wire cloth. The third layer is the fine screen, which is made of .09 inch opening stainless steel wire cloth. The top deck of the containment sumps is a solid top deck that does have 2-inch diameter openings only to facilitate the removal or venting of the air during the filling of the containment sumps. The structural members are specifically to seismically support the screens.

Figure 2.7 shows the plan of the sump and some of the screen, also. The screen is located on a 3-inch high curb and the structural members of the screen are shown here. The sump dimensions are smaller than the screen, 7 feet 4 inches by 18 feet 4 inches. This is the sump.

Figure 2-8 shows the detail of the vortex-breaking unit that has been added on the pump suction piping to facilitate adequate hydraulic performance of this suction pipe. The vortex-breaker unit was suggested during the model testing of the containment spray sump and there was a one-to-one model test made on this sump and screen, and one of the results of this model testing was addition of this

water vortex-breaking unit.

Figure 2-9 shows the elevation of the vortex-breaking unit. What it is is like a hexagon composed of stainless steel grating. It is the same grating as is used for the trash rack on this containment sump. The grating is all around and there is only a opening to interface with the suction pipe.

Exhibit 2-39, the operation of the Containment Spray System.

During plant startup, prior to reaching the maximum allowable shutdown cooling temperature and pressure, the shutdown cooling system is secured and then realigned to the automatic Containment Spray System initiation configuration. The containment spray actuation signal block is removed, and from that point on, the Containment Spray System is ready for normal operation, the normal operation being a condition to be in standby alignment for possible emergency operation. Therefore, during normal operation, the Containment Spray System is not operating except for testing of the system.

Exhibit 2-40, system operation during plant shut-down.

During plant shutdown, the Containment Spray System remains aligned for spraying through the shutdown cooling heat exchangers, which is the normal alignment of the Containment Spray System, until the shutdown cooling pressure

and temperature is reached. When the shutdown cooling pressure and temperature is reached, the Containment Spray System is realigned to bypass the shutdown cooling heat exchangers by using the bypass pipe shown on Figure 2-1 around the shutdown cooling heat exchanger and therefore can be actuated automatically by the containment spray actuation signal as it would be needed.

During the shutdown cooling mode of operation, the low pressure safety injection pumps are pumping through the shutdown cooling heat exchanger and the reactor core. This mode of operation that I have just described is the first mode of the shutdown cooling, and that occurs typically from the onset of shutdown cooling when the temperature of the system is typically between 200 degrees and 350 degrees Fahrenheit.

During the second phase of shutdown cooling, which is in the later stage of shutdown cooling when the pressure is about 350 psia and the reactor coolant system temperature is below 200 degrees, typically 170 degrees, at that point, the Containment Spray System is aligned through the shutdown cooling heat exchanger to work in conjunction with the low pressure safety injection pumps to remove the decay heat from the core, and the shutdown cooling is then continued under the low pressure safety injection and containment spray pumps until the refueling temperature of 125 degrees is

reached. For the record, the plant shutdown operation is on Exhibit 2-40.

Exhibit 2-41 shows the emergency operation, which is the operation for which the system is designed. The containment spray is automatically initiated by the high-high containment pressure signal of 10 psig. The containment spray actuation signal is generated, which starts the containment spray pumps and opens the spray isolation valves. Containment spray can also be initiated manually from the control room. Initially, the spray pumps take suction from the refueling water tank, and when a low level is reached in the refueling water tank, the recirculation actuation signal automatically transfers the suction into the containment sump. The operator manually from the control room remotely closes the valves at the outlet of the refueling water tank. During the recirculation mode, the spray water is cooled by the shutdown cooling heat exchangers prior to discharge into the containment.

MR. KEITH: This completes this section of the presentation, Ed. Any questions?

MR. VAN BRUNT: Any questions? Ed.

MR. STERLING: In your previous set of exhibits when you were talking about the interface between the CESSAR interfaces, in Exhibit 2-33, "Cooling water flow shall be established to the shutdown cooling heat exchanger prior to

or simultaneously with the start of recirculation," then my understanding is that you are running your initial sprays through the shutdown cooling heat exchangers without cooling water flow, is that correct?

MR. KEITH: It all starts automatically, Ed. In the initial part of an accident when you are taking water from the refueling water tank, it is not necessary that you have flow through the heat exchanger, but we are all aligned and in the event of a safety injection actuation signal, we will be getting flow through those heat exchangers.

MR. STERLING: I wondered if the heat exchanger was empty and you were flowing through that with your spray and you didn't have any cooling water going through that you might damage your heat exchangers.

MR. KEITH: That is not the case, and it would not be empty in any event. It could have no flow, but that is not the way it operates. We will have flow through that heat exchanger within the first minute.

MR. STERLING: And the same signal that initiates the containment spray initiates the cooling water, then?

MR. KEITH: Yes.

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

MR. HELD: With reference to Figure 2-9, which shows the vortex-breaking unit, does the circle in the center represent that?

MR. KEITH: This opening (indicating) goes to interface with the suction pump. That is grated on the opposite side of this vortex-breaking unit. This is a completely enclosed unit with stainless steel grating except for this one opening which interfaces with the suction pump.

MR. VAN BRUNT: Where is that suction pipe on 2-8?

MR. KEITH: The suction is right through here (indicating). You would have grating on this face along there (indicating), so all the water flow does go through grating.

MR. VAN BRUNT: The suction is looking toward the bottom of that slide, is that right, Dennis?

MR. KEITH: Yes.

MR. VAN BRUNT: I would suggest you put a suction on it then to clarify that point.

Do you have any other questions, John?

MR. HELD: No.

MR. VAN BRUNT: Some other questions?

MR. HEPNER: I would like to have some verification on the flows that we have used on the testing. Did it include all the safeguard pumps or was it just the high pressure and containment spray?

MR. BIBA: All of them.

MR. KEITH: The low pressure, high pressure, and containment spray.

MR. HEPNER: I would just like to point out that the low pressures are indeed secured in the automatic mode of operation and there is really no plan for usage of the low pressure pumps coming from the sumps, so there is a very substantial margin in there from that regard as well.

MR. KEITH: Thank you.

MR. VAN BRUNT: Other questions? Mike.

MR. HODGE: I have several. The first one may reflect back to the design criteria area, also. Looking at your P&ID, it appears that the containment spray pipe which is up in the upper reaches of the containment is designed in two half circles, a pipe inlet and two half circles that come around. You appear to have two caps on those pipes. Would we get better performance by joining those two pipes together? Is there a criteria why you didn't join those two pipes together? Would it be better redundancy for flow blockage such as flow being able to come around three-quarters of the way to each other's pipes if there was a leakage or break or anything?

MR. KEITH: Mike, those caps on the end provide a positive air cushion to reduce the effects of water hammer when we have the water flowing up and filling up the headers. We do have kind of an air piston, if you will, to reduce the water hammer effects. If you connected them, you couldn't be positive that you would still have that. You might lose

it out an open nozzle.

MR. HODGE: Earlier I asked a little bit about trisodium phosphate. I think the method we have of controlling pH in the sumps is baskets of trisodium phosphate.

MR. KEITH: That's correct.

MR. HODGE: I wonder how that is going to be mixed with the water. I have some concerns in that area. I believe that question has been asked by the NRC, how that is going to be done.

MR. KEITH: Mike, the baskets of trisodium phosphate are all located on the floor of the containment at elevation 80, so the flow going to the sumps flows through these baskets and that is what dissolves the trisodium phosphate.

MR. HODGE: Will the trisodium phosphate dissolve if it gets in clumps or such due to humidity? Would that affect the dissolving of it?

MR. KEITH: It would not dissolve as fast. There will be some sort of periodic inspection programmed to assure that the doesn't become a solid cake.

MR. VAN BRUNT: Dennis, as a followup to that, on one of the slides could you show me where the baskets are located relative to the sumps? Maybe Figure 2-5 would be a good one.

MR. BIBA: The baskets are located throughout the containment building at elevation 80 and they are located at

the place where there is space available. Also, there are inlets at the floor for connecting these baskets. We secure them to the floor. The number of trisodium baskets is indicated on P&ID 13-M-SIP-001. We have about 14 baskets which are 4-by-4-by-4 and I believe there are about eight or nine baskets 2-by-2-by-2.

MR. HODGE: Just to follow up on that point you just made, in your latest P&ID that I looked at, you have a different quantity specified for Unit 1 versus Units 2 and 3. Is that still true?

MR. BIBA: That is correct. The Unit 1 assumes a plutonium recycle. That will be the amount of trisodium phosphate necessary for maintaining the pH of above 7.0 with the boron concentration of 6,200 ppm.

MR. VAN BRUNT: Dennis, again I don't want to belabor the point, but with these baskets scattered around on that floor area, I was thinking in my mind is there some way that you get a bypass flow or are you assured that there is a majority of flow that goes through the baskets? That's what I was really trying to get at.

MR. KEITH: Ed, first, as Paul mentioned, the highest basket is four feet, our minimum water level is four and one-half feet, so all the baskets will be submerged. We have also located them in open areas such that they are not in areas where you could possibly have flow stagnation or

something.

MR. VAN BRUNT: Mike, go ahead.

MR. HODGE: Figure 2-5. When you did your one-to-one sump test, did you take into effect or did you model cable trays, piping, valves, and platforms, the effect that would have in your one-to-one flow test you did or have you restricted those type of installations around the sump? Did you take into effect the flow interruptions that cable trays and such would have in your model, or have you prevented installation of those items so you have a true model of load characteristics in the sump?

MR. KEITH: Mike, basically we modeled a section of the containment. We'll tell you how much. We modeled everything that is in containment around the sump in this area (indicating).

MR. BIBA: The area that was modeled was limited to the capability of the operator and the size of the tank available, and it was approximately modeling everything within about this area (indicating) and also for Train B. So all equipment, piping, structural steel and whatever instrumentation that was in that vicinity of the sumps, this area was modeled.

MR. VAN BRUNT: Dennis, for the record, first off, it is Figure 2-5 that Paul is referring to. Secondly, I think for the reader of the transcript, it would be helpful

if you could put a dotted line around that on this particular drawing that indicates the extent of the modeling that was done. That will then I think support your answer to Mike's question.

MR. KEITH: Fine. We'll do that, Ed.

MR. HODGE: Another question. On your spray nozzles, how do we get up there to inspect those things? I have seen how you are installing them now. You've got all this scaffolding running up on the crane to install them. How are you going to get up there to test these things? I understand you are going to test them with air I believe I read somewhere. How do you get up there to tell the air is going out in the right amount and all that?

MR. SIMKO: I would like to ask a question right on top of that. We have to do a five-year Tech. Spec. requirement by performing an air or smoke flow test to each grade header and verify that each spray nozzle is unobstructed. It goes right along with that question.

MR. KEITH: B says preoperational tests. We have that stuff out there, so we can test that things are flowing when that scaffolding is there, so we can perform that test. I think as far as the five-year test that is required, with smoke you could with binoculars or something -- I don't think you have to get that close. From the top of the polar crane, you would be able to see each nozzle as long as you

had sufficient smoke.

MR. HODGE: This would probably be done during a refueling operation.

MR. KEITH: Definitely.

MR. HODGE: Would that smoke and stuff like that bother the refueling operation?

MR. KEITH: I think you would have to control it so you didn't cloud up the whole containment.

MR. HODGE: I'll yield to Bill if he wants to pursue this further.

MR. SIMKO: If you use hot air, there are infrared techniques to test each one of those nozzles.

MR. KEITH: That may be a better technique.

MR. SIMKO: I don't think we have any problem.

MR. VAN BRUNT: Bill, do you want any more information on that at this point or shall we leave this for a maintenance discussion on it?

MR. SIMKO: Yes, we'll leave it.

MR. HODGE: I have no further questions.

MR. VAN BRUNT: Who else? Bill.

MR. SIMKO: I have a few of them here. On Figure 2-6, do you have the height of the screens in relation to what the water level is going to be? I see the length. I don't see the height.

MR. KEITH: The requirement of Regulatory Guide 1.82

is that the screen is completely submerged during the recirculation mode, and as the minimum water level in the containment is four and one-half feet, which is four feet six, I believe the height of it is something like four feet five inches. I would have to doublecheck.

MR. SIMKO: I am just wondering, because there is grating about four and one-half -- let's see. No, about six feet up from the floor level, there is grating, so it would be under that grating.

MR. KEITH: It would be positively under the grating. The grating is elevation 88 and there are enough structural members that the platform is approximately 10 inches below the eighty-eighth level and this elevation is approximately 84-1/2, so the height of this screen is less than four and one-half feet.

MR. VAN BRUNT: Bill, excuse me, while he's got that slide up there, let me ask a question about it. First off, I think if you could, Dennis, maybe you ought to put the height of this on the slide. Secondly, I believe, Paul, in your presentation, you mentioned that there are some two-inch holes in the top of that screen. I just heard that the screen will be submerged. Under that top grating, is there screening under there as well?

MR. BIBA: Yes, those two-inch holes have the same three layers of screening. That means there is a fine screen,

coarse screen, and the grating.

MR. VAN BRUNT: Is that continuous or just over the hole?

MR. BIBA: Just over the hole.

MR. HEPNER: I have seen some test results for other plants that did not require the air to be vented. They showed satisfactory performance with a layer of trapped air under a solid plate. Did the test program investigate this at all?

MR. BIBA: Our test program included evaporating the air from the upper portion of the screen, and the main reason for that was that this solid top deck, so to speak, is acting as an additional vortex-breaking device. Then there would be an air cushion submerged under the water level and the vortex-breaking capabilities could be perhaps somewhat less, could be smaller.

MR. HEPNER: Well, I guess the question is was it checked one way and the other or did we just jump in and include the vents right from the start?

MR. BIBA: It was tested with the holes in place only.

MR. VAN BRUNT: Bill, go ahead. You had some more questions.

MR. SIMKO: On Figure 2-2, I was also looking at P&ID 13-M-SIP-001. It has the same type of configuration for the suction sizing in the containment spray pump. In

relation to filling the suction side piping along with there is no water in the sump unless you have an accident, you have your two motor-operated valves on the suction piping and that check valve. Can you tell me in relation to your venting and draining and spilling of this line how you are going to guarantee that there is no air slug in this line when you have an accident, you want to start taking suction, opening these valves up and taking suction through the pump.

MR. BIBA: The suction line is going to be completely filled with water up to this check valve (indicating). It will be filled by pressure in the refueling water tank. Between the isolation valves, it will be filled, because there are connections on the pipe that can facilitate filling that portion of the pipe. There are two test and drain connections that can facilitate filling the piping.

MR. SIMKO: It will be filled, then?

MR. BIBA: Completely filled with water, yes.

MR. VAN BRUNT: I take it filling that pipe is part of the startup procedure to be sure it is full at all times.

MR. KEITH: Yes.

MR. VAN BRUNT: Bill, have you got some more questions?

MR. SIMKO: Yes, a couple more. Someone was talking about the trisodium phosphate baskets. It sounded like there was some commitment made that we will check these things periodically. Is that going to be a requirement?

MR. KEITH: Yes. We haven't worked out the details, Bill, on that, but I think there is going to be some requirement at least every refueling that you check the trisodium phosphate to assure that it hasn't caked up.

MR. SELF: Will there be a Tech. Spec. on that requirement?

MR. KEITH: Yes.

MR. HEPNER: I could address that a little bit. I'd like to tell you a little bit about what we have seen on some other plants. Calvert Cliffs and Fort Calhoun are using trisodium phosphate baskets and they started out with a weekly inspection, and at this point, it has evolved into a six-month inspection for Calvert Cliffs and an 18-month inspection for Fort Calhoun once they have developed some operating experience. Your program probably would be similar to Fort Calhoun, although you might have some more frequent --

MR. VAN BRUNT: The humidity.

MR. HEPNER: Basically, it is the humidity that is the criterion.

MR. VAN BRUNT: Have you got some more questions?

MR. SIMKO: Yes. One was on P&ID 13-M-SIP-003. There are some level transmitter instruments right before you get to the distribution header. What are those things for?

MR. KEITH: We have that level indication there so that we can assure ourselves that the pipe is filled to that

point. You may recall on an earlier slide, we talked about having the piping partially filled to prevent water hammer. Our main reason for having that pipe filled is to reduce the containment spray delay time.

MR. SIMKO: So that guarantees it to that point?

MR. KEITH: Yes.

MR. SIMKO: One more question and I think that will do it. You talked about the use of the containment spray pumps during shutdown cooling mode in parallel with the LPSI pumps. We have been trying to get an answer to this question for a long time and still haven't gotten a response. Relating to P&ID 13-M-SIP-002, on the shutdown cooling line RC Loop 1, there are three motorized valves, two outside of containment and one inside containment. One of these valves, I can't remember which one, I think it is 651, the control logic for that is fully open/fully closed on the switch. I think the other two have a jog open/jog closed capability, and we are trying to figure out when in the world you would want to have these valves throttled. We can't figure out why you would want a throttling position on the control logic. If there is a reason, fine. If there isn't, our operators don't like the possibility of putting these things into throttling position on the pumps.

MR. KEITH: Bill, I guess we have responded to your concern, but I am afraid it won't be to your satisfaction,

so we'll do some more homework. That valve is shown that way to meet a CE requirement, but what we will find out is why CE thinks we have to have that valve in an intermediate position.

MR. SIMKO: I know they were CE valves or CE --

MR. KEITH: That is a CE requirement that we have that jog feature, so we'll follow up and find out why they want it. I gather you would prefer not to have it at all.

MR. SIMKO: No, because the operators may make a mistake and move it into throttle position or whatever. If there is no reason to have the jog capability, then we don't want it.

MR. KEITH: Fine.

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

MR. STERLING: To offer a clarification, that has currently been addressed with Combustion and they are looking at it. We are in the process of getting an agreement of what their intent was and we just haven't heard back from them.

MR. SIMKO: I knew it wasn't within Bechtel's scope as far as supply.

MR. STERLING: These were a Combustion-provided item. It was their requirement that they be that way and it is on their P&ID that way, and when that question was raised, we sent back for a clarification from Combustion and they are

currently reviewing that material.

MR. KEITH: Thank you, Ed.

MR. VAN BRUNT: Any other questions? Carter.

MR. ROGERS: Exhibit 2-40, Paragraph 2), discusses shutdown cooling operations when the reactor coolant system temperature is between approximately 200 degrees Fahrenheit and 350 degrees Fahrenheit and it talks about the safety capability of the Containment Spray System during that time. If a loss of coolant accident should occur under these conditions and if that loss of coolant accident resulted in a containment spray actuation signal, what manual actions would be necessary on the Containment Spray System first during the injection mode and secondly during the recirculation mode.

MR. KEITH: No manual action would be required during the injection period when you are taking suction from the refueling water tank. However, prior to receiving the recirculation actuation signal, you would manually have to realign the containment spray system shutdown cooling system such that the containment spray flow went through the shutdown heat exchanger.

MR. ROGERS: Then a follow-on question to that, what guidelines have been given to the APS Operating Department to ensure that procedures cover that mode of operation?

MR. KEITH: I am not sure at this point, Carter, where

we stand on operating guidelines. Those are in the process of being developed by Combustion Engineering.

