SYSTEMS REVIEW

of the

PALO VERDE NUCLEAR GENERATING STATION

CLASS IE AC POWER SYSTEM

before the

POWER SYSTEMS REVIEW BOARD

BETHESDA, MARYLAND

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INDEX

TRANSCRIPT OF PROCEEDINGS

PALO VERDE NUCLEAR GENERATING STATION

AC POWER SYSTEM REVIEW BOARD

Conference Room P-110
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7920 Norfolk Avenue
Bethesda, Maryland

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The above-entitled matter convened, pursuant to Notice, at 9:00 a.m.

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P R O C E E D I N G S

MR. VAN BRUNT: My name is Ed Van Brunt. I am Vice President of Nuclear Projects for Arizona Public Service Company. I am the officer responsible for the engineering design, construction and quality assurance for the Palo Verde Nuclear Generating Station. Paul Check has outlined the purpose of today's meeting which is to perform a system review of the Palo Verde Nuclear Generating Station, Class 1-E Onsite AC Power System.

The concept of performing a system review was developed in some recent meetings and conversations with NRC Director of Nuclear Reactor Regulation, Harold Denton. With this concept the design of a specific plant system is thoroughly reviewed for adequacy of design and compliance with regulations by a board of experts in technical disciplines associated with a particular system under consideration.

Participation by the Nuclear Regulatory Commission personnel in this presentation is encouraged and should aid, we believe, their understanding of the system design basis, detailed design and operation, thereby minimizing or eliminating the review man hours required for that particular system.

As a result of the various conversations I had with

Mr. Denton, APS, as the first step in this process, performed a system review of the Class 1-E DC Power System for the Palo Verde plant. Bechtel Power Corporation, the architect-engineer-construction manager for the Palo Verde plant, was instructed by APS to present the design of the Palo Verde DC Power System to a Review Board, similar to the one we have today, of experts which we impaneled. On April 10, 1980, Bechtel met with that Review Board on some preliminary matters to establish the varied interests and the rules of the game, if you like, as we understood them.

Using the guidance provided in that meeting, Bill Bingham, Bechtel's manager of Palo Verde Project Engineering, assembled the appropriate members of his staff to make a detailed presentation of the Class 1-E DC Power System. This was done on May 8, 1980, and the NRC was represented at that presentation by Mr. Faust Rosa, who is here this morning.

A transcript of that meeting was taken and was provided to the NRC, Chief Power Systems Branch, by letter from Arizona Public Service Company on June 4th, 1980.

At that meeting, several open issues were defined by the Review Board with regard to the DC Power System Review. Bechtel was instructed to prepare responses to those open items for the Board's later review and concurrence. The

initial responses to those open items have been provided by Bechtel and are currently under review by the Board and also has been sent to the NRC for their information. When the Board writes off on those responses or asks for additional information or whatever we do, we will provide those results to the Commission as well.

For todays review of the Palo Verde Onsite AC Power System, we have assembled a Review Board which is seated around the table here similar to that for the DC Power System.

At this time I would like to identify the members of the Board and after I do that I will get Bill Bingham to identify the members from the Bechtel project team that are here to make presentations.

One of the members of the Board, John Allen, who would have been instrumental from my view point in this review, unfortunately is not here today since he came down with phneumonia on Monday and so we will have to proceed without him. John is responsible for the electrical, I&C and health physics areas that are very important in these considerations. John won't be here but he is adequately represented, I believe.

Carter Rogers, seated next to me here, is the other APS nuclear engineering manager who reports directly to me. Carter has the responsibilities for mechanical engineering, chemical engineering, civil engineering, nuclear fuel and other nuclear related matters.

Bill Quinn, who is a little further down the table, is the supervising licensing engineer who reports to John Allen. Bill is responsible for the day to day interface with the Nuclear Regulatory Commission assigned project manager on all matters related to the Palo Verde licensing review.

John Barrow, across the table here, is the supervising electrical engineer. He also reports to John Allen. He is responsible for the review of the Palo Verde electrical systems for APS.

Norm Hoefert, down at the end of the table here is from the Palo Verde operations department, supervising engineer at the Palo Verde plant and will be associated with the engineering at the plant site when the plant goes into operation.

We have also asked Ron Paul, the manager of electrical and I&C design with the Arizona Public Service Company,

Generation Engineering Department, to sit in as an independent member of this APS panel. Ron has not been directly involved in the project although from time to time he has been utilized as a consultant in various areas where he possesses, we believe, some very significant expertise. He is particularly knowledgeable in overall AC system and power system design. He is a valued addition to this Board.

Two of the review members are from Bechtel. These representatives are Karl Kreutziger, the Chief Electrical Engineer for Bechtel, and Sheldon Freid who is is a nuclear engineer from the Bechtel staff. They also are not involved directly in the project but are used from time to time as consultants by the Bechtel project staff.

Representing Combustion Engineering, Inc., who, as you know, is providing nuclear steam supply system for the Palo Verde plant is Chuck Ferguson who is the Palo Verde Project Manager for Combustion.

There are a number of other people who are here from APS and from Bechtel and from Combustion. I have a list here, I think, of all. Let me just run down and tell you who they are and as appropriately recognized, they can ask questions, too, if they like.

Across from me, Arthur Gehr. You can't do anything without a lawyer. He is our attorney-at-law. I won't go anywhere without him. Mike Barnoski is the Palo Verde Assistant Project Manager for Combustion Engineering. Tom Price is the supervisor of standard plant licensing for Combustion Engineering. Terry Quan, down here, is a licensing engineer that works for APS. If I left anybody out, Bill, you can pick up with some of your fellows.