MR. ROGERS: I wonder if we might take that as an open item and respond to that later either today or whenever.

MR. VAN BRUNT: Either that or, as a response to that open item, either get Combustion's assurance or yours that they will be covered in some guideline somewhere.

MR. HEPNER: Could I add a clarification on that last question? I don't believe there has been a real need to take any manual action even prior to the recirculation signal. With the low energy in the loop and the shutdown cooling system performing properly, an immediate action to have the spray functioning completely is probably going to be unnecessary. It will be very chancey whether we will even actuate the spray system in a break like that, so immediate or urgent operator action will not be necessary. Some general guidelines would be appropriate on initiating and realigning.

MR. VAN BRUNT: We want to be assured that those guidelines are transmitted. That is the basic point.

Jim Cook, you had a question.

MR. COOK: Bill Simko mentioned the level transmitters on the risers going to the containment spray headers. A few other power plants have had difficulties with valves leaking through and inadvertently spraying water into the containment

building. Are these transmitters located such that normal water level will be in a position that can be monitored? Do you locate these transmitters so that they could indicate valve leakage into that header?

MR. KEITH: Yes.

MR. COOK: Very good. Thank you.

MR. VAN BRUNT: I have a couple of questions. Anybody else have any questions?

I would like to go to Figure 2-2 just out of curiosity more than anything else. On the main reactor floor there, you show a couple of what looked like nozzles coming through the floor. I was wondering what the purpose of those was. It is just curiosity more than anything else.

MR. KEITH: Ed, we have some flanges and piping so that in the event we do have a LOCA, we don't fill up the refueling canal with the spray water. We will fill up the reactor cavity area, but we will not fill up the refueling canal, because prior to startup following refueling, you remove these flanges and then you have a drain path open from the refueling canal to the sumps.

MR. VAN BRUNT: I would like to go to 2-3. This kind of follows up on my previous question about separation. I think Paul in his presentation talked about the piping coming out of the containment spray pumps and he indicated that there was distance separation. I believe that there is a

physical separation of that piping.

MR. KEITH: Yes. Well, you see this barrier here (indicating) and the piping for one train is on one side and piping for the other on the other.

MR. VAN BRUNT: So there is physical separation. The inference I got was that it was distance, and I didn't think that was correct.

MR. KEITH: Distance plus physical separation.

MR. VAN BRUNT: Additionally, and this was the point I was trying to make earlier, there are both piping and electrical needs to go into the containment from there. There are also piping needs to go out to the spray ponds, which are located to the left on this figure. How do you get piping that has to go to the spray ponds across the electrical and piping that has to go into the containment, which is running toward the top of that figure, and provide physical separation while you are doing that?

MR. KEITH: There is no piping to the spray pond from this level.

MR. VAN BRUNT: From this level. I agree.

MR. KEITH: The only spray pond water we have coming into the auxiliary building is not at this level. It is at the essential cooling water heat exchangers, which are up at another level, and we don't really have those shown on any of the drawings that we have here today.

MR. VAN BRUNT: What I am really getting around to is that you have a pipe tunnel that traverses the buildings that is split, and that doesn't show on any of these drawings What I was trying to get at is that there is physical separation of that piping from the A and B piping that goes into the containment and that is provided by that set of pipe tunnels that go through the piping corridor.

MR. KEITH: That's correct.

MR. VAN BRUNT: I don't have any other questions. Are there any other questions on this part of the presentation? Ed.

MR. STERLING: On Figure 2-2, at the top you show the spray nozzles arrangement and you have your containment spray Train A and containment spray Train B, and in the analysis that was done for the droplet pattern, the pattern for the sprays, you say either train is adequate.

MR. KEITH: That's correct.

MR. STERLING: If both trains are running, is there interference? Is that taken into account, too, or is there just so much coming out that it doesn't matter?

MR. KEITH: I think there is so much coming out that it doesn't matter.

MR. HEPNER: That's what it amounts to. There is so much coming out at that point.

MR. STERLING: At that point, you don't have to worry

about a spray pattern.

MR. HEPNER: Yes.

MR. VAN BRUNT: Are there any other questions?

Dennis, go ahead.

MR. KEITH: We will now continue with Conformance to Regulatory Requirements.

MR. BIBA: Figure 2-10 shows the requirements of Standard Review Plan 6.2.2. Revision 2 for General Design Criteria and Regulatory Guides that are relevant to the system.

Exhibit 2-42, SRP 6.2.2, requirement for the Containment Spray System to meet the redundancy and power source requirements for an essential safety feature and that the systems should be designed to accommodate a single active failure without loss of function. In compliance.

Exhibit 2-43 shows the requirement that the recirculation spray system that circulates the water from the containment sump during the long-term recirculation and after a LOCA shall do so without cavitation. Also, there should be adequate NPSH available to the recirculation pumps. PVNGS is in compliance inasmuch as the NPSH calculations were based on the containment pressure equal to the vapor pressure at the sump water, and there is adequate NPSH available. The effect of the sump screen on the hydraulics of the pump suction was modeled on a one-to-one model and it

was found that vortexing or air entrainment will not occur when a vortex-breaking grating cage is installed on the suction pipe.

Exhibit 2-44, requirement that analyses of the heat removal capability be made of the Containment Spray System. The heat removal capability of the Containment Spray System was performed by Combustion Engineering.

Exhibit 2-45 shows additional requirements connected with the heat removal capability of the system, and the response would be that the heat removal capability was designed by Combustion Engineering.

Exhibit 2-46, requirement that fan coolers be used for the heat removal capability and that the heat removal capability of the fan coolers should be justified. This requirement is not applicable, since at PVNGS, a fan cooling system is not used.

Exhibit 2-47, requirement that the potential for surface fouling of the heat exchangers that are involved and transmit the heat from the containment be considered. PVNGS is in compliance. Surface fouling of the shutdown cooling heat exchangers and, for that matter, also the essential cooling water heat exchangers, was considered. In addition to that, the water within these systems is controlled by chemical systems.

Exhibit 2-48, requirement that the Containment

Spray System should be designed to Quality Group B per Reg. Guide 1.26. In compliance.

The spray system should be designed as Seismic Category I per Reg. Guide 1.29. In compliance.

Provisions shall be made in the design to allow periodic inspection and testing of the systems. In compliance. Periodic inspection and testing is in accordance with ASME Section XI.

Exhibit 2-49, requirement that the instrumentation should be provided to monitor the Containment Spray System performance under normal and accident conditions. In compliance.

Exhibit 2-50, requirement that drainage from the containment spray pumps during the recirculation will be provided and that the screen assemblies around the recirculation piping will be acceptable to prevent debris from entering the recirculating piping. PVNGS is in compliance inasmuch as the containment recirculation sump was designed in conformance with Reg. Guide 1.82 and the screening to 0.09 inches is performed.

Exhibit 2-51, requirement that a system be provided to remove heat from the reactor containment and the system function will be to reduce rapidly the pressure and temperature following a LOCA; also that there is suitable redundancy in components and features and suitable interconnections and

isolation shall be provided to assure that for onsite power system operation and for offsite electric power system operation, the system will function properly. In compliance.

Exhibit 2-52, GDC 39, Inspection. In compliance.

Exhibit 2-53, GDC 40, Testing. In compliance.

Exhibit 2-54, GDC 50, Containment Design. In compliance.

Exhibit 2-55, Reg. Guide 1.1, Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal System Pumps. In compliance.

Exhibit 2-56, Reg. Guide 1.26, Quality Group Classifications. In compliance.

Exhibit 2-57, Reg. Guide 1.29, Seismic Classifications. In compliance.

Exhibit 2-58, Reg. Guide 1.82, Sumps for Emergency Core Cooling and Containment Spray Systems. Requirement for a minimum of two sumps to be provided. In compliance.

Redundant sumps should be physically separated from each other. In compliance.

Exhibit 2-59, continuation of Reg. Guide 1.82, requirement that the sumps should be located on the lowest floor elevation in the containment and that, at a minimum, there are two screens provided, an outer trash rack and a fine inner screen. In compliance.

Requirement for the floor level in the vicinity

of the sump to slope away from the sump. In compliance.

Exhibit 2-60, requirement that all drains from the upper region of the reactor building should terminate in such a manner that it would not impinge directly with the screen. In compliance.

Requirement for a vertically mounted outer trash rack to be provided. In compliance.

Exhibit 2-61, requirement that a vertically mounted fine inner screen should be provided, and the design coolant velocity at the inner screen should be approximately 0.2 feet per second; also the avaiable surface area used in determining the design coolant velocity should be based on one-half of the free surface area of the fine inner screen. In compliance. The design velocity for a 50% plugged fine inner screen is 0.18 feet per second. The design velocity at a 50% plugged outer coarse screen is 0.18 feet per second. The velocity at a 50% plugged trash rack is 0.17 feet per second.

There is a requirement that a solid top deck should be provided. In compliance.

Exhibit 2-62, continuation of Reg. Guide 1.82, a requirement that the trash rack and screens should be designed to withstand the vibratory motion of seismic events. In compliance.

Requirement that the size of openings in the fine

screen should be based on the minimum restrictions found in systems served by the sump. In compliance.

Requirement that pump intake locations in the sump should be carefully considered to prevent degrading effects of vortexing. In compliance.

Exhibit 2-63, continuation of Reg. Guide 1.62, requirement for the materials for trash racks and screens should be selected to avoid degradation during periods of inactivity. In compliance. The screen material is austenitic stainless steel.

Requirement for the trash rack and screen structure to include access openings to facilitate inspection of the structure. In compliance. There is a manhole provided in the top deck to facilitate access into the sump and suction intake structures.

Exhibit 2-64, continuation of Reg. Guide 1.82, requirement for inservice inspection for reactor coolant pump components such as trash racks and screens, and the coolant pump components should be inspected during every refueling period down time and there should be a visual examination of the components for evidence of structural distress or corrosion. In compliance.

Exhibit 2-65, NUREG-0737, Item II.F.1, Subpart 4. There is a requirement for continuous indication of containment pressure to be provided in the control room, and

measurement and indication capability to include three times the design pressure of the containment for concrete, four times the design pressure for steel, and minus 5 psig for all containments. In compliance. The containment pressure is monitored over the range of minus 5 to 180 psig and it is provided with Class IE power with recording on Channel A.

Exhibit 2-66, NUREG-0737, Item II.F.1, Subpart 5, a requirement for continuous indication of containment water level to be provided in the control room for all plants. PVNGS is in compliance. A narrow range instrument reading from the bottom to six inches above the sump is provided for each containment radwaste sump. These narrow range instruments are non-IE, but they have a reliable power source and are qualified to a post-LOCA environment. There is a redundant wide-range instrument which reads from 80 feet 6 inches to 91 feet 6 inches provided with Class IE power with recording on Channel A. The maximum expected water level in the containment is 91 feet, so this wide-range instrument is reading within the expected water level in the containment.

MR. KEITH: This concludes the Containment Spray System.

MR. VAN BRUNT: Before we go to the informal NRC questions that we've got, are there some questions on the presentation? Ed.

MR. STERLING: On Exhibit 2-66, on the containment water level, it indicates that you have to run from the bottom of the containment to the elevation equivalent to 600,000 gallons. As I understand the orientation of the instruments, is it from the bottom of the containment, because there is an overlap between the narrow range that is in those sumps and the wide range. What is the lowest elevation in the containment?

MR. KEITH: Eighty feet is the floor level and then the sumps go down below that.

MR. STERLING: The reactor cavity does not go below that point?

MR. KEITH: The reactor cavity does.

MR. STERLING: How do we address the water level that might be in that cavity versus where we are reading on these instruments that you say in the design feature?

MR. KEITH: There are curbs to prevent water from going into the reactor cavity such that we will fill the radwaste sumps first, so you will have that as indication before the reactor cavity sump will fill.

MR. STERLING: For any water that gets in there other than a direct leak from the vessel then those sumps would fill prior to any water going into the reactor cavity?

MR. KEITH: That's correct.

MR. STERLING: Is the volume of water underneath the

reactor in that cavity such that the lag time between the reading on the sump level indicator and the wide-range indicator on the wall would be a minimal amount of lag?

I don't know what the volume of that cavity is under there, but it is my understanding it isn't great compared to the overall volume.

MR. KEITH: Ed, the curb is such that we will be on our wide-range indication before we start to fill up that reactor cavity sump.

MR. STERLING: Well, my question is is the volume of that area underneath the vessel, that cavity area, such that it would cause a lag on the increasing rising water level in the containment building while that cavity fills? In other words, you have filled your sumps, the water is starting to rise in the containment, you now go above the level of the curb and the water starts going down into the cavity and will start to fill that cavity prior to the rest of the water level going up.

MR. KEITH: That's correct.

MR. STERLING: Is that volume there such that there will be a significant lag in being able to tell where your water level is.

MR. KEITH: Well, no. See, you will know where you are, because you will be on the wide-range indication, so what you read on the wide-range indication will not increase

while you are filling up that reactor cavity sump, but you will have the indicator so you will know where you stand as far as water level in the containment.

MR. STERLING: Let me try it one more time. Is there a significant volume in that cavity? Let me ask it that way.

MR. KEITH: The volume is not significant. We have considered it as far as determining our maximum and minimum water levels in containment, so it has been included.

MR. STERLING: It is not a significant amount?

MR. KEITH: It is included in the calculation.

MR. STERLING: Thank you.

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

MR. STERLING: No.

MR. VAN BRUNT: John Held.

MR. HELD: Exhibit 2-66. Please provide the accuracy specification of the containment water level monitors.

MR. KEITH: We are in the process of procuring those indicators, so we will provide those when we have the data.

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

MR. HELD: No.

MR. VAN BRUNT: Carter, I think you have a question to follow up.

MR. ROGERS: Exhibit 2-49 as it applies to Exhibit 2-66. Exhibit 2-49 refers to Standard Review Plan 6.2.2 and specifically Requirement No. 9) of the Standard Review Plan.

Regulatory Guide 1.97,"Instrumentation for Water Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," states that the instrumentation should have adequate range, accuracy, and response to ensure that the parameters can be tracked and recorded. You do not address Regulatory Guide 1.97, although you do in Exhibit 2-66 refer to NUREG-0737. Are those requirements similar?

MR. KEITH: Yes.

MR. ROGERS: Do you indeed meet Regulatory Guide 1.97?

MR. KEITH: Yes, we are in the process of procuring instrumentation so that we will meet those requirements.

MR. VAN BRUNT: Any other questions from anybody else? Bill.

MR. HEPNER: On Exhibits 2-44 and 2-45 where you are talking about nozzles and the analyses of heat removal capability, you have attributed this to CE. I would like to point out that it is Bechtel that is doing the actual containment analyses and there is an interaction on some of these subjects.

MR. KEITH: That's correct. CE has specified the nozzles, but Bechtel does the pressure/temperature analyses for containment using the data for the containment spray system.

MR. VAN BRUNT: Any others? Carter, you've got some more questions.

MR. ROGERS: Exhibit 2-42 refers to Standard Review Plan 6.2.2. Requirement No. 1) in my copy of that Standard Review Plan indicates that the results of the failure mode in an effective analysis for each system should ensure that the system will be capable of withstanding a single failure without loss of function. I'm sorry, I missed the right-hand side of it. You do address that. Good.

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

MR. KU: I have one. In Exhibit 2-43, we talk about a one-to-one model test and I am wondering when you run the test whether it is a closed environment in which you could control the actual contaminant conditions. I'm just wondering.

MR. BIBA: The model test was made to the conditions. That means the temperature of the water was simulated. And the model was corresponding to the contaminant conditions. The test was run I believe at 180 degrees Fahrenheit, which was the limit of the heaters and the hydraulic velocity there. However, the results were corrected by appropriate correlations to correspond to the actual contaminant temperatures and conditions.

MR. VAN BRUNT: Any other questions?

I think everybody has been handed a copy of the informal questions that we received from the NRC. I think Dennis is going to deal with these. He will give you the

question number, you can read the question yourself, and he will respond to those. That way we will get them on the record. We have given the Court Reporter a copy of these questions and he will append that to the transcript so anybody that is reading it can get the whole picture.

Dennis, go ahead.

MR. KEITH: Question 6.2.1.1.A-4. This CESSAR interface deviation is discussed in FSAR Section 1.9.2.4.1, and it has already been discussed in the presentation today. Is that sufficient?

MR. HELD: Let me bring up one point before we proceed. If you don't feel like answering the questions that pertain to sections other than those covered by the agenda today, feel free just to address those in a letter later.

MR. VAN BRUNT: That was our intention, that we would like to try and deal with these and dispose of as many of them as we can right now to save an interchange of letters. It makes it easier for you and us both. If there are items that we have not been able to prepare an answer for at this time or for whatever reason, we will just hold those as an open item and we will address those separately. That was our intention. We will be very interested in any interaction that you have with the responses as to whether they appear to satisfy your needs or not.

MR. HELD: I don't see any problem with the response you gave to the first question at this time.

MR. KEITH: Question 6.2.1.1.A-5. We do have additional nozzles under the deck under a couple of slabs, as we discussed in the presentation already. Just as background, the rationale for those was during the PSAR stage, the containment offsite dose analysis was showing that we had to reduce the dose and the way to do that was to increase the amount of spray volume inside containment for iodine removal. That is why those auxiliary sprays were added.

MR. HELD: All right.

MR. KEITH: Question 6.2.2-1. The frictional losses in the containment spray pump suction piping were calculated using standard industry practices, the Crane Handbook, Flow of Fluids, Paper #410. These calculations show an available net positive suction head margin during the injection mode of about 140% and during recirculation mode of about 25%, assuming that the vapor pressure in the sump water equals containment pressure. Also, the effect of the recirculation sump screen was modeled on a one-to-one model and hydraulic performance and head losses through the screen were identified in these tests.

MR. HELD: Fine.

MR. KEITH: Question 6.2.2-2. The spray patterns

inside the containment dome were developed and numerically analyzed by CE to minimize the extent of overlapping of the sprays. We don't have an overall drawing showing the dome sprays. However, we do have drawings showing the spray pattern from those spray nozzles. The spray patterns of the auxiliary sprays below elevations 140 feet and 120 feet were developed by Bechtel and reviewed and approved by CE. We have drawings which we will give you today showing the auxiliary spray patterns and the extent of overlapping of the auxiliary sprays.

MR. VAN BRUNT: Dennis, will you give a copy of those drawings to the court reporter to add to the transcript as well?

MR. KEITH: Okay.

MR. HELD: On that question, is there a number in terms of percent specified for maximum allowable overlap of the sprays?

MR. KEITH: Phil, can you respond to that?

MR. HEPNER: I believe we have 90% coverage. I am not sure of a specific overlap number. I can't give it off the top of my head on that.

MR. VAN BRUNT: Why don't we take that as an open item and we will respond to that aspect of the question.

MR. HELD: That's fine.

MR. KEITH: Question 6.2.2-3. CE's analysis of the

heat removal capability of the Containment Spray System indicates that thermal equilibrium is reached in the spray droplets within 10 feet from the spray nozzle. Item 22 of Exhibit 2-28 states that a minimum free fall height of 90 feet is provided for the containment dome sprays. FSAR Section 1.2 provides general arrangement drawings which show that for the auxiliary spray areas, a free fall height of about 16 feet is available. Thus, for both spray areas, thermal equilibrium is attained.

Question 6.2.2-4. During both the injection and recirculation modes of operation, the containment spray is aligned through the shutdown cooling heat exchangers. Therefore, the recirculation actuation signal does not alter the alignment of the system.

Addressing Part b), the design heat removal rate for the shutdown cooling heat exchangers includes fouling factors on the shell and tube sides of 0.0005 and 0.00025, respectively. The Section 6.2.1 analyses presented in the FSAR utilized this design heat removal rate.

MR. HELD: Good.

MR. KEITH: Question 6.2.2-5. We discussed conformance with Regulatory Guide 1.1 and we do assume that the containment pressure is equal to the vapor pressure of the sump water. Our understanding of the Regulatory Guide is that that is in conformance with the Regulatory Guide.

MR. HELD: Assuming that the containment pressure is equal to the vapor pressure of the sump water is not necessarily the same as assuming no increase in containment pressure from that present prior to the postulated loss of coolant accidents. We will have to look at that to see if adequate conservatism has been used, so let's leave it at that for now.

MR. KEITH: Fine.

MR. HEPNER: I think the SRP uses the words that you have used in contrast to the words that are in Regulatory Guide 1.1.

MR. KEITH: John, on Page 6.2.2-2 at the bottom of the page of the SRP, Revision 2, it says: "For clarification the analysis should be based on the assumption that the containment pressure equals the vapor pressure at the sump water."

MR. HELD: You're right.

MR. KEITH: Thank you. Question 6.2.2-6. The 0.09 inches is based on a clearance within the reactor core. One of the grid spacings within the reactor core is the basis for that.

Question 6.2.2-7. Do you require any information other than what has been presented?

MR. HELD: You have answered this already in the presentation.

MR. KEITH: Thank you. Question 6.2.2-8. The trash rack material is stainless steel. I have forgotten whether we stated that earlier or not.

MR. HELD: The point of confusion for me was the statement that all screens are fabricated of austenitic stainless steel and I wasn't sure if that referred to the two inner screens or to all three layers including the trash rack.

MR. KEITH: It does refer to all three.

MR. HELD: Fine.

MR. KEITH: On the next page, that would be Question 6.2.2-9, our P&ID does show those valves as locked closed, and what that indicates is that there is a chain for the manual operator so that you can't manually operate the valve, but that does not affect automatic operation of the valve. That is the point of confusion.

MR. VAN BRUNT: Does that finish the questions on this?

MR. KEITH: I believe so.

MR. HELD: Yes.

MR. VAN BRUNT: We will pick up the rest of them later on.

MR. KEITH: Can we just confirm then that the only open question we have is on the overlap of the sprays?

MR. HELD: As far as I know, that is the only one

that is definitely an open item.

MR. VAN BRUNT: Certainly if after he reviews the transcript he has additional questions, he can raise them.

MR. KEITH: We just wanted to clarify what we need to work on.

MR. VAN BRUNT: Are there any other questions from any of the Board members on this section before we go over to the Containment Isolation Systems?

Okay, Dennis. You've got about 25 minutes until noon, so you can judge as to where you want to stop. Maybe you want to go through the introduction portion. I don't know how far down the next section we'll go.

MR. KEITH: We will go through the Introduction and System Overview and see where we stand, whether we want to take questions at that point in time or break for lunch. We are right now in Containment Isolation Systems and Bill Boles will present that.

MR. BOLES: Thank you, Dennis.

The next part of the presentation is the Containment Isolation System.

Exhibit 3-1. The design objective of the Containment Isolation System or CIS is to allow normal or emergency passage of fluids through the containment boundary while preserving the ability of the boundary to prevent or limit the escape of fission products that may

result from postulated accidents.

The CIS is not a specific engineered system, as we saw in the case of the containment spray system. Each piping system which penetrates the containment incorporates requirements of the integrity of the containment pressure boundary in the penetration design.

Exhibit 3-2, Design Criteria. Two isolation valves shall be provided, one inside and one outside of the containment. As we shall see, there are some other design criteria which apply for different piping penetration assemblies.

Penetration lines and valves shall be constructed to ASME III, Class 2, Seismic Category I.

The design pressure and temperatures of the containment penetration lines and their associated isolation valves shall meet or exceed containment design conditions. Valve operators shall be designed to the prevailing environmental conditions, depending on whether the valve is inside the containment or outside.

Exhibit 3-3 begins the CESSAR interface requirements, CESSAR Section 6.2.4.1.2.

The isolation valves and piping shall be designed to Safety Class 2 and Seismic Category I. They are in compliance.

The isolation valves and interconnecting piping

are protected against missiles. They are in compliance. Valves and piping inside the containment are located between the containment wall and the secondary shield wall, and the containment wall also serves as a missile barrier. Outside the containment, there are valves which are protected by steel and concrete walls and floors of adjacent buildings.

Exhibit 3-4. The isolation valves and piping shall be protected against the effects of pipe whip and jet impingement. We are in compliance. They are provided separation from high energy lines, pipe whip restraints, and barriers are provided where appropriate.

The maximum allowable particle size in the water from the containment sump shall be limited, and, as we have seen, we are in compliance.

Isolation valves shall be designed to operate under environmental conditions and to fulfill their safety-related function under post-accident environmental conditions. We are in compliance.

Exhibit 3-5. Isolation valves and piping shall be qualified to ASME III, Class 2. We are in compliance.

The valve operators and power sources shall be selected for CESSAR scope isolation valves consistent with their required safety function. We are in compliance. The operators are provided by Combustion Engineering. The interface requirements for power sources are satisfied.

Controls for isolation valves shall be designed to actuate remote manual, automatically, or manually locally. We are in compliance.

Exhibit 3-6, System Description. The CIS consists of piping penetrations, pipe, valves, and test connections to control the passage of fluids through the containment boundary and to test the boundary leakage.

At Palo Verde, we use six different basic types of arrangement. The first type, Type A, are normally closed or isolated valves. Type B, or type number two, are normally operating wise closed upon a containment isolation actuation signal (CIAS), main steam isolation signal (MSIS), auxiliary feedwater actuation signal (AFAS), safety injection actuation signal (SIAS), or remote manual. The third type is normally closed, open on an SIAS, AFAS, containment spray actuation signal (CSAS), or recirculation actuation signal (RAS). The fourth type is part of the closed secondary side of the steam generators within the containment. The fifth type are instrument connections for containment pressure. The sixth type are flanged connections and personnel locks.

Let's stay on this slide for just one minute. CE defines the systems and positions and isolation valves for their scope of supply. Penetrations for support systems fall into one of the above categories. Our Final Safety Analysis Report, Section 6.2.4, describes each penetration

in detail.

I have some schematics of some typical penetrations. Figure 3-1 is the Type A penetration, as we see there, which is typical for service air, fire protection, and demineralized water, a closed valve outside, automatic valve inside or closed valve on the inside of the containment with a drain and/or test connection as appropriate to test the valves.

Figure 3-2 is the Type B penetration typical for cooling water, letdown line, reactor drain tank vent, containment purge, which uses butterfly valves, and the radwaste sump discharge, a motor operated valve inside, a motor operated valve outside closed on a CIAS, drain and test connections for testing.

Figure 3-3 is the Type C penetration typical for safety injection, containment spray, and recirculation sump piping. There are valves outside the containment that open on appropriate signals, valves inside the containment and on the recirculation sump open on the appropriate signal.

Figure 3-4 is the Type D penetration arrangement for the main steam lines. I only show one, although there are two main steam lines off of each steam generator. The main steam line comes off, goes through the containment. We have our main steam relief valves and we have our check valves, main steam isolation valve, the line in this case

going through the steam-driven auxiliary feedwater pump turbine.

Figure 3-5 shows again a Type D penetration. This is a feedwater supply side showing the main feedwater line, the main feedwater isolation valves. Within the containment, there are also valves for the CE steam generator. The downcomer feedwater line is shown up here with isolation valves, and the auxiliary feedwater pumps tie into a containment penetration to the downcomer and it also meets our CE interface requirement.

Figure 3-6 shows the Type E penetration for the containment building pressure monitors. Inside containment, there is a small open pipe. Outside the containment, there is a remote-operated isolation valve with a pressure transmitter. From the pressure transmitter all the way through, that is an ASME III, Class 2 system.

Figure 3-7 is the Type F penetration arrangement typical here for the personnel hatch or equipment hatch. The detail, as you can see here, shows a double "0" ring seal and a test connection. This double "0" ring seal is also used on the penetrations used for the containment integrated leak rate test. Those are seals with flanges with a double "0" ring seal. Those other connections just have a flange on the outside.

Exhibit 3-7, System Operation. Containment

pressure is monitored by four different pressure instruments. Upon detection of high containment pressure, a set point of 5 psig, by any two instruments or upon pressurizer low pressure, less than 1,685 psig, a CIAS is generated.

A CIAS will then close the appropriate valves, and the following valves have penetration valves actuated by a CIAS: containment HVAC, the radiation monitors; containment purge, which is also closed by a containment purge isolation actuation signal on high radiation; service gas; chilled water system; instrument air; nuclear cooling water; hydrogen control; chemical and volume control; and secondary sampling.

Exhibit 3-8. Other systems which have penetration valves closed by an SIAS, AFAS, or MSIS are main steam, the main feedwater, steam generator blowdown and blowdown sampling, and safety injection tank drain. The parameters which generate an SIAS also generate a CIAS.

Exhibit 3-9. There are some penetrations which we do not isolate following an accident. It is desirable to leave reactor coolant pump seal injection and chemical and volume control system charging paths open to prevent additional core protection after an accident in which offsite power is available.

Charging pumps can be transferred to the emergency bus off the diesel generator at the discretion of the

operator in the event that offsite power is lost.

It is also undesirable to lose charging or seal injection capability during normal operation due to an inadvertent CIAS. The potential release of fission products through the penetration is not a concern for the following reasons: First, the flow is into the containment and the reactor coolant system; second, we provide check valves inside the containment to prevent backflow out of the containment if the charging pumps should stop; the connecting portions of the chemical volume control system outside containment are designed to Safety Class 2, Seismic Category I, standards and have a design pressure well in excess of containment building design pressure; and, four, the operator has the capability of isolating these lines if necessary.

Exhibit 3-10. The main steam and feedwater systems, while not essential, aid in heat removal during a small LOCA, and these systems are not isolated by a CIAS generated on low pressurizer pressure. The steam and feedwater systems are isolated for a main steam line break by a main steam isolation signal on high containment pressure or low steam generator pressure.

Override of a CIAS signal is available for each containment isolation valve by the control switch for that valve. The resetting of a CIAS does not result in the automatic opening of containment isolation valves. Reopening

requires operator action for each valve and does not compromise the containment isolation signal.

MR. KEITH: Any questions?

MR. VAN BRUNT: Ed.

MR. STERLING: Would you detail on Exhibit 3-10 what action the operator does have to take for that control switch such that he doesn't inadvertently operate the valve? Can somebody just run through a sample?

MRS. MORETON: To override the containment isolation signal, the operator has to perform two actions. He has to turn the control switch on the main control board to the closed position or the actuated position, which arms the override, and then turn the control switch to the open position, which would then open the valve. Does that answer your question?

MR. STERLING: Yes.

MR. ALLEN: I've got a followup on that. I notice some of the systems can be isolated by two different signals. Which of the isolation valves is the longer? If you are in one of the modes, you went to override on it, you got another signal in from -- maybe you were in a CIAS mode, you went to override on it, opened it up, and then got an SIAS, would you still close that valve then?

MRS. MORETON: The containment isolation signal initiating parameters for the CIAS are the same as the

initiating parameters for an SIAS and the override effectively blocks both signals, so once the operator overrides the containment isolation signal, the SIAS is overriden. However, for the containment purge valve, we are in the process of implementing separate overrides so that once the containment isolation signal is overriden, the containment purge signal would still automatically close the purge valve.

MR. VAN BRUNT: Some other questions? Pete, go ahead.

MR. PENSEYRES: Figures 3-3 and 3-1. Let's take them one at a time. On Figure 3-1, the lower drawing indicates a drain and a test connection in the left-hand side. How would that inside isolation valve be tested if there is no lock valve to the left of the drain and test valve?

MR. BOLES: There are valves outside, but we just haven't shown them. I believe this is one typical for the demineralized water, and that has piping all throughout the containment building. There are valves out here (indicating). All of those would have to be closed.

MR. PENSEYRES: I assume the same is true then on Figure 3-3 at the top. That is the check valve.

MR. BOLES: I'll try to answer your question. There is a closed volume valve here (indicating), so that we would pressurize the volume detector at that particular valve. It

is just that we haven't shown it. We were just interested in showing isolation valves.

MR. VAN BRUNT: As a followup to that, is there some way for the record -- I think on a previous drawing, you could do it without much trouble by putting a valve and just saying "typical of many valves downstream" or something. Is there some way on this drawing that you could in the same manner maybe just put an arrow that it is a line which will be pressurized or something so that we don't have this same confusion for somebody looking at the slides.

MR. BOLES: It does depend somewhat upon the system. For example, for the containment spray system, you go to the other spray nozzles. If it is a safety injection line, then the penetration assembly is the same, but downstream it is different.

MR. VAN BRUNT: I understand, but in some typical manner you could show it so that the same question wouldn't come up again.

Any other questions? Ed.

MR. STERLING: Figure 3-7. On the personnel lock, you have a detail showing your sealing for the inside containment. On the outside, what do you do to assure that you have a seal and is there a monitor on that continually while that is sealed?

MR. KEITH: Ed, we are not sure of the detail on the

flange on the outside one. However, when using the personnel hatch, you have to periodically pressurize the complete hatch, which, of course, would test that outer seal.

MR. STERLING: Well, I think maybe we ought to have that slide doctored. You show your inside -- For example, if that was a pipe, you would have your valve inside and your valve outside. You detail what your inside seal is, but you haven't detailed what your outside is. Maybe we ought to have that slide updated to show what the outside seal is. Or is there only a single level of protection there?

MR. BOLES: There are two seals to provide a double level of protection.

MR. STERLING: But that is only inside the containment. Is there something outside the containment?

MR. KEITH: We'll check and confirm. I am pretty sure that the outer door of the personnel lock has a double "O" ring, but we'll check and confirm and doctor up the slide to show what is appropriate.

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

MR. ALLEN: Just for verification of something. All your schematic diagrams show motor-operated valves on isolation. Do you have any air-actuated valves?

MR. KEITH: John, we do have some.

MR. ALLEN: Do you use an accumulator then, because you don't have safety-related air.

MR. KEITH: They all fail closed.

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

MR. ROGERS: I want to go back to Figure 2-1, if we could. It seems to me that when you are in the recirculation mode following a loss of coolant accident, the water in that system becomes fairly highly radioactive or could become fairly highly radioactive. There are several paths to the outside from that system. For instance, if you take a look at the refueling water tank and the connection to the refueling water tank, you will see a check valve and a motor-operated valve. Also, if you take a look at the bypass line or miniflow line from the containment spray pumps, you see a motor-operated valve and solenoid-operated valve going to the refueling water tank. You haven't addressed those as containment isolation. Yet, they have apparently similar requirements. Do those valves indeed meet the same requirements as your containment isolation valves?

MR. KEITH: Yes, they are all Section III, Class 2 valves and receive power from the Class IE buses.

MR. ROGERS: And those are redundant power as necessary?

MR. KEITH: Yes.

MR. ROGERS: The recirculation actuation signal is omitted from Exhibit 3-8. I assume that that signal is generated in the same kind of manner and meets the other requirements as the safety injection actuation signal and

auxiliary feedwater actuation signal, and so forth, is that correct?

MR. KEITH: Yes. That is tied in with our engineered safety feature actuation system. There is no difference there. That wasn't included on that table because none of the containment isolation valves as such receive that signal.

MR. VAN BRUNT: Any other questions?

Seeing none, I think this is a gratuitous time to break for lunch, so we will take a break for lunch.

(Thereupon the meeting was at recess.)

May 21, 1981
1:00 p.m.

MR. VAN BRUNT: Bill, go ahead and ask your questions.

MR. SIMKO: We were talking about putting isolation valves on these drawings up there.

MR. KEITH: Figure 2 --

MR. SIMKO: 3-1 or 3-3. Figure 3-3. On the top there that looks like the containment spray system. What is the criterion for not having the isolation valve on the left-hand side of that drawing so that you can't test either the check valve or that motorized valve outside of containment? What is the criterion for systems that have to run continuously during post-accident conditions versus systems that may run -- I would really like to know what is the criterion for testing

these isolation valves on the containment if we cannot do a leak rate test.

MR. BOLES: I want to make sure I understand your question. You are concerned about a local leak rate test of this particular valve arrangement?

MR. SIMKO: Right.

MR. BOLES: This particular valve arrangement gets the Type A test with the integrated leak rate test along with some other penetrations like the main steam. Then we come along to those particular penetrations such as this one and do the Type C test, which is a local. That upper penetration does not get a local Type C test.

MR. SIMKO: I guess the real question then is what is the criterion for systems or valve alignments that do not need Type C tests, only need Type A tests?

MR. BOLES: Bill, the criterion is that systems which are required to operate to mitigate the effects of an accident, those penetration lines are open and in use during that period of time, they don't get the local Type C test. Those that are closed to maintain the containment pressure boundary do get the Type C test.

MR. HUONG: In the statement you made there, you just considered single active failure systems. Say you have redundant systems and one system fails to operate. Under post-LOCA conditions, that system may be isolated from the

containment, and at that particular time, you may have to test them because there is a certain amount of leakage.

MR. KEITH: I think what Bill was saying earlier is that all the systems do get tested when you do the Type A test, the integrated leak test for the whole containment.

MR. HUONG: I will accept that if I consider a single active failure. In a redundant system, one of the systems may fail that may provide a containment isolation function and that particular valve may be required to be the Type C test, say, for instance, a continuous free line and the check valve may be required to be tested Type C unless you can demonstrate that the system outside would provide a pressure outside always higher than the containment pressure in the loss of coolant accident condition. Then if you would provide a seal in the post-LOCA condition, then you may not have to test them.

MR. KEITH: Let's take the Containment Spray System. If the spray pump failed to operate, your single action failure, then what you are saying is that you are relying only on this check valve to prevent isolation. You do have a system back here (indicating) which is ASME Section III, Class 2, and Seismic Category I, and all that, so even were this check valve to fail, the probability of getting anything from containment outside containment through this path is very small.

MR. HUONG: Let's assume you have a passive pump seal leak. You are going to leak all the water out of the lines, so eventually you have a potential air path there.

MR. KEITH: Potentially, you would. Presumably that would take a long time. The operator would shut this valve (indicating) at some time.

MR. HUONG: Since you don't test that valve either, there is also a leakage potential there through that valve, so there is a potential for an air leak path through that.

MR. KEITH: There is a possibility. All I am saying is it is very remote, I think.