We are presenting this system review here today in Bethesda to facilitate maximum attendance by the Nuclear Regulatory Commission and to give them an opportunity to see how this embryonic licensing review procedure works or at least as we see it working. We hope that by familiarizing yourself with the system review procedure as it has evolved for us that it will help you -- help them, I should say, in reviewing the systems for Palo Verde. We will provide a transcript of this review to the Nuclear Regulatory Commission as soon as we receive it from the Court Reporter and proof read it. For the benefit of the Court Reporter, I will ask that all of the Review Board members or anyone else who makes a statement please identify themselves before making a statement. We would encourage any of the NRC staff here

today, in particular the members who have been designated to represent the Commission, to ask any questions you would like or to pursue any procedural matters or anything else that you would like to talk about. We are a very informal group and this is an informal meeting. It is not a formal meeting so I would encourage you all to participate to the extent you see fit.

Bill, I would request that the Review Board and the NRC be allowed to ask questions at the close of each section of your presentation. As I understand it, you have it broken down into various areas. When you come to a convenient point, then we can ask questions. Otherwise, I would ask that everybody refrain from asking questions unless it is some clarification or something necessary at the point of presentation. Also, based on the experience we had at the last meeting, I would ask that whenever you are referring to a slide or something or other or any of the Board is referring to a slide -- I understand that now there is some identification on the slides -- that they be referred to so that when we read the transcript, it will make sense.

Does anybody on the Board or anybody else have any questions or anything that they would like to ask? If not, Bill, I will turn it over to you. Introduce your people and then go ahead and proceed at your leisure.

MR. BINGHAM: This is the second formal meeting of the ANPP System Review Board which today will cover the AC Power System. As Ed mentioned, we previously covered the DC Power System.

We have with us from Bechtel today Dennis Keith, Assistant Project Engineer. Gerry Kopchinski is responsible for nuclear engineering and licensing on Palo Verde. Fred Tajaddodi is an electrical engineering specialist.

I would like to note that this is just one more step in a continuous process that both the applicant and the engineer go through on systems review. In general, each of the documents produced on the system is reviewed by both the engineers of Bechtel and APS. The engineers' review includes review by staff experts of the originating discipline -- in this particular case, the electrical discipline -- and by other disciplines whose systems interface with the particular system that we are talking about. In other words, we have a multi-discipline review. The documents reviewed include the design criteria, the basic documents that form the scope for the work; the P&ID's, flow diagrams, single line diagrams,

system descriptions, system layout, and the drawings that are used or the scale model that is used for this particular plant. I believe all of the Board is aware that at Palo Verde there is a large scale model of the plant, of the power block itself. These reviews have been documented but not on an overall basis. Our presentation today has pulled all of the information together and will be presented in a comprehensive form.

If we could have the first slide which is the agenda, we intend to cover a system overview as a first part. At the end of that, we will entertain questions. I prefer the Board to direct them to me.

Second, we will go through the standard review presentation. System redundancy requirements. Single failure criterion. Standby and preferred power systems independence. Standby power supplies. How we identify cables, raceways, terminals. Vital supporting systems. System testing and surveillance. Of course, other areas will be reviewed. I believe there is enough information in this first five or six that we will stop at the end of each one and entertain questions. Then we will hit the diesel generator instrumentation and control and the IE bulletins, circulars and information notices and how they apply to the system. I want to make sure that from our last meeting we have addressed the acceptance criteria and the standard review plan. So for the Board's information, we have re-formated the presentation this time to focus in on how the criteria is set up and how the design does meet the standard review plans for the AC power system.

Fred, will you start the presentation please.

MR. TAJADDODI: The Palo Verde Project has a common switchyard which we call the offsite power grid with four independent lines coming to the switchyard. These four independent lines actually feed three startup transformers for the three units.

Each of the units has its independent load groups. "A" and "B" load groups and their power supply is completely independent being fed in this manner from the startup transformer which are actually fed by offsite power supply.

Now the dash line here represents the offsite power supply also supplying the normal part of AC power during the startup of the power plant. This actually means that both of these lines for each unit can feed the normal AC power during the startup of the plant. As you can see, each unit

has its own independent offsite power system with independent redundant load groups. The overall system also has got the normal AC power supply. It gets its power from a turbine generator which also supplies power to the grid and supplies power to the normal source of power to the unit.

Finally, each ESF load group not only gets its power from the offsite power source as shown here but also gets its power from the standby onsite power supply which is diesel generators. These diesel generators are independent, each one supplying its dedicated load group AC system.

This is a system overview slide, Figure 1-1,

Figure 1-2, showing the four independent offsite lines coming into the switchyard feeding the three startup transformers for the three units of the Palo Verde generating station. It shows that these lines are such that any failure of the offsite power is not going to jeopardise the other three lines. They are designed so that in case one of the lines or any malfunction happens to one of the lines, the other three lines maintain their integrity and provide power to the switchyard.

Here the three transformers -- start-up transformers -- provide the power to the onsite AC and ESF systems.

This is figure 1-6 which shows in some detail how this offsite power is being brought into the units. There are four lines in here coming from the switchyard feeding the three startup transformers with double circuitry. Each startup transformer is capable of providing power to any of the three units. We have a normal position of the breaker supplying each unit independently from the startup transformers. In this case, the two redundant load groups of Unit One being fed respectively from this startup transformer here and the other one being fed from this startup transformer here. So we can see that we have got redundancy and independence of the lines coming from the switchyard with two outside sources.