MR. HUONG: I don't know the possibility or probability. That's the whole problem. Unless you can demonstrate that the possibility is so small you don't have to consider it --

MR. KEITH: I don't know what --

MR. VAN BRUNT: I was struggling the same way, Dennis. I think probably what you want to do is, if you understand John's question, maybe we will leave it as an open item and go back and test it against your criteria and respond after you have a little more time to think about it.

Bill, did you get the answer to your question? Are you satisfied or not?

MR. SIMKO: Well, let me just ask one more question. Is it true that besides the Containment Spray System, the other systems that don't require local leak rate tests for

the valves are essentially closed loop systems? What I am wondering about is the discharge header for the spray is really open to containment atmosphere, so when we pressurize this thing, we are going to be pressurizing right through that line and if we happen to flunk the ILRT because these valves here are leaking badly, well, we didn't check them in the first place because they didn't require a local leak rate test, so now they flunk the integrated leak rate test and we are not in too good of a position there. I am just concerned that the end of this system is open to containment atmosphere where some of these other systems are really closed loop and once you close all the valves, it is really totally bottled up due to the piping. Here this is open directly to the containment pressure.

MR. KEITH: Your concern, Bill, is that we maybe won't pass the integrated leakage rate test because of this system?

MR. SIMKO: Yes.

MR. BOLES: All I can say is that this valve (indicating) would have to have a seal replaced as necessary until you did pass the ILRT. This connection down here (indicating) is to ensure that you have full differential test pressure versus atmospheric pressure across the valve during an ILRT. San Onofre had some problems. As I understand, during a hydro test, the valves leaked and they

had to re-lap them.

MR. SIMKO: All right. Well, go on. I won't belabor the point right now.

MR. TOSETTI: Also, the systems opening to the containment such as CSF systems, the system itself is tested for leakage, so it becomes an extention of the primary containment. That is really your boundary for your ILRT test.

MR. HUONG: I personally accept the hydro test on the check valve if you can demonstrate water leakage through the test valve is so small that you can always maintain water head above the check valve. That's all right, too. In other words, demonstrate you don't have a potential air leak path through there.

MR. VAN BRUNT: Dennis, I think you are going to take this as an item to think about.

Any other questions going back to where we were before lunch?

Seeing none, why don't you go ahead and finish up this part of the presentation.

MR. KEITH: We will proceed with Conformance With Regulatory Requirements.

MR. BOLES: Conformance With Regulatory Requirements under Standard Review Plan 6.2.4, Revision 1, showing the General Design Criteria, Regulatory Guides, and Branch

Technical Positions. We have added in here GDC-4 and I will talk about that when we get to it.

Exhibit 3-11. The Standard Review Plan Acceptance Criteria is Standard Review Plan 6.2.4.

General Design Criteria 55 and 56 require that lines that penetrate the primary containment boundary and are part of the reactor coolant pressure boundary or connect directly to the containment atmosphere should be provided with isolation valves as follows, A, B, C, and D, and we are in compliance. The automatic isolation valves outside containment cannot be a simple check valve.

Exhibit 3-12. GDC 57 requires that lines that penetrate the primary containment boundary and are neither part of the reactor coolant pressure boundary nor connected directly to the containment atmosphere be provided with at least one locked closed, remote manual, or automatic isolation valve. The main steam and feedwater systems are closed loop systems inside, and outside we provide main steam isolation valves and main feedwater isolation valves.

The General Design Criteria permit containment isolation provisions for lines penetrating the primary containment boundary that differ from the explicit requirements of GDC 55 and 56 if a different basis for acceptability is defined. Reg. Guide 1.11 describes the acceptable containment isolation provisions for instrument lines, and

we are in compliance with the requirements of Reg. Guide 1.11.

Exhibit 3-13. Containment isolation provisions for lines in engineered safety features or engineered safety features-related systems may include remote-manual valves, but provisions should be made to detect possible leakage from these lines outside containment. We are in compliance.

Containment isolation provisions for lines in systems needed for safe shutdown may include remote-manual valves, but provision should be made to detect leakage. We are in compliance.

Exhibit 3-14. Containment isolation provisions for lines in the systems identified in Items B and C in the previous exhibit may consist of one isolation valve inside and one outside. If it is not practical to locate a valve inside containment (for example, it may be under water), you may locate both valves outside. Palo Verde uses valves inside the containment in these particular cases.

Exhibit 3-15. E allows a single isolation valve if it can be shown that the reliability is better. This is not applicable. That type of isolation is not used at Palo Verde.

Sealed closed barriers may be used in place of automatic isolation valves. These sealed closed barriers may include blind flanges and sealed closed manual valves,

and we are in compliance.

Exhibit 3-16. Relief valves may be used as isolation valves provided the relief set point is at least 1.5 times the containment design pressure. The only relief valves which could be considered to fall in this category are the main steam relief valves, which do have a set point well above containment building design pressure.

Isolation valves outside containment should be located as close to the containment as practical. We are in compliance considering the access for maintenance and interferences.

The position of an isolation valve for normal and shutdown plant operating conditions and post-accident conditions depends on the fluid system function. If a fluid system does not have a post-accident function, the isolation valves in the lines should be closed automatically. For engineered safety feature systems, the valves may be open or closed. The position should be indicated and the valve operator should be the "safe" position. We are in compliance.

Exhibit 3-17. There should be diversity in the parameters sensed. We are in compliance.

System lines which provide an open path from the containment to the environs should be equipped with radiation monitors. We are in compliance.

Part 8) here goes on to Exhibit 3-18 and 3-19 and

it concerns the valve closure times following postulated accidents and for containment purging during normal operation. We are in compliance with Branch Technical Position CSB 6-4, Section B.1c and B.5a. PVNGS uses an on-line purge system with 8-inch lines and butterfly isolation valves. The system may be operated continuously. The accident analysis is covered in FSAR Sections 15.4.5 and 15.6.6.

Exhibit 3-18 is a continuation of the previous Exhibit 3-17.

Exhibit 3-19. The top of the exhibit is a continuation.

The next item, the use of a closed system inside containment is acceptable if the following parameters are met, and we meet those parameters for the main steam and feedwater systems.

Exhibit 3-20 at the top of the exhibit is a continuation of the parameters from the previous exhibit.

Insofar as the Containment Systems Branch is concerned with the structural design of containment internal structures and piping systems, the protection of isolation barriers against loss of function from missiles, pipe whip, and earthquakes will be acceptable if isolation barriers are located behind missile barriers, pipe whip was considered in the design of pipe restraints and location of piping penetration through the containment, and the isolation

barriers are designed to withstand the effects of a safe shutdown earthquake. Again, we are in compliance.

Exhibit 3-21. The criteria applied to components performing a containment isolation function, including the isolation barriers, are acceptable if Quality Group B standards are used and the components are designed to Seismic Category I. We are in compliance.

The design of the Containment Isolation System is acceptable if provisions are made to allow the operator in the main control room to know when to isolate fluid systems that are equipped with remote-manual isolation valves. Such provisions may include instruments to measure flow rate, sump water level, temperate, pressure, and radiation. We are in compliance.

Exhibit 3-22. Provisions should be made in the design of the Containment Isolation System for operability testing of the containment isolation valves and leakage rate testing of the isolation barriers. We are in compliance.

Exhibit 3-23, General Design Criteria 4, Environmental and Missile Design, was not specifically addressed in the Standard Review Plan. We have included it because the valve operators will be environmentally designed to appropriate environmental conditions either inside or outside of the containment.

Exhibit 3-24, General Design Criteria 54, Piping

Systems Penetrating Containment. We are in compliance.

Exhibit 3-25, General Design Criteria 55, Reactor Coolant Pressure Boundary Penetrating Containment. We are in compliance.

Exhibit 3-26 continues with GDC 55. We are in compliance.

Exhibit 3-27, General Design Criteria 56, Primary Containment Isolation. We are in compliance. The containment pressure instrument connections are considered part of the containment boundary. As I said earlier, they are designed to ASME Section III, Class 2. The latches, locks, and double-flanged connections are also considered part of the containment boundary.

Exhibit 3-28, General Design Criteria 56, continues. The isolation valves should be designed to take the position that provides greater safety, and we are in compliance.

Exhibit 3-29, General Design Criteria 57, Closed System Isolation Valves. We have already said the main steam and main feedwater lines fall within this General Design Criteria. Other systems which could fall into it we have designed to more stringent General Design Criteria 56.

Exhibit 3-30, Regulatory Guide 1.11, Instrument Lines Penetrating Primary Reactor Containment. The instruments which are part of the protection system should satisfy requirements for redundancy, independence, and testability.

They are in compliance.

They should be sized or orificed to assure that in the event of a piping or component failure the leakage is reduced to the maximum extent possible. The instrument lines we use are three-quarter inch. As I have said, they are considered extensions of the containment boundary.

They should be provided with an isolation valve outside containment capable of remote operation. They are in compliance. The isolation valve is remote and is manually operated from the control room. Open or closed position is indicated, and the valve fails as open, since this is a part of our essential safety system.

The lines should be designed at least to the containment quality and protected from environmental effects. We are in compliance.

Exhibit 3-31, Regulatory Guide 1.26, Quality Group Classification. We are in compliance.

Exhibit 3-32, Regulatory Guide 1.29, Seismic Design Classification. We are in compliance.

Exhibit 3-33, Regulatory Guide 1.141, Containment Isolation Provisions for Fluid Systems. This Regulatory Guide refers to an ANSI standard, ANSI N271-1978, with some comments by the Nuclear Regulatory Commission. This particular ANSI standard is a rather long one and we have reduced the amount of words for this presentation, so it has

been abridged rather severely. For those who may be familiar with it, it is not word for word. We are in basic compliance with all the requirements of the ANSI standard and we will go through and compare our design to the requirements.

Isolation function, we are in compliance.

Isolation valves must meet the requirements of 10CFR50, Appendix J. We are in compliance.

We use the more stringent GDC 56 for closed systems other than the main steam and feedwater systems.

Exhibit 3-34 is the design basis of GDC 55 and 56. We are in compliance.

For instrumentation lines, we are in compliance with Regulatory Guide 1.11.

Exhibit 3-35. Isolation provisions for remote manual valves. We are in compliance.

Relief valves in the backflow direction may be utilized. We are in compliance.

Exhibit 3-36 if a closed system outside containment is used for one of the isolation barriers. We are in compliance.

Exhibit 3-37, piping outside the containment between the containment and the outside isolation valve. We are in compliance with the requirements.

Exhibit 3-38, containment isolation provisions inside the containment shall be designed to withstand the

maximum containment temperature and, non-concurrently, the containment pressure. We are in compliance.

All power-operated isolation valves shall be capable of remote manual actuation from the main control room. We have indication valves and the valves are not reopened unless there is deliberate operator action.

Exhibit 3-39. As you can see, we are in compliance with the diversity of actuation, actuation features appropriate to the valve type shall be provided for required closure time, and the position of the valve for normal and shutdown plant operating condition depends on the fluid system requirements.

We are in compliance with establishing valve closure times to limit radioactive release, and a containment isolation signal closes the appropriate valves.

Exhibit 3-40. We are in compliance and we meet the more stringent requirements of GDC 56 as opposed to GDC 57.

Exhibit 3-41. As you can see, we are in compliance. Our isolation barriers are Safety Class 2. They are protected from missiles, pipe whip, protected against loss of function from flooding, from loss of function from earthquakes, loss of function from fire.

Exhibit 3-42. As you can see, we are in compliance. Physical separation has been considered, the valves inside

the containment are designed to function with appropriate combinations of conditions for normal operations and LOCA and local accidents. Our valves are designed for the most severe environmental conditions outside the containment, and they are designed to the radiation doses.

Exhibit 3-43. We are in compliance with the type of valves allowed and limiting the valve leakage as low as reasonably achievable. We are in compliance with ANSI Standard N278.1-1975.

Exhibit 3-44. We are in compliance. A system providing a sealing fluid or vacuum between isolation valves was not used at Palo Verde.

Exhibit 3-45. We meet the requirements of Section 5 of this standard for our piping. We are able to test the valves. 10CFR50, Appendix J, has been followed for testing, and provisions have been made for leakage rate testing of isolation valves.

Exhibit 3-46. Maintenance has been considered and procedures and maintenance schedules will be complied with and prepared and a maintenance program will be established which is consistent with the operating requirements of previous operating experience.

Exhibit 3-47. We have used materials that meet the requirements of ASME Code Section III, Division 1, Subsection NA.

Exhibit 3-48. We now begin the Branch Technical Positions CSB 6-4, Containment Purging During Normal Plant Operations. The on-line purge system at Palo Verde is independent of the purge system used for the reactor operational modes of cold shutdown and refueling.

The on-line purge system is designed in accordance with the following criteria: The performance and reliability are consistent with Branch Technical Position MEB-2. The design basis for the valves and actuators has included the buildup of containment pressure for the LOCA break spectrum. The number of purge lines that is used is one purge line.

Exhibit 3-49. We are in compliance. The purge line is eight inches.

The isolation provisions meet the standards appropriate to the engineered safety features.

We are in compliance with the diverse parameters required to operate these isolation valves.

Exhibit 3-50. Purge system isolation valve closure times, including instrumentation delays, should not exceed five seconds. We are in partial compliance with that requirement. The valve closure time is five seconds or less. The instrumentation delay is one second or less. Calculations in the SAR show that the offsite exposure is within guidelines for six-second closure time on any containment isolation signal.

We are in compliance and provisions are made to ensure that isolation valve closure will not be obstructed by debris.

The purge system should not be relied upon for temperature and humidity control within the containment, and we have provided atmospheric clean-up systems within the containment.

Exhibit 3-51. Provisions should be made for testing the availability of the isolation function and the leakage rate of the isolation valves individually during reactor operation. We are in compliance. A leakage test connection is provided between the isolation valves outside the containment.

The following analyses should be performed to justify the containment purge system design: An analysis of the radiological consequences of a LOCA. We are in compliance. The analyses are discussed in FSAR Sections 15.4.5 and 15.6.6.

An analysis which demonstrates the acceptability of the provisions made to protect structures and safety-related equipment located beyond the purge system isolation valves against loss of function. We are in compliance. The equipment outside the containment beyond the isolation valves are nonsafety related. A postulated accident during purge operation will not result in a release exceeding 10CFR100

guidelines.

Exhibit 3-52. Provide an analysis for the reduction in the containment pressure resulting from the partial loss of containment atmosphere during the accident. We have already discussed in the previous section calculations for the safety pumps net positive suction head assume the containment atmosphere is entirely steam, and no credit was taken for air pressure in the containment.

The allowable leak rates of the purge and vent isolation valves should be specified for the spectrum of design basis pressures and flows against which the valves must close. We are in compliance. The purge isolation valve leak rates are specified to meet AWWA C-504.

Exhibit 3-53, the requirements of NUREG-0737, Item II.E.4.2. The containment isolation system designs shall comply with the recommendations of Standard Review Plan Section 6.2.4 for diversity of parameters. We are in compliance. A containment isolation signal is diversely generated by either a high containment pressure signal or a low pressurizer pressure signal. In addition, the purge valves are closed on high containment purge radioactivity.

Exhibit 3-54. All plant personnel shall give careful consideration to the definition of essential and nonessential systems, identify each system determined to be essential, identify each system determined to be

nonessential, establish the basis for selection of each essential system, modify their containment isolation designs accordingly, and report the results of the reevaluation to the NRC. The response continues on to the next Exhibit 3-55. We are in compliance. A generic review of fluid systems penetrating the containment for CE-designed plants was conducted for the CE Owners Group on Post-TMI Efforts.

Essential systems are those systems critical to ensure the capability to mitigate consequences of accidents, to ensure the integrity of the reactor coolant pressure boundary and to ensure the capability to shut down the reactor and maintain it in a safe shutdown condition. Table 3-1 lists essential systems penetrating the containment. No essential systems are functionally isolated by a containment isolation actuation signal with the exception of the hydrogen control system. This system is not immediately required for accident mitigation. The isolation valves can be manually opened from the control room as part of the hydrogen recombiner startup procedures.

Exhibit 3-55 shows Table 3-1, the essential systems penetrating the containment. Systems are the High Pressure Safety Injection, Low Pressure Safety Injection, Containment Spray, Recirculation Sump Suction, Long Term Recirculation, Auxiliary Feedwater, Hydrogen Control, and the Containment Pressure Sensor. We show the normal position

of the isolation valve, the post containment isolation actuation signal position, and various notes: opens on certain signals, manually opened, function requires it to stay open, or isolates on CIAS.

Exhibit 3-56. All nonessential systems shall be automatically isolated by the containment isolation signal. We are in compliance. Nonessential systems are listed in Table 3-2. Nonessential systems are automatically isolated by a CIAS with the exception of the following systems: Those which contain locked closed valves or flanged closed connections, main steam and feedwater, steam generator blowdown and blowdown sample and safety injection train, reactor coolant pump seal injection and CVCS charging. We have discussed the reasons why those particular systems are not isolated on a CIAS.

Exhibit 3-57 shows Table 3-2, the nonessential systems, as you can see, such as Demineralized Water, Pool Cooling, Equipment Air, Equipment Hatch, Pressurizer Samples, Service Gas, Instrument Air, Nuclear Cooling Water. The normal position of the penetration valve is shown, the post-CIAS position, and on the next exhibit, 3-58, the remaining systems, their position and applicable notes to the table.

Exhibit 3-59 is a continuation of the words from 3-57, which we have already discussed previously on why

these systems are not isolated.

Exhibit 3-60 continues from Exhibit 3-59.

Exhibit 3-61. The design of control systems for automatic containment isolation valves shall be such that resetting the isolation signal will not result in automatic reopening. Reopening of containment isolation valves shall require deliberate operator action. We are in compliance with it, as we have previously discussed on the override of the CIAS signal and then operator action to reopen the valves.

The containment set point pressure that initiates containment isolation for nonessential penetrations must be reduced to the minimum compatible with normal operating conditions. We are in compliance. As previously indicated, the CIAS set point is 5 psig. Calculations are in progress to confirm that the trip set point represents the minimum value, and preliminary figures indicate that we cannot reduce the 5 psig value any lower.

Exhibit 3-62. Containment purge valves that do not satisfy the operability criteria set forth in Branch Technical Position CSB 6-4 must be sealed closed. We are in compliance. Containment power access purge isolation valves satisfy the criteria set forth in the Branch Technical Position.

Containment purge and vent isolation valves must close on a high radiation signal. We are in compliance.

That I believe concludes this part of the presentation.

MR. VAN BRUNT: Any questions? Ed, I will start with you again.

MR. STERLING: On Exhibit 3-38, in that section, you say you are in compliance with Part D when the valves shall not be opened until the signal is removed. When you reset your signal, is it such that the control surface will not cause the valves to change state?

MR. KEITH: Yes.

MR. STERLING: On Exhibit 3-57, the table with the nonessential systems penetrating the containment, the Instrument Air System, the sixth from the bottom, closes on containment isolation. Is there any instrumentation items that were vented by that system in the containment that could feed back to the operator a false signal or anything of that sort because you have lost air to that instrumentation? I know that is a nonessential system, but is there maybe some feedback that would lead the operator to wrong conclusions?

MR. KEITH: I think, as you pointed out, it is a nonessential system, not a safety-grade system. We do not have any instrument feed, we have some valves that are fed off the instrument air, so instrumentwise there would be no false indication.

MR. STERLING: And the cutoff of the instrument air to these valves will not cause any type of problem of misoperation?

MR. KEITH: That's correct.

MR. STERLING: That's all I have.

MR. VAN BRUNT: Any other questions?

MR. HEPNER: On Exhibit 3-57 when you labeled the Shutdown Cooling as nonessential, it seems to me that the shutdown cooling is part of the overall plan for small break LOCA mitigation, so even though where you place it doesn't affect the CIAS characterization, it seems like it should be on the other list.

MR. KEITH: As far as I know, at Three Mile Island, they never used the shutdown cooling system. Of course, in the classic LOCA, you don't use it. I have no problem either way, Phil. If you would like to take it off --

MR. HEPNER: It is not part of the Three Mile Island scenario, which wasn't the small break LOCA scenario, but in a typical small break LOCA scenario as described in CESSAR, you indeed use the shutdown cooling system. Otherwise all the facts are correct that says the normal positions are closed and after signal do indeed stay closed.

MR. KEITH: I think in view of that, then we should remove it from this list.

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

MR. HELD: Yes. Referring to Exhibit 3-55, there are a number of notes indicating that signals other than the containment isolation actuation signal affect the listed valves. Do all those signals listed in the notes preempt the CIAS?

MR. KEITH: We are just verifying the valves that do not receive the CIAS.

MR. HELD: So the only one on that table that does receive the CIAS is hydrogen control, is that correct?

MR. KEITH: That's correct.

MR. HELD: All right. That's all.

MR. VAN BRUNT: Some other questions? Marty.

MR. RAINES: On Exhibit 3-59, down in the middle of the paragraph under Design Feature, it states, "In addition, the charging pumps can be transferred to emergency power at the discretion of the operator in the event that offsite power is lost." Unless I miss the boat, any time you lose offsite power, the transfer is made automatically, but with the two-out-four logic sequence from the voltage relays, the operator doesn't have a choice.

MR. KEITH: You are correct. It is a little misleading the way it is worded.

MR. RAINES: I think the statement also appears on Exhibit 3-9, also.

MR. KEITH: You're right.

MR. VAN BRUNT: Dennis, could we ask you to maybe fix the slide up a little bit to reflect that?

MR. KEITH: We will do that, and 3-9.

MR. VAN BRUNT: Any other questions? John.

MR. HUONG: Exhibit 3-12.. I would like to make a comment on the use of the Regulatory Guide 1.11. I think that Reg. Guide 1.11 should not be applied to those lines that directly open to containment air. I don't know if you understand that position or you don't.

MR. KEITH: Would you go through that again?

MR. HUONG: I think Reg. Guide 1.11 should not be applied to those penetrations of instrument lines that directly open to containment air. I just want to clarify this. This has been our position. We found a couple of other applicants adopted this Reg. Guide 1.11 for the penetration of instrument lines which are open to containment air.

MR. KEITH: What criteria apply to those lines?

MR. HUONG: Reg. Guide 1.11 in our position only applies to those instrument lines that connect to primary stations.

MR. KEITH: As far as the instrument lines that are open to the containment air, what --

MR. HUONG: Then you probably should apply GDC 56. I don't know whether you have those penetrations or not. I

just wanted to make a point.

MR. KEITH: This is our containment pressure monitor and, obviously, we don't meet GDC 56.

MR. HUONG: I think we should leave that as an open item, because we don't think Reg. Guide 1.11 should apply to those instrument lines.

MR. KEITH: So it is your position that GDC 56 --

MR. HUANG: It should be GDC 56.

MR. KEITH: This is a special case, because these instruments are required following the accident, so you really don't want to isolate by putting a valve in.

MR. HUONG: No. You can reopen it. Right? You want to isolate them, and after that, if you want to reopen them, you can reopen them.

MR. KEITH: I am sure your people that want us to follow the course of the accident would have a fit.

MR. HELD: Excuse me, I think the problem here is that Reg. Guide 1.11 may be open to some misinterpretation and I think it would be best at this point if we left it as an open issue and had further discussion perhaps over the phone to clear it up later.

MR. KEITH: Okay, I think we will have to.

MR. VAN BRUNT: We will leave this as an open item, Dennis, and then you can follow up with some discussions with these fellows, and then when you respond to the open

items, you can reflect whatever the results of those discussions were.

MR. KEITH: Fine.

MR. VAN BRUNT: Are there any other questions? John, you had a question.

MR. ALLEN: Clarify something for me. By looking at some of the tables and then some of the tests, are the letdown and charging lines isolated on CIAS or not?

MR. KEITH: Where do you see these?

MR. ALLEN: On 3-59, it says to leave charging paths open and I thought on one of the tables I saw where you closed it. How about the letdown?

MR. KEITH: The letdown is on the previous one. That closes. The letdown closes. The charging we leave open.

MR. VAN BRUNT: Any others? Pete.

MR. PENSEYRES: On Table 6.2.4-1 of the FSAR, several penetrations normally contain cold water between the isolation valves or the blind flanges; for example, Penetration 53, the fuel transfer tube, and Penetrations 61 and 62, which are chilled water. These lines from the inside isolation valve or flange to the containment penetration will be exposed to elevated post-accident temperatures with a fixed volume of cold water trapped between the isolation valves. Will the increased pressure inside these lines as a

result of heating cause rupture of the piping?

MR. KEITH: We will hold that as an open item.

MR. VAN BRUNT: Any other questions, Pete?

MR. PENSEYRES: Yes. Also, in Table 6.2.4.1 of the FSAR, there is a statement that one of the steam penetrations will be Type C tested. It is a one-inch line and there is no other identification that I can see on there. Which penetration is that and why is that singled out? It is on Table 6.2.4.3 of the FSAR.

MR. KEITH: We will hold that as open for now. We will try and check the P&ID and answer the question before we leave.

MR. VAN BRUNT: Is that all you had, Pete?

MR. PENSEYRES: Yes.

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

MR. TOSETTI: On Figure 3-4, you show some traps coming over the main steam lines and I wonder how those satisfy GDC 57 in terms of automatic valves.

MR. KEITH: As you know, the presentation today, although we have been getting into leak testing, was not really covering leak testing. Rich is talking about these lines here (indicating), which are one-inch lines going to the steam traps. The position we have been taking on the secondary side of the steam generator -- let me just read from 6.2.6 in the FSAR. 6.2.6 is Containment Boundary

Leak Rate Testing. "Isolation valves connected to the secondary side of the steam generator such as main steam isolation valves, main steam relief valves, feedwater valves, blowdown lines, and blowdown sample lines are not considered containment isolation valves and are not subject to Type C tests. If there is leakage from the primary to secondary side, the steam generator may be flooded in the event of a LOCA to effectively seal any tube leakage. If required, filling the steam generators will be performed from the auxiliary feedwater system, which meets the single failure criteria." Basically, the position we have been taking is that the leaks in the secondary side of the steam generator and the piping connected to it, which is all ASME Section III, Class 2, is part of the containment boundary, so those valves outside the boundary are not really part of containment isolation. That is our position on that.

MR. TOSETTI: So there is no provision to test these?

MR. KEITH: As you can see, there are manual valves that are normally open and we do have a steam trap beyond, which is designed, of course, just to pass water and seals on steam. But that is the position on that.

MR. TOSETTI: I guess I am a little unclear, because I know other plants have taken that outside valve as an isolation valve on the main steam line. The main steam valve has been treated on some plants as an isolation valve.

MR. KEITH: I would be surprised if they could pass the leakage rate test on them. I know those are big valves and they have to shut in five seconds and I think the practicality of the thing is that it is difficult to get them to pass the Type C test.

MR. TOSETTI: It's not easy. It's like a BWR on a main steam isolation valve.

MR. KEITH: Of course, with the BWR, they are directly connected to the reactor coolant, of course, so there is a much different ballgame with a BWR.

MR. VAN BRUNT: Are there any other questions? I have one. I want to go to Exhibit 3-33, just a clarification under Item 3) there. It says, "In compliance. PVNGS uses the more stringent GDC 56 for closed systems other than the main steam and feedwater systems." Does that mean that the main steam and feedwater systems just meet GDC 56, or exactly what does it mean?

MR. KEITH: Well, in general, what it means is the main steam and feedwater systems meet GDC 57 except that the figure we just put up shows you how in some cases on the main steam and feedwater systems we don't even meet GDC 57. That's why I am saying that our position really is that the secondary side of the steam generator and all the piping inside containment is really part of the containment boundary

MR. VAN BRUNT: It isn't clear to me from this

statement here as to what criteria the main steam and feedwater systems do meet. This really doesn't tell you. You say you are in compliance with this other than for those. Where do you cover those, those being the main steam and feedwater systems.

MR. KEITH: What we have discovered, Ed, is basically that there has been an inconsistency in the FSAR basically in Chapter 6.2.4. We have been saying that the main steam and feedwater systems meet GDC 57 closed system inside containment, and there is amplification in the SRP about what the closed system has to meet. It has to be Section III, Class 2, it has to be protected from pipe whip, and all that, inside containment. Our main steam and feedwater systems do meet all those criteria. However, outside containment, as we just saw in the slide we just put up, there are some valves there which don't meet the criteria of GDC 57. In Chapter 6.2.6 of the FSAR, we have been taking a different position, not that we meet GDC 57, but that the secondary side of the steam generator is part of the containment boundary basically, and that is what the design currently meets.

MR. VAN BRUNT: I guess I understand. The problem I have is I think this statement is a little misleading, or maybe not misleading, but it is a little bit open-ended, I guess, relative to the main steam and feedwater systems. I

am looking for a mechanic's item to fix it, I guess, more than anything else.

MR. KEITH: Let me 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: Dennis, you are going to have a conversation with the NRC representatives relative to another question. I understand you have a question in your mind about this that you want to discuss with them. Why don't you leave this open pending that discussion and then, if necessary, fix this and any other slides that may be affected by the outcome of your conversations, and then you can document that into the letter that you send on the open items.

MR. KEITH: That's fine.

MR. VAN BRUNT: Any other questions?

MR. SIMKO: I have a couple. On Exhibit 3-50, Item G, I was wondering how you are complying with Item G on that exhibit.

MR. KEITH: Inside containment, the eight-inch purge line ties in with our 42-inch purge line, which is the refueling purge, but that line ties into the 42, and then, at each outlet or inlet on the 42, there is a grille, but even if something were to get through the grille, it would have to follow a rather tortuous path to get to the valve seat and reside there.

MR. SIMKO: I've got one other point here. I won't belabor it, but it is really driving at the NRC position on integrated leak rate testing and documentation. I think in Section 6.2.6 in the FSAR, I have worked with Bill on this, our FSAR states that we are going to use an ANS 45.2-1972 document for integrated leak rate testing. That was spelled out in 10CFR50. That is an old document and 10CFR50, Appendix J, hasn't been updated for quite a while. People are now using the Workshop ANSI ANS N274 workshop document and we have in our FSAR that we will use that as a Revision 3, November '78. The final workshop document just came out. That is an ANS 56.8 document. Supposedly the NRC does accept these documents as a workable method for the integrated leak rate test, which essentially states absolute methods for doing a mass plot analysis, but this 10CFR50 document doesn't say anything about this. Where do we really stand on using this new document and shall we go ahead and revise the FSAR to include this 56.8 document?

MR. VAN BRUNT: Bill, if I understand that correctly, you are addressing that to the NRC representatives.

MR. SIMKO: Yes, indirectly.

MR. VAN BRUNT: John, either John, if you don't want to answer that now, that's fine. One way for us to do is write them a letter and ask them. I don't know if you are in a position to answer that right now or not. Maybe we can

ask you unofficially.

MR. HUONG: Personally, I can, but not officially.

MR. VAN BRUNT: Possibly in the interim between now and the time you have this other phone conversation with the fellows, you could check into this and give us some feedback at that time and then we can incorporate that into one of our responses. I think that would be acceptable.

MR. SIMKO: Also, this TOP-1 report that talks about total time analyses, that is back in 1972, also, that was accepted. We put that in the FSAR, also, that we may go ahead and use that method as an alternate to these other methods. That seems to be the only document that allows you to do a less than 24-hour test, so along with this conversation, if we go ahead and we do test ourselves and use the 56.8 document, which is a brand new document, can we go ahead and do a less than 24-hour test? If everything looks fine after, say, 12 hours and we extrapolate the data out 24 hours, can we stop at 12 hours and will the NRC write that off? It seems to be going around in a big circle all the time.

MR. VAN BRUNT: Could we ask you fellows if you could look into that and get some feedback.

Do you have any other questions, Bill? Anybody else?

Dennis, do you want to go to the NRC questions and

see if we can dispose of some of those?

MR. KEITH: Yes. Question 6.2.4-1. Spare penetrations will be sealed by welded caps. These caps are considered part of the containment liner plate. Penetrations 62B and 62C are isolated by a flange with double "O" ring seals as shown in Amendment 2 to Figure 6.2.4-1, Assembly 27.

MR. HELD: On the same question, will the welded caps provided on the spare penetrations be such that a double barrier will exist?

MR. KEITH: They would be equivalent to the containment liner plate.

MR. HELD: Fine.

MR. KEITH: Question 6.2.4-2 will be responded to later.

MR. HELD: On 6.2.4-2, I need to make a clarification. I know copies of this were passed around the room. I wish you would all correct your copy. On the seventh line of that question, the last two words are "screwed or." Those two words should be deleted. You have a different typed version than I have, but the words "screwed or" in the last sentence should be deleted. That is our mistake.

MR. KEITH: Question 6.2.4-3. We have examined all the containment isolation valves listed in Table 6.2.4-1, and it almost every case, looking at the requirements for accessibility and inspection on these valves, those

requirements dictate that we can't move the valves any closer. However, the valves which are on the table which we were just discussing, these are the valves tying into the steam traps -- in fact, that is how we discovered our problem that we were just discussing -- those valves could be moved closer, so that will be a part of the discussion we have with you. If they become designated as containment isolation valves, then those could be closer, but none of the other valves that we have looked at, and, as I have said, we looked at all of them, none of the other valves could reasonably be moved closer.

Question 6.2.4-4. These valves are the shutdown cooling valves, which are normally closed. The only time they would have to close on a CIAS is if we were in the shutdown cooling mode, between 350 degrees and 200 degrees cooling down to a cold shutdown, and you had a LOCA at that point in time. That is even more improbable than a LOCA up at pressure. In addition, the mass energy release rate is much, much lower, and we feel that the 80-second closing time would be sufficient and not of any concern.

MR. HELD: All right.

MR. KEITH: Question 6.2.4-5. These valve closure times -- I think this may be an old question.

MR. HELD: It is.

MR. KEITH: They've got in an amendment.

MR. HELD: That question can be deleted.

MR. KEITH: Question 6.2.4-6. We believe this information is included in Table 6.2.4-1 in Figure 6.2.4-1.

MR. HELD: I believe you're right.

MR. KEITH: Question 6.2.4-7. The question refers to a vent line inside containment. If this valve were open, of course, we would have leakage from the reactor coolant system. We dont' feel that there is a need to lock it shut.

MR. HELD: Is there a direct communication from that valve back to Penetration 41?

MR. KEITH: Yes.

MR. HELD: I would say that we need some further resolution on this, then. Can we leave that as an open item?

MR. VAN BRUNT: Yes, we will mark that as an open item.

MR. KEITH: Question 6.2.4-8. In the penetrations you are referring to, the valves are related to the hydrogen analyzer. It appears that we should either lock those valves shut or provide a CIAS to them, so we will leave that open and get back to you.

MR. STERLING: Those valves, are not those wrong, the H_2 control on that one table that you had up there?

MR. KEITH: Well, they are tied off that same penetration, but the valves that I was referring to are the

valves that go directly to the recombiner, but branching off those lines on the containment side. Branching off from the containment side of those isolation valves are these lines going to the hydrogen analyzers, so that is the concern that has been raised here.

Question 6.2.4-9. Let's see if I can just go down the list. On the main steam valves, the first, fourth, fifth, sixth, seventh, and tenth valves are all related to the steam traps, so that is the one we have already discussed and is left as an open item. I understand the third and the --

MR. BOLES: It is Valve SG-V603, which is the third one, and 611 which are at issue, which we are going to try and resolve here.

MR. KEITH: It has already been raised in the question, so we are looking at the P&ID to try to answer that one before we leave today.

MR. BOLES: I believe that was Bill Simko's Type C test on those valves.

MR. KEITH: The remaining main steam valves are atmospheric dump valves, which are normally closed and are only used in the event we are cooling the plant down and are under close manual control by the operators. We don't feel any other controls are needed on those.

MR. HELD: Does this close manual control under the

operators meet the definition of administrative controls that is contained in the SRP?

MR. KEITH: Yes. When I say close manual controls, the only time they would be open the operator would be directly controlling that valve and auxiliary feedwater valves, so his full attention would be on those vavles.

MR. HELD: Does that mean that they will stay locked closed during normal operation?

MR. KEITH: There is no locking mechanism as such for those valves. There are some solenoids. In order to open the valves, there are two separate manual actions which an operator has to do in order to open the valves. They are air-operated valves and do fail closed on loss of air as well as on loss of power to the solenoids, but they are not tied into the containment isolation actuation system.

MR. HELD: We will have to think about that one.

MR. KEITH: The fire protection valve, FP-V089, that should be locked closed, and we will check the P&ID on that.

Penetration 9 is a radwaste penetration. That valve does close on CIAS. It is shown in FSAR Figure 9.3-4.

The remaining valves, all associated with containment purge, all close on CIAS or CPIAS. Those are shown on Figure 9.4-13.

MR. HELD: For that valve FP-V089, I understand that it closes on CIAS, but what I am looking for here is failing

closed rather than failing as is.

MR. KEITH: Okay, that's your question. That valve is a manual valve is our understanding.

MR. HELD: Pardon me?

MR. KEITH: Our understanding is that that valve is a manual valve.

MR. HELD: I referred to the wrong valve. Excuse me. I was talking Valve RD-UV023.

MR. KEITH: That does fail as is. It is a motor-operated valve. They normally fail as is.

MR. HELD: Well, I still think it should fail closed, so maybe we should leave this as an open item for further discussion. If that means changing the type of operator, that's something we will have to discuss.

MR. KEITH: I gather, John, that your problem with containment purge valves is that they are all motor operators.

MR. HELD: Yes.

MR. KEITH: Keep in mind that the inside containment valves and the outside containment valves are supplied from different electrical power supplies, so we do take care of a single failure in that way.

MR. HELD: That is another thing we are going to have to leave open for now, I think.

MR. KEITH: Question 6.2.4-10. Where we have a valve, we can lock it closed. In some of the areas, we just have a

plug connection for this test connection, so there is really no practical way to lock it as such.

MR. HELD: Well, taking the equipment hatch as an example, the figure in the FSAR which describes that shows a big flange type connection just on one side of the containment, so it appears that your double barrier consists of the two "O" rings in your double "O" ring seal.

MR. KEITH: That's correct.

MR. HELD: My concern is that that test connection may be inadvertently left open defeating one of your two barriers.

MR. KEITH: We will take that as an open item and address all those kinds of connections.