This shows the details of the onsite system, how it is designed. After coming from the startup transformers from the switchyard, we show here only the connections for one unit. We do not want to repeat it for the other two units. You see how the startup transformers provide the offsite power to the Class 1-E system for the two redundant load groups in here. Each source of preferred power is distributed to the different voltages for each load group. Each load group has got an independent source altogether with

an onsite power supply. We have blocked out this DC power system which has got four independent power sources as this was presented previously. So we do not want to bother with making the details of the drawing in here but it shows how the source also provides power to the vital instrument buses from the DC supply as a normal source and also as a backup source from the 480 volt system where you can have power through the transfer switch in case the inverter fails.

In addition, it shows also how the third of a kind equipment is being treated. Here, in this case, this is the way the third of a kind loads are being provided power to. One source of power is always available to the motor through the breaker while the other standby source has got only a space where we can physically remove the breaker here and insert it in this position here should this power source fail and then realign the transfer switch in the same manner. That was figure 1-7.

This is figure 1-5. It again shows with some detail how the interconnections of offsite power to the Class 1-E Systems are done. It shows how the offsite power from the 13.8 KV system through the startup transfermers being fed through the ESF service transformers as the normal source of power for each load group. We have some alternate power sources for each load group should one of these offsite power sources fail. We can manually connect the buses to these breakers if one of these sources is not available. This is done only manually and we will go through the details of this drawing later on when we are making the presentation for the different aspects of the design. We will have this handy.

This is figure 1-3. It essentially shows the physical arrangement of the equipment. We have shown here -- this whole area belongs to the AC system. Train A and Train B are separated by the wall right in the middle here. This is where the ESF switch gear and load centers are located with the separation of the three hour walls around to make sure that they are independent structures and isolated from each other. We will also go into these drawings later on in more detail as the presentation proceeds.

Figure 1-4 is also a physical arrangement showing two of the redundant diesel generators separated by a three hour wall here with independent instrumentation panels for each of the trains being housed in a separate room isolated from the redundant load group. All of the pertinent instrumentation to each of the diesel generators actually is housed in the area belonging to that train.

MR. BINGHAM: Are there any questions from the Board. I might indicate also we have copies of the slides for the observers at the end of the session if they would care to have one. Ed, do you have any questions on the system overview?

MR. VAN BRUNT: Do you have any questions at this point?

(No response.)

MR. VAN BRUNT: No, go ahead. Not at this point, no.

MR. TAJADDODI: This is figure 2A-1. We start with the requirement of system redundancy requirement as required by SRP. It requires that the system be designed such that the redundancy of the system meets the requirement of the different criteria set forth in the GDC's. The design for the Palo Verde provides for two redundant ESF systems with a dedicated onsite power supply in addition to some alternate means of providing power if one of the sources of the preferred power fails.

The specific requirements are that the two redundant load groups provide power to the respective loads. The PVNGS design provides for that kind of a design.

This is figure 2A-2, a continuation of the requirements, the safety actions. The PVNGS design provides for each load group to provide its own safety actions independent of the redundant group. So, in effect, the actuation systems for the safety actions of each load group are completely independent. The power supply requirement are such that two offsite power supplies and one onsite power supply are provided for each load group and that provides for the availability and redundancy that is required to meet the safety aspects -- safety requirements of the plant.

This is figure 2A-3, continuing with the requirements. The common power supply requirement Actually PVNGS does not have any common power supplies. With the exception that we will go into detail later on with the manual operation. The preferred power supply description is that there are two circuits from the offsite source available as the preferred power source to provide power to the ESF load groups.

This is figure 2A-4, the preferred power supply availability. There are two immediate power sources available to each group. In addition, if one of the power sources is not available, there are some manual operations that provide power to the redundant load groups.

This is figure 2A-5, offsite and onsite power. Each redundant load group on the Palo Verde project has two offsite sources of power and one onsite, which is a diesel generator. There is actually no automatic connection between the redundant units and there is no automatic connections between the onsite power sources. There are some manual connections between the offsite and the onsite buses.

As it can be seen here, figure 1-5, the two offsite power sources are being provided by the startup transformer of the units, one coming to this bus and the other coming to the redundant bus. Now, should one of these buses or power sources fail, there is a manual means of connecting this source of power to the bus. This is only done manually. The connections done in this manner are going to preclude the possibility of jeopardising both offsite sources and redundant loads due to a single failure because of the fact that they are connected in series should the fault happen or occur in one of these buses, the single failure criteria provides that we can allow for one failure in the system. If this breaker here fails, the other one is going to open and isolate the two sources from each other. Under this operation, the redundancy is maintained. In addition, we have an onsite power source, the diesel generator, such that it can only close this bus if the two breakers feeding the power from the offsite source are open.

Figure 2A-6, independence and redundancy requirement. There are requirements for four independent instrument buses to be provided for the instrumentation and these are exhibited in figure 1-7.

We have got four independent 120 volts AC ungrounded instrument buses feeding and getting their power from the inverters that are fed from the DC sources. In addition, we have a back up power supply should the DC power sources fail. We have a manual transfer switch in here for each of the independent vital instrument buses. So those are being provided.