MR. VAN BRUNT: Are there any other comments on this section of the presentation?

It is just 2:30. Why don't we just take about a five-minute break at this point and then we can finish up the hydrogen and we'll be off.

MR. KEITH: Fine.

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

MR. KEITH: Now we will go into the Combustible Gas Control. As all of you know, NRC and industry have been considering the degraded core and large amounts of hydrogen released. This is being studied by the NRC and industry. We will not cover that in the presentation today. In the

looks that have been done at large PWR containments, which is what we have at Palo Verde, it appears that excessive amounts of hydrogen are not a problem, but, in any event, we will not be discussing that today.

MR. VAN BRUNT: Dennis, what will be the limits of your discussion with regard to generation generally speaking?

MR. KEITH: What the current regulations are in the Standard Review Plan and Regulatory Guides and all.

With that, Nick Baldasari will present Combustible Gas Control.

MR. BALDASARI: Figure 1 is the simplified P&ID for the containment hydrogen control system. The containment penetrations are motor operated, double isolation valves. All of this system is Q Class safety grade. The containment atmosphere is sampled through this line here (indicating) going to the containment hydrogen recombiner system. These (indicating) are two movable units that are installed for the three units. The line returns back to the containment, through the containment, through the other motor-operated valve and check valve. The containment post-accident hydrogen analyzer taps off at this point. Samples here go through the analyzer and come back. There is a nonsafety grade hydrogen purge unit that is installed. It is a nonsafety grade backup. The code break between safety and nonsafety occurs down here (indicating), thus these isolation valves

here (indicating). It purges through. The filter unit is over here (indicating) and extends to the plant vent. The cooling for the heat exchanger for the recombiner takes air from the interior of the auxiliary building, goes through, and then discharges back out into the corridor in the auxiliary building.

Exhibit 4-1, Combustible Gas Control in Containment Design Criteria.

1) The containment hydrogen recombiner system should be designed with two external mobile recombiners for the three units, and shall be capable of being connected to the required services within 72 hours and initiated within 100 hours following a loss of cooling accident.

2) The post-accident hydrogen purge system shall be designed as a backup to the hydrogen recombiner systems. The system shall consist of a mobile filter unit connected to any of the units as needed.

3) The containment hydrogen control system shall be designed to be manually initiated prior to the hydrogen concentration reaching 3.5% by volume for the hydrogen recombiners and at 4.0% by volume for the post-accident hydrogen purge system. This is to prevent the concentration of hydrogen from exceeding the lower flammable limit of 4.0% by volume.

4) The maximum containment temperature and

pressure for the components at the system shall be as shown.

5) Provision shall be made for continuation of air flow through the filter unit to remove heat generated by radioactivity following use post-LOCA.

Exhibit 4-2, continuing Design Criteria.

6) Each recombiner and the filter unit shall continue to function after exposure to 1 x 10^6 rads.

7) Hydrogen concentration in the containment and recombiner performance shall be monitored periodically using hydrogen analyzers.

8) The Seismic Category I recombiner system shall be designed such that components remain functional after a safe shutdown earthquake with the recombiner shut down. Components of the recombiner system shall remain functional during and after an operating basis earthquake with the recombiner operating.

9) Both hydrogen recombiners and the hydrogen analyzers shall be provided with Class IE power.

10) Special electrical receptacles fed from the Class IE power system shall be provided at the operating locations of the external mobile recombiners. Power leads on the recombiners shall be provided with mating plugs that will fit no other equipment within the unit.

Exhibit 4-3, System Description. The recombiner system consists of two mobile, safety grade, thermal hydrogen

recombiners capable of processing 50 standard cubic feet per minute of containment atmosphere gas containing up to 5% hydrogen. All equipment is located external to the containment except for the piping, two motor-operated containment isolation valves, and two check vavles. These (indicating) are the six motor-operated valves and two check valves on the discharge back into the containment.

Exhibit 4-4, System Operation. The post-accident hydrogen analyzers are placed in operation.

The hydrogen recombiners, including the control cabinets, are connected to the containment penetrations and started at or below 3.5 volume percent hydrogen concentration.

The inlet gas temperature is raised by the recombiner heaters until the hydrogen-oxygen reaction starts at approximately 1300 degrees Fahrenheit.

The recombiner blower creates a differential pressure to return the recombiner exhaust gas to the containment.

In the event that both recombiners are inoperable, the purge system may be used to exhaust the containment atmosphere through filters to the outside environment at a rate of 50 standard cubic feet per minute.

Exhibit 4-5. The calculations for the containment hydrogen build-up used the following assumptions:

Containment temperature maximum is 300 degrees Fahrenheit.

Containment net free volume is 2.6 x 10^6 cubic feet

Zirconium-water reaction fraction is 5%. This is based on 5 times the 1% required by 10CFR50.

The operating power level was assumed at 3,817 megawatts.

234 pounds of aluminum were assumed within the containment.

58,498 pounds of zirconium were used within the core, 26,335 pounds of zinc galvanized steel spread over a 278,940 square feet area, 7,200 pounds of zinc as zinc-based paint over 181,000 square fett.

I have a correction. The slide didn't show it very well. 284 pounds instead of 234.

Figure 4-2. This is a summary of the results of the calculation. This curve here (indicating) shows the accumulated hydrogen buildup following the accident. It reaches 3.5% by volume at nine days after the accident. With one recombiner operating, the peak is reached at about 16 days at 3.8%. It stays at that level until about 22 days and then starts dropping off. With two recombiners, the hydrogen drop-off is faster.

The individual contributions are shown on these other curves: For zirconium-water, this one right here

(indicating); for zinc, this one right here (indicating); the radiolysis is this one (indicating); and for aluminum is this one right here (indicating). This is a revised figure from the one that is in Section 6.2.5. The FSAR will be revised or amended to include this figure.

MR. KEITH: That concludes this portion of the presentation. Are there any questions?

MR. VAN BRUNT: Rich.

MR. TOSETTI: I have a question on Exhibit 4-1. Item No. 4) on the pressures indicates the hydrogen analyzer pressure and recombiner, et cetera. Are those designed pressures or expected operating pressures?

MR. KEITH: Design pressures.

MR. TOSETTI: In the procedures following LOCA and the hydrogen buildup, the purge acts as a backup to the recombiner system. Would the purge be expected to come on at the same time as the recombiner system and, if so, why are they different pressures?

MR. BALDASARI: May I have Figure 4-2? The reason for the difference is the purge unit is designed to be put into operation at 4.0 volume percent versus 3.5 volume percent. There is an additional buildup you would get at this point before you would be required to put the purge unit on in about 14 days.

MR. TOSETTI: On Exhibit 4-2, you talk about in Item

No. 6) the radiation level of 10^6 rads. Does that include the activity buildup on the filter if the purge unit is used?

MR. BALDASARI: This would include that value. The primary reason for the 10^6 rads was airborne dose primarily.

MR. TOSETTI: On the purge system, it is an open line from the containment, and if you purge, then the lines would be open. What is the driving force for that purge if the containment is at atmospheric pressure?

MR. BALDASARI: May I have the simplified P&ID? If that condition were in effect and it were lower than, let's say, its atmospheric driving force would be, we could supply service air through this connection here (indicating) and into the containment through the return line and purge it out this way (indicating). We could supply air at 50 standard cubic feet per minute.

MR. TOSETTI: Would that produce enough pressure in the containment to drive 50 cfm through the filter?

MR. KEITH: It would at some point in time.

MR. TOSETTI: I guess my concern, and it may be okay, but it is not intuitively obvious that if there is such a large surge volume there that it would produce it at the same time that you needed the flow. There is time delay between the initiation of the air and the flow through the filter system.

MR. KEITH: You are correct. Of course, there would be a time delay. We have not calculated that time delay.

Let me just for the record state that the purge system would only be used if both recombiners failed, and that is strictly a last resort, because, of course, you are discharging radioactivity to the atmosphere. So it is strictly a last resort system.

MR. VAN BRUNT: Are you satisfied?

MR. TOSETTI: I think you may want to look at it just to see if there is a significant time delay or if it is something reasonable that could be accommodated.

MR. KEITH: We will hold that as an open item.

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

MR. HEPNER: On the air supplied to these recombiner units, if you lose the air supply, can that induce any failure inside your box here?

MR. BALDASARI: The only air supply that goes to this skid, it is actually mounted on skids, is a fan unit and this takes air from the auxiliary building just from the surrounding atmosphere, runs it across the heat exchanger, and then discharges it back out.

MR. HEPNER: Well, what I am wondering is if it stops while the unit is operating, is that going to induce any failure within the device that could breech the boundary. You've got a single line coming in.

MR. BALDASARI: What would happen is that the recombiner will shut down based on high temperature from the heat exchanger. That will cure that one. The other one would still be able to be operational.

MR. HEPNER: And it is fail-safe in the situation where you have loss of air?

MR. BALDASARI: Yes.

MR. KEITH: Excuse me, I think there may be a misunderstanding, Phil. There is no service air supply to the recombiners. The air we are talking about is just ventilation air. There is a Class Q blower that is part of it.

MR. HEPNER: It is circulated within the unit itself?

MR. KEITH: Yes.

MR. HEPNER: But it must cross some heat exchanger surface that should maintain its integrity if it's gotten hot and then you lose air, and you are saying you shut down immediately so that temperature isn't a problem with this boundary. The other thing is that you've got a single line. Do you take any special precautions to maintain the integrity of that common line under seismic or extraneous blockage conditions that could exist?

MR. BALDASARI: You are talking about this line here (indicating)?

MR. HEPNER: Yes, your intake line and your discharge

line.

MR. BALDASARI: It is Seismic Category I, Q Class, so it is safety related.

MR. HEPNER: And somebody can't throw a rag over the intake or something like that or park a truck against it?

MR. KEITH: We have examined it as far as looking at it from a high energy line break standpoint and those kinds of things. It is protected from any postulated missiles or pipe rupture or anything like that.

MR. BALDASARI: The other point is that the system is placed in operation after the event, so it would be manually initiated to hook it up. It is not going to be a permanently installed type of thing that is going to be there for people to allow rags to build up on it during the shutdown period or when the plant is normally operating without the recombiners required. You examine that portion of the system before you place it in operation.

MR. HEPNER: The only temporary hookups you make are along the containment line; there are no hookups to this air source piping, then? That is all just off the skid itself.

MR. KEITH: The boundaries of the skid are right here (indicating), so this ducting, which is HVAC ducting, is permanently installed. The point which was being made is simply that before you hook everything up, you will just visually check that there are no obstructions in the suction

and discharge piping. It is just ventilation duct piping.

MR. HODGE: Just to expand on that, I have heard discussions that maybe these units will be left in place for storage. Is that a possibility? Would that change what you just said?

MR. KEITH: You're right, Mike. They will be left in place. You would still examine the ends of the ducts before you put the thing in operation.

MR. VAN BRUNT: Where are you going to leave them in place?

MR. KEITH: Before Units 2 and 3 go into operation, they will both be left in Unit 1. Then when Unit 2 goes into operation, there will be one in Unit 1 and one in Unit 2. Then when Unit 3 goes into operation, there will be one in Unit 1, and one in Unit 3.

MR. VAN BRUNT: John, did you have a question?

MR. HELD: Yes. My question pertains to our determination of the acceptability of the hydrogen recombiner system. I am not sure we have enough information yet to make that determination. There is a reference listed in FSAR Section 6.2.5-6, Reference 1, authors Henry, J. O., and Stone, L. R. Title "Thermal Hydrogen Recombiner System for Water-Cooled Reactors." It is a Rockwell International Report No. AI-75-2 Revision 3(P), Canoga Park, California, July 1977. We have been unable to obtain a copy of this. Are you familiar

enough with the contents of this report to say whether you have covered it in the information in your presentation today?

MR. KEITH: It has been a while since we have seen that report, but I don't think there are as many details in our presentation as are presented in the report.

MR. HELD: I would like you to present a synopsis of what is in that report. If not today, maybe at some later date.

MR. VAN BRUNT: Is that a proprietary book?

MR. HELD: I believe that is what the "P" means.

MR. KEITH: I am about 90% sure that that has been submitted to the NRC. Maybe not to your branch. This was back in the PSAR stage. I think the easiest thing is if we can get a copy and send it.

MR. HUONG: If you can identify whether we have reviewed it and whether we have accepted it, that would be the easiest thing to do. If we have already reviewed it and found it acceptable, just let us know.

MR. HELD: Yes. As an alternate to providing a synopsis of this report, if you can just show that the NRC has accepted a similar system on another plant, that would be good.

MR. VAN BRUNT: Just as a side issue, we have loaned one of the recombiners to Duke Oconee and it is at Oconee

right now. We are going to get it back for one of the others.

MR. HELD: Has that been accepted for use at Oconee?

MR. VAN BRUNT: As far as I know. We also have another one that we have in our box ready to send to SMUD, Sacramento Municipal Utility District, for use at Sequoia on 24-hour notice, and they presented that under whatever circumstances they were getting permission to continue to operate after Three Mile Island and that was accepted as the basis.

MR. HELD: Good.

MR. HUONG: On Exhibit 4-1 on Item 2), I would like to make a comment on the hydrogen purge system. It is my understanding of the regulation that we never made the hydrogen purge system a backup to the hydrogen recombiner system. It is a nonsafety system and the regulation requires that you install controlled purge capability. That is what we said in the regulation, I believe. All I want to tell you is we don't treat it as a backup to the recombiner system. Whether you agree with me or not, that is my understanding. Therefore, on Exhibit 4-4, Item 5), you assume in the event that both recombiners are inoperable. Since they are redundant safety grade, I don't think we should assume two of the systems failing in the post-LOCA condition.

MR. KEITH: We only said that because that is the only reason we got the thing. There is no other reason to

have it.

MR. HUONG: There is a reason. I was giving the reason. The control purge system may be used in the long-term contaminant air control non-LOCA. Maybe a year or several months later, you want to clean up contaminants, and at that particular time, this controlled purge system may be used for it. I just don't want the people to have the wrong idea that this control purge system can be used as a backup.

MR. TOSETTI: It does provide in the Standard Review Plan, though. The reference was a backup system.

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

MR. STERLING: My only question was it is not indicated in any of the exhibits that you have presented so far where control of the hydrogen recombiners is once they are hooked up. My understanding is that all control for those units is in the control room. Is that correct?

MR. KEITH: All the controls are down here (indicating). The only thing we have in the control room is an alarm to indicate if we have any trouble with the units. Once you press the button and start it up, it is designed such that you don't require any operator action.

MR. STERLING: The valves that connect the system together are all operated from the control room, is that correct?

MR. KEITH: The main process valves, which are containment isolation valves, are operated from the control room, but those ventilation valves are operated locally.

MR. STERLING: In that area down there where those control panels are, they are accessible during that period of time for that guy to get down there and work?

MR. KEITH: Yes.

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

MR. HODGE: I am going to pass.

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

MR. ALLEN: On Exhibit 4-3, you talk about the two recombiners have 50 cubic feet. Is that 25 apiece or each of them at 50?

MR. KEITH: Each are 50.

MR. ALLEN: The total capacity of 50? You mean that to be total process of 50?

MR. KEITH: Right. We need to say each.

MR. VAN BRUNT: Why don't you change that slide.

MR. KEITH: Will do.

MR. VAN BRUNT: Any other questions?

Seeing none, continue.

MR. KEITH: We will now go to Conformance With Regulatory Requirements.

MR. BALDASARI: Figure 4-3 shows the Standard Review

Plan 6.2.5, Revision 1; General Design Critera GDC-41, 42, 43, and 50; Regulatory Guides 1.7, 1.26, 1.29; the Branch Technical Positions ASB 9-2 and CSB 6-2.

Exhibit 4-6. The SRP Acceptance Criteria is SRP 6.2.5, Combustible Gas Control in Containment.

Requirement 1. The analysis of hydrogen and oxygen production in the containment following postulated accidents should be based on parameters set forth in Table 1 of BTP CSB 602. Palo Verde is in compliance. The design is based on parameters listed in Table 1 except that a metal-water reaction fraction was conservatively taken as five times the 1% mass.

Requirement 2. The fission product decay energy used in the calculation of hydrogen and oxygen production from radiolysis of the emergency core cooling water and sump water is acceptable if it is equal to or more conservative than the decay model given in BTP ASB 9-2. We are in compliance.

Exhibit 4-7. Requirement 3. A system should be provided to mix the combustible gases within the containment. The functional design of this system will depend on the type of containment. It may consist of a fan, a fan cooler, or containment spray. For containments which rely on convective mixing in conjunction with system operation to mix the combustible gases, the containment internal structures must

have design features which promote the free circulation of the atmosphere. Palo Verde is in compliance. We use containment sprays and natural convection based on temperature differentials to mix combustible gases. Internal structures are designed to promote free circulation of the atmosphere.

Figure 4-8. Requirement 4. The systems provided to reduce the concentration of hydrogen or oxygen in the containment will be accepted, from a functional standpoint, if analyses indicate that a single system train is capable of maintaining the concentration of hydrogen or oxygen below the concentration limits specified in Table 1 of BTP CSB 6-2. Palo Verde is in compliance. Systems provided for combustible gas control are fully redundant. Margin is as shown in Figure 4-2. The hydrogen recombiners are placed in operation nine days after the accident.

Exhibit 4-9. Requirement 5. Containment atmosphere sampling or analyzing equipment temperature limitations should be compatible with the temperature of the sample gases. Palo Verde is in compliance.

Requirement 6. Combustible gas control systems should meet the redundancy and power source requirements for essential safety features. Palo Verde is in compliance.

Exhibit 4-10. Requirement 7. Combustible gas control systems should be designed, fabricated, erected, and tested to Group B quality standards, as recommended in

Reg. Guide 1.26. Palo Verde is in compliance.

Requirement 8. Combustible gas control systems, including foundations and supports, should be designated as Seismic Category I. Palo Verde is in compliance.

Requirement 9. Qualification tests should be performed on system components such as hydrogen recombiners, combustible gas analyzers, air moving equipment motors, and valve operators. The tests should support the analyses of the functional capability of the equipment and demonstrate that the equipment will remain operable in the accident environment for as long as the accident condition require. Palo Verde is in compliance.

Exhibit 4-11. Requirement 10. Combustible gas control systems should be designed with provisions for periodic inservice inspection, operability testing and leak rate testing. Palo Verde is in compliance.

Requirement 11. Combustible gas control system designs should include instrumentation needed to monitor the system or component performance under normal and accident conditions. Palo Verde is in compliance.

Exhibit 4-12. Requirement 12. The sharing of system equipment between nuclear power units at a multi-unit site or between sites is acceptable provided (a) the availability of the shared equipment meets the redundancy requirements for an ESF, (b) the shared equipment is designed

to Seismic Category I criteria, (c) the shared equipment is mounted in a Seismic Category I structure, (d) adequate design, installation, and procedural provisions have been made, and (e) the stored equipment can be made available to perform its function in a time period that is equal to or less than one-half the time before it is required to operate. Palo Verde is in compliance.

Exhibit 4-13. Requirement 13. Where system is shared between nuclear power units at a multi-unit site or between sites, surveillance programs should be coordinated to assure that redundant equipment is not out of service at the same time. Palo Verde will comply.

Requirement 14. Branch Technical Position 6-2 recommends that a backup purge system be provided. The backup purge system is not required to be designed to ESF requirements with regard to single failure protection, since it is not the primary method for controlling combustible gas concentrations in the containment. The backup purge system is acceptable if purge doses are within the guidelines established in Branch Technical Position 6-2. Palo Verde is in compliance.

Exhibit 4-14, General Design Criteria 41, Containment Atmosphere Cleanup. Palo Verde is in compliance.

Exhibit 4-15, General Design Criteria 42, Inspection. Palo Verde is in compliance.

Exhibit 4-16, General Design Criteria 43, Testing. Palo Verde is in compliance.

Exhibit 4-17, General Design Criteria 50, Containment Design. Palo Verde is in compliance.

Exhibit 4-18, Reg. Guide 1.7, Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident. Each PWR fueled with uranium oxide pellets within cylindrical zircaloy cladding should have the capability to measure the hydrogen concentration in the containment, mix the atmosphere in the containment, and control combustible gas concentrations without relying on purging and/or repressurization of the containment atmosphere following a loss of coolant accident. Palo Verde is in compliance.

Exhibit 4-19. Requirement 2). The continuous presence of redundant combustible gas control equipment at the site may not be necessary provided it is available on an appropriate time scale. Provisions should include access to the area where the mobile combustible gas control system will be connected and provision for shielding to allow the coupling operation to be executed. Palo Verde is in compliance. The recombiners are located on site and access to the recombiners is possible at any time, since hookup locations are outside of the containment. Coupling operation is designed to be completed within 72 hours post-accident.

Exhibit 4-20. Requirment 3) Combustible gas

control systems and the provisions for mixing, measuring, and sampling should meet the design, quality assurance, redundancy, energy source, and instrumentation requirements for an essential safety feature. Palo Verde is in compliance.

Exhibit 4-21. Requirement 4). All water-cooled power reactors should also have the installed capability for a controlled purge of the containment atmosphere to aid in cleanup. The purge or ventilation system may be a separate system or part of an existing system. It need not be redundant or be designated Seismic Category I, except insofar as portions of the system constitute part of the primary containment boundary or contain filters. Palo Verde is in compliance.

Requirement 5). Defined parameter values should be used in calculating hydrogen and oxygen gas concentrations in the containment and evaluating designs provided to control and to purge combustible gases evolved in the course of loss of coolant accidents. Palo Verde is in compliance.

Exhibit 4-22, Reg. Guide 1.7. Requirement 6). Materials within the containment that would yield hydrogen gas due to corrosion from the emergency cooling or containment spray solutions should be identified, and their use should be limited as much as practical. Palo Verde is in compliance.

Exhibit 4-23, Reg. Guide 1.26, Quality Group

Classifications. Palo Verde is in compliance.

Exhibit 4-24, Reg. Guide 1.29, Seismic Classifications. Palo Verde is in compliance.

Exhibit 4-25, Branch Technical Position 9-2, Residual Decay Energy. Palo Verde is in compliance.

Exhibit 4-26, Branch Technical Position 6-2, Control of Combustible Gas Concentration in Containment Following a Loss-of-Coolant Accident.

All water-cooled power reactor facilities should have the capability for measurement of the hydrogen concentration, for mixing the atmosphere in the controlling combustible gas concentrations without reliance on purging of the containment atmosphere following a LOCA. Palo Verde is in compliance.

Continuous presence of combustible gas control equipment at the site may not be necessary provided it is available on an appropriate time scale. Palo Verde is in compliance.

Exhibit 4-27. Requirement 3). Combustible gas control systems and the provisions for mixing, measuring, and sampling should meet the design, quality assurance, redundancy, energy source, and instrumentation requirements for an essential safety feature. Palo Verde is in compliance.

Requirement 4). All water-cooled power reactors should also have the installed capability for a controlled

purge of the containment atmosphere. The purge system need not be redundant nor be designated Seismic Category I. Palo Verde is in compliance.

Exhibit 4-28. Requirement 5). Defined parameter values should be used for the purpose of calculating hydrogen and oxygen gas concentrations in the containment and evaluating designs provided to control and to purge combustible gases evolved in the course of loss of coolant accidents. Palo Verde is in compliance.

Requirement 6). Materials within the containment that would yield hydrogen gas due to corrosion from the emergency cooling or containment spray solutions should be identified and their use should be limited as much as practical. Palo Verde is in compliance.

Ehxibit 4-29. Requirement 7). Plants for which a notice of hearing on the application for a construction permit was published after November 5, 1970, should conform to Items 1 through 6 of 10CFR50.46. Palo Verde complies with those items.

Exhibit 4-30. This is NUREG-0737.

For plants using external recombiners or purge systems for post-accident combustible gas control of the containment atmosphere should provide containment penetration systems for external recombiner or purge systems that are dedicated to that service only, that meet the redundancy and

single failure requirements of General Design Criteria 54 and 56, and that are sized to satisfy the flow requirements of the recombiner or purge system. Palo Verde is in compliance. There are two portable recombiners. They are on site and available for connection to the affected unit. Either recombiner is capable of reducing hydrogen levels as noted in FSAR Section 6.2.5. The two systems are completely independent and meet single failure criteria. Each system has dedicated containment penetrations, external hydrogen monitors, and connection points for an external hydrogen recombiner.

An additional hydrogen reduction capability is provided by a nonsafety grade charcoal filtered purge exhaust unit. This capability would only be utilized in event of separate failures in both recombiner units.

Exhibit 4-31, continuing requirements for NUREG-0737, Item II.E.4.1.

The procedures for the use of combustible gas control systems following an accident that results in a degraded core and release of radioactivity to the containment must be reviewed and revised, if necessary. Palo Verde is committed to reviewing our design under degraded core conditions when generic guidance is provided.

Exhibit 4-32. This is Item II.F.1, Subpart 6.

A continuous indication of hydrogen concentration

in the containment atmosphere shall be provided in the control room. Measurement capability shall be provided over the range of zero to 10% hydrogen concentration under both positive and negative ambient pressure. Palo Verde is in compliance. Continuous indication of containment atmosphere hydrogen concentration is available in the control room. Indication is available within 30 minutes of the initiation of safety injection.

The analyzer functions are as shown. Additionally, the analyzers can monitor the containment atmosphere under a negative pressure.

MR. KEITH: That concludes our presentation on Combustible Gas Control.

MR. VAN BRUNT: Ed.

MR. STERLING: Before I make a comment, on Exhibit 4-30, that last paragraph down there which indicated that the charcoal filter purges were in there in case of a double failure, why don't we modify that paragraph the same as we were going to do the one in the previous section?

MR. VAN BRUNT: I think there is a number of cases where that applies.

MR. KEITH: Yes. I think wherever we say double failure, we'll strike that.

MR. VAN BRUNT: Are there other questions? Mike.

MR. HODGE: On Exhibit 4-7, how do we prevent dead

spaces in the equipment drain tank room and in the elevator shaft for that service elevator that is in the containment?

MR. KEITH: You are getting at the question the NRC has asked.

MR. HODGE: I had that one before they asked it, too, but also the elevator shaft.

MR. KEITH: I think, for the record, you said equipment drain tank room, but meant reactor drain tank room.

MR. HODGE: I'm sorry, yes, and also the elevator shaft.

MR. KEITH: For the elevator shaft, there is no source of hydrogen in there.

MR. HODGE: Is there any potential that some could start accumulating in there where the source might be right near the door or whatever? Is that sealed off in any way? It is a large shaft. It goes through quite a few levels.

MR. KEITH: Well, obviously, it is not airtight.

MR. TOSETTI: I might comment perhaps that is a question that is more addressed toward a degraded core scenario where the concentrations of hydrogen could be substantially higher versus the design basis conditions.

MR. VAN BRUNT: You might want to look, Dennis, at whether that shaft is sealed at the top. I don't know. As I remember from walking around, the driving mechanism is on top and the shaft is open at the top, but I couldn't swear

to that. Why don't you check it?

MR. KEITH: Anyhow, we will hold that as an open item.

MR. HODGE: Do you want to go to their questions first? I have two more questions.

MR. VAN BRUNT: Go ahead.

MR. HODGE: On Exhibit 4-10, you talk about qualification tests for the recombiners. Is the area that they are going to be placed in air conditioned to prevent heat transients or something that might ruin instruments or parts of the recombiner or is it designed to take maximum temperatures that might occur in that building.

MR. KEITH: It is designed to the temperatures that would occur in the building.

MR. HODGE: The last one is on Exhibit 4-14. That is back to the P&ID which shows the hydrogen purge unit. If we have a failure of that pressure control valve there which has to cut the pressure to 5 pounds, is there a potential of leak of radioactivity to the atmosphere through the plant vent? Did you ever consider dual regulators there, monitor regulation, in case there is a failure of that pressure control valve?

MR. KEITH: You are talking about this valve (indicating)?

MR. HODGE: Yes. I guess if it was raised to 5 psig in that unit, if it did fail, would you blow out something

like the HEPA filters or something, the charcoal filters, that could allow some additional radiation exposure than what we would want?

MR. KEITH: It is extremely unlikely that we would have a problem, because, as was pointed out by Rich Tosetti's question, it is going to be a long time before we get up to 5 pounds inside containment, since we are just bleeding in through this valve past here (indicating) at the 50 cfm rate and you will be monitoring the pressure in containment, so it is unlikely that you would have any problem. Normally, this valve (indicating) would be wide open and just provide some protection in the event that we did get a little bit above 5 pounds.

MR. HODGE: You think you have covered yourself, then?

MR. KEITH: Yes.

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

MR. HODGE: No.

MR. VAN BRUNT: Any other questions? Phil.

MR. HEPNER: On Exhibit 4-18, you talk about the mixing function of the spray system. What sort of guidelines have been developed and what information do we get out of the hydrogen system equipment to get to the point where we can tell the operator to stop the sprays and they are no longer necessary to provide the hydrogen mixing function?

MR. KEITH: I know we have looked at the mixing back in the PSAR stage and I think maybe somebody from Combustion Engineering did an analysis then and, as I recall, it was, in order to assure that we have maintained the hydrogen mix, that we operate the sprays every so often. Even though we didn't need it for containment cooling, you would operate them every half hour for five minutes or something like that was the kind of program that I recall.

MR. HEPNER: So you are going to do it on a programmed basis and not derive any kind of indication from your hydrogen system or some ultimate level where you would reduce the concentration, say you no longer feel it is necessary to provide the mixing.

MR. KEITH: We are providing the capability in addition to the spray to hook up our normal cooling fans so that they could be used to mix the containment spray.

MR. HEPNER: At some extended point in time, you will get out of it by --

MR. KEITH: By using fans.

MR. HEPNER: -- by using backup equipment?

MR. KEITH: Yes, I think at some point when you do get the hydrogen concentration down low and, depending on the accident, you can make inferences insofar as whether there is any other hydrogen generation still going on inside containment.

MR. VAN BRUNT: Any other questions? John, you had one.

MR. HELD: This pertains to the post-TMI considerations and it also relates to Reg. Guide 1.7. We would like you to provide the results from NUREG-0737, Item II.B.2, entitled "Plant Shielding" with regard to the installation and operation of the hydrogen recombiners and hydrogen purge system and operation of the hydrogen monitors following a LOCA. If you are not prepared to do that now, we can just make it an open item.

MR. VAN BRUNT: I think that ought to be an open item. We are in the process of doing that analysis right now.

MR. HELD: Fine.

MR. KOPCHINSKI: We have been looking at that and one thing I am having trouble coming to grips with is the assumption of a degraded core tied in with the assumption that the hydrogen recombiners are useful under that condition.

MR. HELD: That is something I am not prepared to discuss now.

MR. KOPCHINSKI: Degraded core activities imply a large amount of hydrogen. The recombiners are designed for the Reg. Guide 1.7 quantities. It seems incompatible to me to mix the two. If you can provide any guidance in the future, we would appreciate it.

MR. HUONG: I think regarding Reg. Guide 1.7, we do

have a requirement for shielding considerations indicated on Exhibit 4-19.

MR. KOPCHINSKI: That's correct, but those are different assumptions.

MR. HUONG: You can use it for the time being. I think at least you can use the design loss of coolant accident as the basis there to evaluate the dose level in the area.

MR. KOPCHINSKI: You think for the classical LOCA where the activity is all mixed with the containment sump?

MR. HUONG: Yes, any sources you can identify.

MR. KEITH: We will provide you what we expect as far as dose rates.

MR. VAN BRUNT: John, do you have any other questions?

MR. HELD: Not at this time.

MR. VAN BRUNT: John over here.

MR. ALLEN: Just for the record, could you describe what we have done to be sure we can move these recombiners around? Forklift? Cart? Whatever.

MR. KEITH: Yes. At our engineering facilities in Downey, we have a three-quarter inch to the foot scale model of the Palo Verde power block and we have in there checked that we can move a recombiner around, that we don't have piping or electrical cable trays or anything in the way. We have made a complete check that the recombiners can get in

and out of the auxiliary building, and, of course, when they are installed in Unit 1, that will be the final check.

MR. TOSETTI: In relation to that, are there any special handling requirements in terms of rigging or mobile cranes required?

MR. KEITH: No, a forklift is all that is required.

MR. VAN BRUNT: Are there any other questions?

MR. TOSETTI: A question regarding the hydrogen monitor, and that is relative to Exhibit 4-32. There is a difference between the accuracy stated in this table versus that in the FSAR.

MR. KEITH: These are the correct ones. The FSAR will be modified to reflect these.

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

MR. STERLING: On that same exhibit, there is some difference between the availability in the paragraph above and the system warmup time.

MR. KEITH: We keep the analyzers warmed up all the time in order to meet that availability requirement. It is necessary because of the warmup time to keep them warmed up all the time.

MR. VAN BRUNT: Dennis, do you want to go to the informal questions that we have?

MR. KEITH: Yes. Question 6.2.5-1. We will provide you with those figures unless we already have.

MR. HELD: You can delete that question. We have them.

MR. KEITH: Question 6.2.5-2. Within each train, the suction and discharge points are separated by 22 feet in elevation and 22 degrees radially. A slab is located between the suction and discharge points for the recombiners. The two recombiner trains have a minimum radial separation of 116 degrees. So one recombiner comes in about here (indicating), the discharge coming in here (indicating), and the suction coming in say about at this point (indicating). The other train is located with the discharge coming in about there (indicating) and the suction over here (indicating) All the piping is designed to ASME Section III, Class 2. It is designed for containment design pressure and is supported to Seismic Category I requirements. Isolation valves are qualified to post-LOCA environment and are powered with Class IE power.

MR. HELD: Adding to this question a little bit, I would like to make sure that the locations for hydrogen monitoring will provide representative values.

MR. KEITH: John, the points that the analyzers are using are the same as far as inside the containment. They go through the same penetration.

MR. HELD: Are you reasonably assured then that the samples you will be getting from those locations will give

you values which are representative of what is there throughout the containment?

MR. KEITH: Yes. I think with the spray system operating, the containment is going to be well mixed.

Question 6.2.5-3. We are putting in an FSAR change to reflect that the hydrogen recombiner is Quality Group B. The table did note that it was Section III, Class 2 which has been the case all along.

Question 6.2.5-4. PVNGS has two complete recombiner units. After completion of construction, the normal storage locations when all three units are in operation is with one recombiner and its control cabinet in Unit 1 in the auxiliary building and the other one in Unit 3.

The procedure to install and place the recombiner into operation is as follows:

The recombiner and control cabinet are moved into place via forklift.

Cabinets are secured to mounting supports.

Power cables are connected between equipment and dedicated Class IE power receptacles.

Blank flanges are removed from installed piping and connections made up to recombiner suction and discharge.

The recombiner is placed into a 24-hour warmup mode.

The associated containment isolation valves are

opened and the recombiner blower is started.

MR. HELD: Do you think all that can be done within 24 hours?

MR. KEITH: It can. As you saw, we committed to a 72-hour startup.

MR. HELD: But you think it would be reasonable to expect it to be done within 24 hours if it had to?

MR. KEITH: If it had to, yes.

Question 6.2.5-5. The hydrogen generator analyzer subsystem had dual indication (zero to 1 volume percent and zero to 10 volume percent) as well as an alarm function in the control room. The control room has a trouble alarm from the recombiner control cabinet. Specific alarm indications are read on the recombiner control cabinet. Other local indications are also available to monitor the operation of both the recombiners and the purge system.

MR. HELD: On the last part of that question, I wanted to verify that you also have recording in the main control room in addition to indication.

MR. KEITH: We are adding recording for one channel of the hydrogen analyzer.

Question 6.2.5-6. The hydrogen purge subsystem will be installed in the affected unit along with both recombiners following a LOCA. The purge unit installation is as follows:

The skid is moved into place via forklift.

Piping is connected to installed suction and discharge piping connections.

That is all there is for the installation. It is just a matter of starting it.

The time required to install and place the purge unit into operation is less than one day.

The normal storage location of the purge unit is in the warehouse. Adequate radiation protection is available for the operator, although that is an open item which we are getting back to you, since we are talking about the same area as the recombiners.

Question 6.2.5-7. The hydrogen analyzer, as we have stated, is permanently installed and the readout is in the main control room. Therefore, radiation exposure to personnel is minimized.

Question 6.2.5-8. The steam mass was calculated assuming saturated steam conditions inside the containment and we used the pressure-temperature conditions that we calculated for our pressure-temperature analyses as presented in Chapter 6.2.

Does that take care of that one, John?

MR. HELD: I think so. I may come back with another question later. Let's leave it at that for now.

MR.KEITH: Fine.

MR. VAN BRUNT: You always have that right anyway.

MR. KEITH: Question 6.2.5-9 is the one which Mike brought up on the reactor drain tank. The rupture disk does discharge inside the reactor drain tank compartment. We haven't been particularly concerned about that compartment, because we don't feel there is any source of hydrogen ignition.

MR. HELD: That is not to say there is no source of hydrogen.

MR. KEITH: That's correct if you postulate some sort of pressure transients which would cause our safety valves to relieve. We do not have a power-operated relief valve. We have just code safeties, which go to 2,500 pounds, roughly. So if you postulated them relieving, then the rupture disk would go and, of course, there is hydrogen in the pressurizer.

MR. HELD: This is related to our concern of hydrogen pocketing within the containment and, in general, whether there is adequate provision for mixing.

MR. KEITH: We looked at this a long time ago and, as I said, concluded that there is no electrical equipment in that compartment, so we didn't see it as a problem.

MR. HELD: I've got a couple of other comments related to the same question. Have you done any analyses of the containment atmosphere mixing to demonstrate that both

hydrogen mixing and containment cooling will be adequate throughout?

MR. KEITH: When you say throughout, are you talking about throughout the containment, not throughout the accident?

MR. HELD: Right. Throughout the containment, excuse me.

MR. KEITH: Yes, we have. Mike has already brought up the elevator shaft and I am sure at one time we looked at that, and I just don't recall the results. We will have to get back. We can get back with you, because I can recall looking at drawings of sections through the containment to see if there were any compartments that would likely create significant hydrogen pockets. We will hold that as open.