Figure 2A-7, third of a kind load groups. CESSAR requires that should the normal source of power to the third of a kind component ever fail, power can be supplied from the redundant power source. In the manner that we have designed the system on the Palo Verde, we can provide this requirement by removing the breaker from this position and inserting it in this position and aligning the two breakers within two hours without any single failure jeopardising both of the buses due to the fact that this is open. If there is a

fault on this source, it will not jeopardise this bus and vice versa.

MR. BINGHAM: Are there any questions on this part of the presentation, system redundancy?

MR. KEITH: Let me just clarify for everybody that we do, under the requirement, list where the requirement came from. I think most of it is self explanatory. CESSAR, in this case, is the CESSAR FSAR. The interface requirements are in there because it is standard SAR. So when you see CESSAR under there, that is what that indicates. The others, I think, are self explanatory such as reg guides.

MR. BINGHAM: Karl, you had a question?

MR. KREUTZIGER: Yes. Kreutziger. Are we going to be discussing the area of technical specifications. Will we cover that later with respect to continued operations? I have a question. My specific question is a loss of ESF service transformer. You indicated in your discussion that you could lose an ESF service transformer and continue operations. What are the technical specifications with respect to providing two sources of power to ESF buses on loss of one of the ESF service transformers.

MR. TAJADDODI: Let's go to figure 1-5. Now the

requirements of Reg Guide 1.32 and IEEE 308 call for at least one source of offsite power normally all of the time. Now, if this normal source of offsite power for all of these load groups fail, these ESF transformers have capability such that it can provide power to both of these load groups simultaneously. It has the capacity for doing so.

Now, you can operate indefinitely in this mode as long as there are no subsequent signals coming in such as the SIAS or other accident signals. If that happens, all of these breakers are going to be tripped. But as long as there is no emergency and you are operating in the normal mode, you can operate. You can align these breakers and this transformer here can provide power to all of these sources and this is allowed per the SRP. You can do this as long as you have two breakers in series such that you will negate the probability of violating the single failure criteria.

MR. KREUTZIGER: The answer then is that there is continued operation during an outage of any of the ESF service transformers?

MR. TAJADDODI: I do not know whether we have really provided any specific technical specifications regarding this part of your question but we do not see any drawbacks or

any limitation in providing this power because it is already a viable operating procedure.

MR. BINGHAM: I am not sure we have answered the question. Dennis, make sure we have --

MR. VAN BRUNT: Do you want to go off the record.

MR. BINGHAM: Lets go off the record.

(Discussion off the record.)

MR. VAN BRUNT: On the record.

MR. KREUTZIGER: I see very well that there are two immediate access circuits for ESF buses in the normal line up, my question came to providing -- whether or not there was any technical specification when the ESF transformers were out of service to provide -- whether or not there was an operating restriction on time. Whether or not there was another means whereby a second access source would be provided to the ESF.

MR. TAJADDODI: I understand your question now. Yes, there is. You are saying, how long can you operate under that mode?

MR. KREUTZIGER: Yes.

MR. TAJADDODI: Well, that operation -- the limitation of that operation is per the requirements of reg guide 1.93,

which tells you that you can operate for a limited period of time if you lose one source of offsite power. Actually, that is tantamount to losing an offsite source of power. So if you lose one source of offsite power, you are allowed to operate for 72 hours continuously and then if you cannot restore the source of offsite power, you are supposed to bring the plant to a shutdown mode. Does that answer your question?

MR. KREUTZIGER: Yes. I was wondering if you were on those tech spec limits or whether there was an alternate means to get power.

MR. TAJADDODI: That was the reason for it. If you do lose power, this provides power to this source during those hours. This will enhance the design because you can still operate without this source. This design enables you to provide power for the additional degree of availability to the plant without jeopardising the power to the loads that might be running at that time.

In addition, I think there was a statement that I made here that if there wereaan emergency condition, an SIAS, then you would trip these breakers. What I meant to say was that the accident conditions that would trip these breakers would

be the loss of offsite power and not SIAS. So I would like to clarify that for the record.

MR. KREUTZIGER: One other question. Has the project purchased a spare ESF transformer? I would assume the ESF service transformers are equal size for all six service transformers?

MR. TAJADDODI: They are equally sized.

MR. KREUTZIGER: Is there a spare that has been purchased at this time?

MR. TAJADDODI: To the best of my knowledge, there is no spare.

MR. KREUTZIGER: So an outage of one service transformer would result in a tech spec limit on continued operation?

MR. BINGHAM: Karl, I believe -- put that on the list to check. I believe we have purchased one spare ESF transformer. I know we have purchased one spare.

MR. BARROW: John Barrow. During this outage that Karl hypothesised, where you lose the ESF service transformer, is that situation when you are powering both ESF buses off of one transformer, does the diesel generator on the bus that has lost its own power supply -- is it run during that period of time?

MR. TAJADDODI: No. As long as there is power in here,

the diesel generator is not started.

MR. ROSA: And that is in accordance with 1.93, reg guide 1.93?

MR. TAJADDODI: 1.93 does not tell you to bring in the offsite power with your diesel generator on.

MR. ROSA: I think if you lose your immediate access offsite power circuit, your diesel will come on automatically.

MR. TAJADDODI: But it will not be connected.

MR. ROSA: It should. If the other one is a manual.

MR. TAJADDODI: If there is power from here, this will start but the operator can connect it in here. If there is voltage in here, you cannot close this breaker. It will be interlocked.

MR. KREUTZIGER: But Fred, I think Faust's question is: we are hypothesising there was a fault on the ESF service transformer. That will result in a protection to trip off the power supply to that ESF bus.