MR. HELD: Along the same lines, what we would like you to do is discuss, utilizing appropriate general arrangement drawings, how the internal structures of the containment building are designed to promote natural convective flows and prevent stagnate accumulations of containment atmosphere.

MR. KEITH: We'll include that with the discussion.

Question 6.2.5-10. The cooling system is essential to operation of the hydrogen recombiner. This has been discussed earlier, you will recall. As we stated, the blower for that ventilation system takes the suction inside the auxiliary building and discharges inside the auxiliary building. All that ventilation ducting is Seismic Category I

Our ventilation duct, and this is true throughout the plant, is not built to Section III, Class 2, so it is not Quality Group B. Because it is inside the building, the inlet and outlet are protected from tornadoes, floods, missiles. That is no problem.

MR. HELD: I didn't catch whether you addressed Point b there or not.

MR. KEITH: I was stating that the suction and discharge are inside the building.

MR. HELD: Is the blower or fan for bringing in cooling air from outside the auxiliary building and then returning it to the outside provided as part of the portable hydrogen recombiner skid package?

MR. KEITH: Oh, I'm sorry, I missed it. It is part of the skid package. It is taking suction from inside the building and discharging inside the building.

MR. HELD: So the question was partially in error, too.

MR. KEITH: Yes. The blower is part of the skid package and is Quality Class Q, Seismic Category I.

MR. HELD: I've got one more thing on that last item. Since you are doing everything inside the building, have you accounted for heat generation because of the operation of that machinery and then provided for heat removal?

MR. KEITH: Yes.

MR. HELD: How is that done?

MR. KEITH: We have done analyses. Let me hold that as an open item. We will get back to that and give you the details on that.

MR. HELD: Fine.

MR. VAN BRUNT: Are you going to cover this NUREG-0737 information?

MR. KEITH: I think we have already covered it all. Do you know offhand, John? Is there anything we haven't?

MR. HELD: Could you address the first two points on that page?

MR. KEITH: Point 3.a., we did add that it does operate under negative pressure.

Let's see, John, can you help us? On Question 3.b., Appendix B, does that cover anything that we haven't covered? I am not sure. I don't want to say we are meeting that.

MR. HELD: Not having it right in front of me, I can't verify that. I think we will have to talk about it later.

MR. KEITH: Okay, we can talk about that one. Part 3.c., we have confirmed that we have recording and indication within 30 minutes.

Item 4, we have stated we are in the process of changing our containment pressure monitors to meet that

requirement.

We are responding to Question 5. We described the water level monitor.

MR. HELD: All right.

MR. ALLEN: John, for your information, also, we submitted our lessons learned implementation report to the NRC a while back. I don't know if you were provided with that or not. It's got all the 0737 stuff in it.

MR. VAN BRUNT: Are there any other questions?

Let's go off the record for just a moment.

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

MR. VAN BRUNT: I would ask that Bill Quin and Gerry Kopchinski compare notes on the open items and come up with a final list and provide it for the court reporter so that when we issue the record of this review that everybody that receives it will have a list of the open items and they can verify that they are satisfied with those. We will be issuing that to all the Board members. Bechtel or whoever else has been designated will be responding to the open items very shortly. We will get those out. We don't really have too many, I don't think, of any significance from this hearing, so we ought to get them out pretty quick. We would appreciate turn around or your agreement with those as quickly as we can get them so we can submit the documents

to the commission and hopefully get this closed up so they can get their draft SER.

Are there any other issues anybody wants to raise?

I want to thank everybody for their participation. We will call this session closed.

* * *

I HEREBY CERTIFY that I was present at the meeting before the Palo Verde Nuclear Generating Station Containment Systems Review Board; that I made a shorthand record of all proceedings and testimony had and adduced before said Review Board at said meeting; that the foregoing 198 typewritten pages constitute a full, true and accurate transcript of said record, all to the best of my skill and ability.

Mark M Grumley

MARK M. GRUMLEY
Court Reporter

ADDENDUM I - NRC QUESTIONS

QUESTION 6.2.1.1.A-4:

The FSAR shows that containment spray flow is initiated inside the containment building at 87 seconds following a LOCA assuming loss of offsite power and 80 seconds following a MSLB assuming offsite power is available, (Table 6.2.1-7).

Explain and/or correlate these delay times and those stated in CESSAR, Appendix 6A, Section 5.3.

QUESTION 6.2.1.1.A-5:

Justify the Table 6.2.1-7 value of 3890 gpm per containment spray pump in view of CESSAR Appendix 6A, Section 3.3.1 which gives the design flow rate as 3500 gpm excluding minimum flow.

QUESTION 6.2.2-1:

Identify and justify the conservatisms applied in calculating the friction losses in the containment spray pump suction piping.

QUESTION 6.2.2-2:

Provide elevation and plan drawings showing the containment spray patterns. Specify the extent of overlapping

of the sprays. If significant overlapping of the sprays exists, evaluate the effect in terms of degraded heat removal capability. (Note: The above information is not provided in Section 6.5.2.2.)

QUESTION 6.2.2-3:

Provide an analysis of the heat removal capability of the containment spray system. The analysis should include the degree of thermal equilibrium attained by the spray water, reference SRP Section 6.2.2. (Note: The above information is not provided in the referenced CESSAR Appendix 6A, Section 2.1.2.)

QUESTION 6.2.2-4:

Provide additional information on the operation of shutdown heat exchangers, including:

a. Operational modes and actuation during the injection and recirculation phase of the spray system.

b. The potential for surface fouling of the secondary side and how this effect has been treated in the heat removal capacity of the heat exchanger used in the Section 6.2.1 analyses.

QUESTION 6.2.2-5:

Verify that the Containment Spray System has been designed in accordance with Regulatory Guide 1.1 to provide adequate NPSH to the system pumps assuming no increase in containment pressure from that present prior to postulated loss of coolant accidents.

QUESTION 6.2.2-6:

Identify the limiting restriction in systems served by the CSS sumps, upon which the maximum fine screen opening of 0.09 inch is based.

QUESTION 6.2.2-7:

Describe the design features of the pump intakes in the CSS sumps which will minimize vortexing and other degrading effects on pump inlets.

QUESTION 6.2.2-8:

Identify the material from which the outer trash rack is fabricated, and provide assurance that this material is resistant to degradation during long periods of inactivity and has a low sensitivity to spray induced corrosion.

QUESTION 6.2.2-9:

Explain why Valves SI-UV672 and SI-UV671 in the lines between the shutdown cooling heat exchangers and the containment spray headers (passing through Penetrations 21 and 22) are locked closed during normal operation. These valves are supposed to open automatically on receipt of a containment spray actuation signal.

QUESTION 6.2.4-1:

Describe containment isolation provisions for the following penetrations which are not included in FSAR Figure 6.2.4-1:

Penetration No.	Function
5	Spare
32B	Spare
32C	Spare
62B	ILRT Verification leak
62C	ILRT Pressure measurement

QUESTION 6.2.4-2:

FSAR Section 6.2.4.3 states that an Operating Procedure will require that manual valves such as those shown in Valve Arrangements 3, 5, 12, 28, and 35 be verified as closed prior to any operation requiring containment integrity. It is our position that in order for a manual valve to serve as an isolation barrier, the valve should be under the

administrative control required for "sealed closed barriers" as defined in SRP Section 6.2.4.11.3.1. This guidance applies also to manual valves in test, vent, and drain lines although screwed or welded caps or blind flanges may be used in place of sealed closed isolation valves.

Provide assurance that the above guidance will be followed for all manual valves employed as containment isolation barriers. (Note: This does not apply to remote manual valves in lines which must be opened for safe shutdown of the plant.)

<u>QUESTION 6.2.4-3:</u>

Provide evidence that all valves in FSAR Table 6.2.4-1 greater than 10 feet from the containment have been placed as close to the containment as practical, as required by GDC 55, 56 and 57.

<u>QUESTION 6.2.4-4:</u>

Valve closure times should generally be less than one minute. Reference SRP 6.2.4. The maximum closure for 16-inch valves SID-UV654, SIB-UV656, SIC-UV653, SIA-UV655 is 80 seconds. Refer to Table 6.2.4-2, Sheet 4. Discuss considerations such as system design capabilities on which this valve closure time is based in order to justify this longer than prescribed closure time.

QUESTION 6.2.4-6:

Tabulate information demonstrating that containment isolation provisions are designed to allow the isolation barriers to be individually tested.

QUESTION 6.2.4-7:

Provide assurance that Valve CH-V393 in the regenerative heat exchanger vent line (Reference FSAR Figure 9.3-13 Sheet 1 of 5) will be locked closed during normal operation.

QUESTION 6.2.4-8:

Explain why the following valves will not be automatically closed by a containment isolation signal:

Penetration Number	Valve Number	Service
35	HP-HV007A	Hydrogen Control
36	HP-HV008A	Hydrogen Control

QUESTION 6.2.4-9:

Explain why the following valves in nonessential lines will not either: (1) be automatically closed in the event of an accident requiring containment isolation and fail closed on loss of power to the valve operators; or (2) be locked closed during normal operation:

Penetration Number	Valve Number	Service
1	SG-V127	Main Steam
1	SG-HV184	Main Steam
1	SG-V603	Main Steam
2,3	SG-V096	Main Steam
2,3	SG-V092	Main Steam
2	SG-HV178	Main Steam
2	SG-V133	Main Steam
3	SG-V139	Main Steam
3	SG-HV185	Main Steam
4	SG-V611	Main Steam
4	SG-V145	Main Steam
4	SG-HV179	Main Steam
7	FP-V089	Fire Protection Water
9	RD-UV023	Radwaste Water
56	CP-UV003A	Containment Building Purge
56	CP-UV002A	Containment Building Purge
57	CP-UV002B	Containment Building Purge
57	CP-UV003B	Containment Building Purge
78	CP-UV005A	Containment Building Purge
78	CP-UV004A	Containment Building Purge
79	CP-UV004B	Containment Building Purge
79	CP-UV005B	Containment Building Purge

QUESTION 6.2.4-10:

Describe the special precautions that will be taken, such as locking the test connection closed, to ensure that a double barrier will be maintained at each of the following penetrations during normal operation:

Penetration Number	Service
53	Fuel Transfer Tube
L-2	Equipment Hatch

QUESTION 6.2.5-1:

Provide copies of Figures 6.2.5-1, -2, -3 missing from the FSAR.

QUESTION 6.2.5-2:

Provide additional information (i.e., description, drawings) showing the location of the containment H_2 control system influent and effluent piping in containment. Provide sufficient detail showing that direct recirculation between effluent and influent will not occur. Provide additional information on capability of influent and effluent piping to withstand environmental and dynamic effects such as pressure spike transients following a LOCA.

QUESTION 6.2.5-3:

Table 3.2-1 shows that the containment combustible gas control system is not classified to Reg. Guide 1.26 Group B. NRC position is that these systems with the exceptions of the H_2 purge system be designed, fabricated, erected, and tested to Group B. Provide a discussion of your plans to correct this design deficiency.

QUESTION 6.2.5-4:

Provide a more complete description of the procedure to install and put into operation the H_2 recombiner. State where the H_2 recombiner and control cabinets are stored during normal operation.

QUESTION 6.2.5-5:

Describe more completely the instrumentation provided both locally and in the main control room to monitor the operation and performance of the H_2 recombiners and purge subsystems. Also verify that the H_2 monitoring system has indication and alarms in the main control room.

QUESTION 6.2.5-6:

State whether the H_2 purge subsystem will be immediately installed along with H_2 recombiner following a LOCA. Provide a brief description of the procedure to install the H_2 purge subsystem and the estimated maximum time to put it into operation. State where the H_2 purge subsystems will be stored during normal operation. Verify that adequate shielding is available for radiation protection of personnel during H_2 purge subsystem hookup and operation.

QUESTION 6.2.5-7:

Describe the procedure required to manually initiate

the operation of the H_2 monitoring subsystem. Verify that following a LOCA this can be done with adequate radiation protection to personnel.

QUESTION 6.2.5-8:

Provide additional information on how FSAR Figure 6.2.5-2 accounted for the steam released into the containment atmosphere following a loss of coolant accident and how the steam mass as a function of time was calculated.

QUESTION 6.2.5-9:

Provide additional information supporting the FSAR statement that no source of hydrogen is generated within the reactor drain tank compartment. Specifically indicate if the reactor drain tank rupture disk line discharges inside or outside the reactor drain tank compartment.

QUESTION 6.2.5-10:

Provide the following information concerning the hydrogen recombiner's cooling air system:

a. Is the cooling system essential to operation of the hydrogen recombiner?

b. Is the blower or fan for bringing in cooling air from outside the auxiliary building and then returning it to the outside provided as

part of the portable hydrogen recombiner skid package?

c. Are the permanent portions of the cooling air ducts, filter, and louvers designed to Seismic Category I and Quality Group B?

d. Are the cooling air inlet and outlet structures protected against tornados, floods, missiles, et cetera?

TMI NUREG-0737 RELATED

REQUESTS FOR ADDITIONAL INFORMATION

1. Item II.E.4.1 - Dedicated Hydrogen Penetrations:

Applicant must commit to review and revise as necssary the Palo Verde procedures for the use of combustible gas control systems following an accident that results in a degraded core and release of radioactivity to the containment and report the findings of the review to NRC.

2. Item II.E.4.2 - Containment Isolation Dependability:

Provide all required information to demonstrate compliance with this NUREG-0737 requirement.

3. Item II.F.1 - Attachment 6, Containment Hydrogen Monitor:

Provide the following information concerning the containment hydrogen monitors.

a. Confirm that the hydrogen monitors will function under both positive and negative pressure.

b. Verify that the hydrogen monitoring system will conform to NUREG-0737, Appendix B requirements.

c. Indicate whether the hydrogen monitors can provide continuous indication and recording in the control room within 30 minutes of the initiation of safety injection. Recording capability must be incorporated into the design

4. Item II.F.1 - Attachment 4, Containment Pressure Monitor:

The existing containment pressure monitors at Palo Verde (CESSAR Section 7.5) do not meet the measurement and indication capability of three times the design pressure of the containment (3 x 60 psig = 180 psig) and -5 psig. Provide information on how the design will be modified to conform to this requirement. Also provide confirmation that NUREG-0737, Appendix B requirements will be met and provide the accuracy and response time specification of the complying pressure monitors.

5. Item II.F.1 - Attachment 5, Containment Water Level Monitor:

Provide all required information to demonstrate compliance with this NUREG-0737 requirement.

ADDENDUM II - OPEN ITEMS

1. Change Figure 2-1 to include the shutdown heat exchanger bypass line. (Page 34)

2. Alter wording of Exhibit 2-5 to clarify power sources for spray pumps. (Page 39)

3. Investigate potential of high activity leakage being present in the piping downstream of the leakage relief valves which discharge into the auxiliary building. (Page 49)

4. Investigate loading restrictions on the ground over the pipe tunnel to the refueling water tank. (Page 54)

5. Add suction markings to Figures 2-8 and 2-9 as applicable. (Page 66)

6. Indicate the extent of the modeling done during the containment sump flow testing on Figure 2-5. (Page 70)

7. Add height of screen to Figure 2-6. (Page 73)

8. Determine justification for jog capability for valve 13-M-SIP-002, and if valid for PVNGS. (Page 78)

9. Document guidelines that have been provided to APS operations for the containment spray system operation as per Exhibit 2-40, Paragraph 2. (Page 79)

10. Provide the accuracy specification of the containment water level monitors. (Page 93)

11. Provide drawings of spray patterns to be appended to transcript. (Page 98)

12. Provide the maximum allowable overlap of the sprays and the fractions coverage. (Page 98)

13. Clarify valve arrangements of Figure 3-3. (Page 112)

14. Provide indication on Figure 3-7 of type of seal on outer hatch of personnel lock. (Page 113)

15. Look into possibility of atmospheric leakage through Type C penetrations, particularly via spray leaders. (Page 120)

16. Remove the shutdown cooling system from the "non-essential" list of Exhibit 3-57, to "essential" list on Exhibit 3-55. (Page 138)

17. Reword Exhibit 3-59 to show automatic transfer to emergency power, also 3-9. (Page 139)

18. Clarify application of Reg. Guide 1.11 to containment penetration monitors. (Page 141)

19. Examine the need to add relief systems to closed-cold penetrations. (Page 142)

20. Identify the Type C tested 1-inch steam penetration in Table 6.2.4.1 of FSAR. (Page 143)

21. Clarify the use of steam straps on the main steam lines as per GDC 56 and 54. (Page 145)

22. FSAR Section 6.2.4.3 states that an Operating Procedure will require that manual valves such as those shown in Valve Arrangements 3, 5, 12, 28, and 35 be verified as closed prior to any operation requiring containment integrity. It is our position that in order for a manual valve to serve as an isolation barrier, the valves should be under the administrative control required for "sealed closed barriers" as defined in SRP Section 6.2.4.11.3.1. This guidance applies also to manual valves in test, vent, and drain lines although welded caps or blind flanges may be used in place of sealed closed isolation valves.

    Provide assurance that the above guidance will be followed for all manual valves employed as containment isolation barriers. (Note: This does not apply to remote manual valves in lines which must be opened for safe shutdown of the plant.) (Page 150)

23. Provide assurance that Valve CH-V393 in the regenerative heat exchanger vent line (Reference FSAR Figure 9.3-13 Sheet 1 of 5) will be locked closed during normal operation. (Page 150)

24. Explain why the following valves will not be automatically closed by a containment isolation signal --HP-HV007A, 008A. (Page 152)

25. Confirm that the usage of motor operated valves for containment purge valves is acceptable. (Page 155)

26. Resolve possibility of test connection being left open on double o-ring type seals, thereby defeating one of two barriers. (Page 156)

27. Revise the FSAR Hydrogen Generation figures to those presented. (Page 163)

28. Determine time delay due to surge volume of containment prior to 50 cfm purging being driven by injected service air. (Page 164)

29. Provide a copy of, or location of, "Thermal Hydrogen Recombiner System for Water-Cooled Reactors," Rockwell Int'l Report No. Al-75-2, Rev. 3 (P), Canoga Park, Ca. July 1977 as referenced in FSAR Sec. 6.2.5-6, or demonstrate NRC acceptance of a similar system on an existing plant. (Page 168)

30. Revise Exhibit 4-3 to clarify capacities of individual recombiners and total capacity. (Page 171)

31. Remove references to double failure of recombiners, throughout, as basis for need of purge system. (Page 181)

32. Examine and resolve possibility of hydrogen accumulations of higher concentration in closed regions of the containment, particularly reactor drain tank room and elevator shaft. (Page 182)

33. Provide results of Shielding Review as per NUREG-0737, Item II.B.2. (Page 186)

34. Revise FSAR to indicate corrected accuracy of hydrogen monitor. (Page 188)

35. Demonstrate the adequacy of containment designed arrangement to assure convective mixing throughout of hydrogen and adequate cooling. (Page 194)

36. Provide data demonstrating adequate HVAC capacity in auxiliary building with recombiners in operation. (Page 195)

37. Verify that the hydrogen monitors will conform to NUREG-0737, Appendix B. (Page 196)