MR. TAJADDODI: You are hypothesising that there is a fault in here or on the transformer?

MR. ROSA: On the transformer.

MR. TAJADDODI: If there is a fault in the transformer, there will be loss of offsite voltage in here detected.

MR. FAUST: That would start the diesel generator.

MR. TAJADDODI: Under that condition, yes. The under voltage relays are going to initiate starting the diesel generator. That is true. But if there is such that -- if the operator anticipates that there is not going to be power in here, we can have power in here without letting the diesel generator be connected here. If there is no action on the part of the operator, if the operator does not take any action, the under voltage relays are going to start a diesel generator and start a sequencing of the loads. If the process is created by the operator closing this breaker in here, then this diesel generator cannot be closed.

MR. ROSA: I was postulating a failure that would deenergize the bus. In which case, the diesel would come on automatically and connect to the bus. The operator can then restore offsite power by this other circuit manually.

MR. TAJADDODI: If he takes the action at a later time -- at a much later time -- he can disconnect the diesel generator and connect this breaker here and isolate the diesel generator.

MR. ROSA: I guess what has to be brought out clearly is the fact that should you lose voltage to that bus, offsite power voltage, the diesel would start automatically and

connect to the bus automatically.

MR. TAJADDODI: That is true. Automatic operations, that is true.

MR. VAN BRUNT: Faust, you are all set.

MR. ROSA: Yes.

MR. VAN BRUNT: Anybody else have any questions.

MR. BINGHAM: Could I ask that the panel identify themselves, please.

MR. VAN BRUNT: Bill, I noted in your presentation series, you are talking about electrical independence and redundancy and etc. Are you somewhere going to talk about independence between mechanical systems and electrical systems? If you are not, I would like to ask a couple of questions now. If you are going to get into that later, I will just wait. Are you going to talk about separation of the "A" train and the "B" train mechanically and electrically or are you just going to talk electrically?

MR. TAJADDODI: I think we are going to cover it to the extent that the mechanical things have any pertinence to the discussion, yes, but we are not going to emphasize the mechanical equipment per se.

MR. VAN BRUNT: I will wait.

MR. BINGHAM: Why don't you ask the questions now and we will make sure we address them as we go through.

MR. VAN BRUNT: What I was interested in is the degree of separation you have between the electrical systems and mechanical systems on the same or different trains. In other words, do you mix up an "A" electrical system with a "B" mechanical system so that you can get a cross failure or something.

MR. BINGHAM: We will talk about that. If we have --

MR. VAN BRUNT: I will get the specifics.

MR. TAJADDODI: If you ask a specific question, we will answer it.

MR. BINGHAM: Are there other questions?

MR. VAN BRUNT: Does anybody else have any questions?

(No response)

MR. VAN BRUNT: Go ahead, Bill.

MR. BINGHAM: Go on with single failure criterion.

MR. TAJADDODI: This is exhibit 2B-1, conformance with single failure criterion. The requirements of the single failure criteria are such that during a fault, a single failure, the two ESF buses do not get jeopardised. The design of the PVNGS can be noticed in here if we hypothesize any kind

of failure or fault to any one of those groups is such that under any conditions, one load group does not affect the other one. The distribution system independence is also such that all of the electrical systems distributing power to the load groups are completely independent and they are capable of supplying power completely, physically separate, and electrically isolated per the requirements of 1.75 and IEEE 384.

This is exhibit 2B-2. Further requirement, distribution system capability. The capability of the system is such that it is able to provide power to start and operate all of the loads for each load group of the unit. The size of all of the equipment is such that they are capable of providing the necessary energy to provide that requirement.

Distribution system auxiliary devices. All of the auxiliary devices pertaining to the ESF load groups are dedicated to that load group that they are supposed to monitor and control and actuate. There are no auxiliary devices that are shared by two load groups. They are all independent.

This is exhibit 2B-3. The requirements are such that if there are any non class 1-E cables or equipment being served from the class 1-E system -- isolation devices not only being class 1-E but being housed in class 1-E structures -- are provided in our design. We have some non class 1-E feeders

being fed from the class 1-E feeders. They are provided with an isolation device which are breakers which trip on SIAS and/or fault conditions. Those breakers are housed in class 1-E structures.

Parallel operation, if there is any parallel operation requirements per 1.6. There is no parallel operation on standby power supplies in the Palo Verde design. The only time that we parallel is during testing with the offsite power source and there is no parallel operation of the two units with the exception, again as I said, of manual operation under administrative control where the operator has the option of providing power to this bus through one of the ESF transformers. That is the only time you parallel the two systems. But that is not a normal source of operation. That is manual, and there is no automatic parallel operation. (Referring to exhibit 1-5).

This is exhibit 2B-4, manual interlocks. There are manual interlocks provided within the ESF load groups such that the onsite and offsite power sources do not interact. There are interlocks between the onsite diesel generator breaker and the two breakers providing power from the preferred source such that the diesel generator breaker cannot be closed into the bus if either of these two breakers

are in closed position. There are also interlocks between these two. There are additional interlocks such that we cannot provide paralleling with the offsite power source when you are operating on this breaker. You can only paralled with this source of power during testing.

Isolation devices requirements per 1.75 are such that to have a qualified isolation device for the power circuit, the breakers have got to be actuated on signals other than fault currents. It provides that the breakers be tripped on an SIAS signal and they are class 1-E breakers housed in class 1 structures.

This is figure 2B-5. The requirement is that a redundant load group be in separate safety structures and be completely isolated. We have shown in figure 1-3 and 1-4 that the equipment pertaining to the load groups are completely isolated in separate structures separated by the three hour walls and they meet that requirement.

The diesel generator building in figure 1-4 shows that this requirement is met by providing the two special structures for the two redundant diesel generators. There are dedicated panels and equipment.

The associated circuits requirements per reg guide 1.75

is that associated circuits be treated as class 1-E up to isolation devices and after the isolation devices they are treated as non class 1-E. In some cases, like the instrumentation and control systems where this cannot be done, we provide analysis and show that the effect of any fault cannot jeopardise the class 1-E portions. Those are identified uniquely and they are routed in the class 1-E raceways.

MR. VAN BRUNT: Fred, could you give an example?

MR. TAJADDODI: We have associated circuits and instrumentation where we are keeping the safety equipment status panel. In those areas we have got some associated circuits that are -- since the SESS panel is non safety, we have got a few circuits which are associated and they are identified by proper color coded cables and they are routed such that they are treated as class 1-E and an analysis will be presented in due course of design. There are very few cases where we have associated circuit instrumentation systems. We do not have anything in the power circuits. They are all black. They are not class 1-E after leaving the isolation device. But in some cases we have associated circuits instrumentation systems.

This is figure 2B-6, the routing of the redundant

circuits. One of the requirements is that redundant class 1-E circuits not be routed in tunnels. We do not have any tunnels in the Palo Verde design. We do have some areas, some corridors at Palo Verde, where we are taking appropriate measures to make sure that the redundant raceways and cables maintain their integrity with proper design of these barriers and other means that we will go into in greater detail later on.

The shared systems requirement. We do not have any shared systems within the units or between the load groups of each unit. Each unit is independent, completely independent. The load groups of each unit are completely independent. As you can see, we do not share class 1-E systems. The class 1-E systems are all dedicated. There is no interconnection between the class 1-E systems of each unit. Each of the buses are feeding the loads of that load group and are completely independent. There are no interconnections between the buses. There are no interconnections between the units of the buses and they are completely dedicated.

MR. BINGHAM: Any questions?

MR. ROGERS: Carter Rogers. On Exhibit 2B-5, the part about separation, paragraph 8. The statement is made

that redundant equipment is located in separate safety class structures and circuits are provided with adequate separation and isolation. Are you going to address what is adequate in a little bit more detail?

MR. TAJADDODI: The requirements of separation and isolation are delineated in lEEE 384 and Reg Guide 1.75. We did not want to go into detail of IEEE 384. All it says is that we need to separate the equipment in separate structures by three hour walls.

In the case of the raceways, we have five feet and three feet separations, as required. If not; we provide barriers. All of those separations are delineated in IEEE 384 and we do not take any exceptions to them. If there was a specific separation problem, I would like to address that but we are meeting 384 and 1.75 requirements for separation and isolation.

MR. ROGERS: I take it that these are criteria that have been established with regard to design, say from the very beginning. Is that correct?

MR. TAJADDODI: That is correct.

MR. ROGERS: How are these criteria normally presented? Perhaps we should talk about that a little. Maybe this is not the time for that.

MR. TAJADDODI: The detailed requirement, the detailed design of the Palo Verde is actually in our design criteria. It is in our FSAR and in our system description and also is in our drawings. We have got means of finding out specifically in what areas what kind of separation we have and I do not know whether it would be appropriate to discuss the details in this presentation because of lack of time. It would take too much time to go into the details of each area showing how the raceways are being designed, what kind of separation we have, where we put barriers, where do we have covered trays, where we have fire protection and things like that. We try to provide the general concept of how our plant is designed to meet the requirements and we say we do not take any exceptions.

MR. BINGHAM: Fred, why don't we let Dennis just give an overview again. We did discuss this in some detail with the DC review. It probably would be of interest, I think, to the panel and the observers, if we touched on that particular issue and how the design criteria is being implemented.

MR. VAN BRUNT: Bill, I think I know where Carter is coming from. What he is really looking at is the standard

review plans, the reg guides, and all of those kinds of things establish certain criteria. What we are interested in is whether you view those as minimum criteria or what. If it says they shall be no less than eight inches apart, are they always eight inches or are they sometimes ten, twelve, fourteen or whatever?

MR. TAJADDODI: That is the minimum standard.

MR. KEITH: Does that take care of you. I sensed that there is a little more?

MR. ROGERS: That is part of it. Another thing. If you have shown a design of the control building and you have shown the diesel generator building separations. I assume there are separations that is carried forth on other buildings. I am sure that is the case but I think the record ought to show that there are separations not only in your control and diesel generator buildings. If there is any differences in those criteria that you have established in the reg guides and so forth are carried forth in the other buildings. The containment building is a good example. That is one where there there is no easy way to separate. Do you have a good separation criteria in the containment building? I think we need to address that a little bit.

MR. KEITH: Once again, as Fred said, we meet -- in all of our buildings -- IEEE 384 and Reg Guide 1.75. As far as the separation requirements, we started off with a concept -- to kind of address your question on whether we go beyond the requirements -- which compartmentalized the trains, particularly in the control building, the diesel generator building. It compartmentalized train "A" and train "B" to the maximum extent possible. Because of that, in most cases, we exceed the separation requirements because you have train "A" equipment on one side of the building and train "B" equipment on the other side. So, therefore, you can route your cabling so that it does not even some close. There are some areas where we are approaching the Reg Guide 1.75 limitations insofar as the train "A" and train "B" due to some equipment locations.

Your earlier question, maybe now is a good time to talk about that a little. The system which I think is toughest probably as far as separation is the safety injection system where you have requirements on the valves that are fed by the train "A" pump. You have to supply some of those valves with train "A" power and some with train "B" power. In those cases it is sometimes just physically necessary to locate those valves fairly close to each other. Therefore, you get train

"A" conduit running fairly close to train "B" conduit, very close or approaching the Reg Guide 1.75 limitation.

MR. VAN BRUNT: Do you ever get to that minimum?

MR. KEITH: I do not know of any instances where we do. I know we are never less than the limits.

MR. TAJADDODI: Let me say one thing to complement what Dennis said. Since these circuits are run in conduit and the separation requirements of Reg Guide 1.75 and IEEE 384 call for a minimum of one inch, it is hard not to meet that requirement. Two valves are more than one inch apart. So to meet that requirement, we have got separation per Reg Guide 1.75 for conduits.

MR. ROGERS: What do you do inside cabinets?

MR. KEITH: Inside cabinets, there are barriers to separate them. In some of the cabinets we have fire protection, fire suppression systems installed, so we are taking care of that.

MR. VAN BRUNT: Karl?

MR. KREUTIZIGER: Karl Kreutiziger. To what extent has Palo Verde project addressed the separation that is not addressed in 1.75 or 384 with respect to shutdown circuits exposed to fire. What criteria has the Palo Verde project used in these areas?

MR. KEITH: Yes, we are wrestling with the exposure fire. I guess, just general background, the fire protection requirements are generally such that meeting IEEE 384 and Reg Guide 1.75 is not sufficient and the current requirement is such that the trains be separated by at least twenty feet for the exposure fire criteria. We have some trays, train "A" and train "B" trays which are closer than twenty feet. We are installing sprinklers in those trays and there are other requirements that you either have barriers or you wrap them with fire protection materials. We are currently working on that problem. We have identified these areas in our Fire Protection Evaluation Report and the design in these areas is not finalized yet but we are aware of the problems and are working on those problems and we are going to solve it.

MR. VAN BRUNT: Dennis, in this whole area of separation stuff, you might elaborate a little bit on what part the model plays. First, in identifying a lot of these problems and secondly, in solving them. How does that get filtered into the design.

Mr. KEITH: Okay. For general information, we have a design model at our Bechtel offices in Downey for all of the

buildings. It is a large model. It is three-quarters inch to a foot and we have virtually every piece of equipment on that model. We have used that model from day one very extensively.

First, well not first--in the area of high energy line break which gets into separation. What equipment can be affected by a high energy line break. The model, I think, has been invaluable. There are very few of us that can really visualize what an area looks like from looking at three or four different drawings which is really what needs to be done on projects which do not have access to a design model. It is being done on most projects in the United States today but it is a real tough job. I have done it a little bit and have talked to people on other projects. On a three dimensional model, you can see things as they are. It is a great aid.

We have done separation reviews. In addition to considering the high energy line break, we have looked at all of the hazards, fire, flooding, missiles, all of those kinds of things. We have looked at all of those kinds of things at the reviews that we have performed at the model. That was for general information. It is off the track a little bit. We also look at maintenance considerations which gets you

into in-service inspections and those kinds of things. The model is used very extensively to aid us in the design of the plant.

MR. FREID: In figure 1-D --

MR. KOPCHINSKI: There is no 1-D.

MR. FREID: Figure 1-4. In the diesel generator building, you show a double wall between train "A" and train "B" without any barrier in the upper part of that figure. I presume there is a fire barrier there closing off train "A" equipment room from train "B" equipment room?

MR. TAJADDODI: In this area here, we have got a door but we have to check to see if we have a three hour door or barrier in there. This can be an item to be verified. We do not have a ready answer for you at this time.

MR. FREID: Will you check to make sure the door is closed. Also that there is annunciation on that door.

MR. TAJADDODI: We will verify this. We do not have an answer for that. We can check that as an item to be looked into.

MR. FREID: I have one other question. It concerns the potential when you have a failure of the ESF service bus and you have a cross connect between the two trains, train "A"

and train "B". I understand the fact that you have two breakers and from a single failure point of view, you would not connect load group "A" and load group "B". My concern is that you have SIAS going into both breakers, one train "A" SIAS and one train "B" SIAS. Since there is an electrical connection, is there any possibility of actually having a cross connect between the protection systems of train "A" and train "B" through those breakers?

MR. TAJADDODI: The SIAS is not going to do anything but start the loads if the offsite power is available.

MR. FREID: No, at the point where those two buses are connected, is there a potential for a possibility of a cross connect between the protection system of train "A" and train "B" through those breakers?

MR. KEITH: The SIAS signals are -- it is not really correct to call them a train "A" signal or train "B" signal. They all get, you know, intermixed and you have two out of four coming out and then a signal going to train "A" and train "B".

MR. FREID: Is there a possibility of cross connecting the protection system to the two load groups by having a cross connect between load group one and load group two through the

breaker. Is there a fault load that could give you a common mode failure that would cross connect the protection system?

MR. TAJADDODI: The protection system for each breaker is dedicated to that compartment. In other words, all of the protection systems for this load group is in this physical arrangement here. The same thing is true in here. There is no interconnection of wiring.

MR. FREID: But there is -- Where the breaker is out, there is now a physical connection between load group one and load group two and a single failure would, in effect, isolate the two load groups. I understand that. But there is a protection system signal that would open either one of those breakers and presumably that protection signal is in load group one in one case and in load group two in the other case.

MR. TAJADDODI: Right.

MR. FREID: My concern is: is there a way of cross connecting load group "A" and load group "B" once that wire is connected.

MR. TAJADDODI: The protection system is not connected via the power system as shown here. The protection system is confined to the load group that it is dedicated to. In other words, the protection system for this breaker is in here and

there is no connection to here. Only the power lines are interconnected and not the protection system.

MR. FREID: Okay. In other words, is there a fault load on the breakers that could cause an interconnection. That is the question.

MR. TAJADDODI: There is none whatsoever. The protection system is completely independent. Even though the two power lines may be connected, interconnected, the protection schemes are completely independent. They both will sense the same fault conditions. For instance, if there is a fault in here, both of these will be sensing the same fault current and they both will be responding. However, if one of the breakers gets stuck due to a single failure, the other one is going to open. Both will sense the same abnormal condition and they are going to be responding independently. However, if there is a malfunction in one of them, the other one is going to actuate and isolate the system. The protection system is not interconnected. Only the power feed is connected.

MR. FREID: I guess the answer is that a fault in the breaker would not be able to propagate that into the protection relay. There is a relay there that is going to close that breaker on SIAS. There is no fault mechanism in that

breaker that would connect those two--

MR. TAJADDODI: SIAS is not going to close these breakers. The breakers are already closed. It is not going to do anything.

MR. FREID: It would open them. It would open them.

MR. TAJADDODI: No, the SIAS is going to start loading the loads. Only on LOP are we going to open those breakers.

MR. FREID: Only on LOP?

MR. TAJADDODI: That is right. As long as there is power available from the offsite source, we are not going to open breakers. We are going to sequence the loads on the bus. You are going to start a diesel generator but it is going to be idling. It is not going to do anything.

MR. FREID: Under item 7, it says isolation devices are actuated by SIAS. What isolation devices are you referring to?

MR. TAJADDODI: Item 7?

MR. FREID: 2B-4, item 7.

MR. TAJADDODI: These are not isolation devices. Isolation devices are those devices that are providing a link between the class 1-E bus and the non class 1-E loads.

Let's say, for instance, that you have a non class 1-E motor connected to this load center here -- to this switch here, excuse me. The breaker will act as isolation device. That isolation device, in order to meet the requirement of the isolation device has got to trip on SIAS to isolate the non class 1-E system from the class 1-E system. Those are isolation devices. These are not isolation devices. These are part of the system.

MR. FREID: Aren't they isolating the offsite from the onsite systems.

MR. TAJADDODI: They can do that but they are not, per se, called isolation devices. Every breaker is an isolation device.

MR. FREID: And they only go out on loss of offsite power.

MR. TAJADDODI: The only time these breakers are tripped are when the relay on the bus, senses an undervoltage condition, sends a signal for these breakers to open and they start the diesel, close the diesel generator breaker and start loading. That is the only time when you open breakers. Otherwise, if the power is available from the offsite source, there is no sense in opening the breakers.

MR. FREID: The question came from a misunderstanding of what we were defining as the isolation device. I was thinking it was the four breakers above the 4.16 KV buses.

MR. TAJADDODI: No, these are not isolation devices. I mean --

MR. FREID: They are but not --

MR. TAJADDODI: They can be isolation devices but within the definition of 384 and 1.75 what would be called isolation devices are those devices that separate the class 1-E from the non class 1-E systems to make sure that the non class 1-E is not going to jeopardise the class 1-E system. In order to do that, you have got to have an element which is reliable and you can isolate this system and those are the class 1-E breakers which are actuated by SIAS.

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

MR. ROSA: Figure 2B-5, item 9. I wonder if you could clarify that statement on the right about associated circuits. Let me give you what I got from the last time you addressed that. Those associated circuits do not have isolation devices. First of all, only instrumentation type circuits --

MR. TAJADDODI: Instrumentation and control.

MR. ROSA: They do, however, have the normal overcurrent protective devices?

MR. TAJADDODI: Yes.

MR. ROSA: Are those associated circuits class 1-E all the way down. I assume they are not?

MR. TAJADDODI: They are going to be treated as such and they are going to be identified as such.

MR. ROSA: They are going to be treated as class 1-E all the way down to the end component?

MR. TAJADDODI: Or they are going to be analyzed.

MR. ROSA: Or they are going to be analyzed.

MR. TAJADDODI: Yes, either of these two.

MR. ROSA: Your analysis then will demonstrate that given a short circuit on those circuits, it will not --

MR. TAJADDODI: It will not jeopardise the class 1-E.

MR. ROSA: Even if it were sustained by failure of the overcurrent protective devices that would not jeopardise the class 1-E source.

MR. TAJADDODI: We have to. We have to demonstrate that by analysis.

MR. VAN BRUNT: John.

MR. BARROW: John Barrow. A little bit further along

this line. Aren't the only ones of those that we have identified right now on the SESS?

MR. TAJADDODI: To the best of my knowledge, the only associated circuits are going to SESS panels. We do not have any other. The other pieces of equipment are either completely non class 1-E or are class 1-E. There are only a few circuits that are going to SESS systems that fall in that category in which we have to do some analysis or identify them as such.

MR. VAN BRUNT: Does anyone have other questions? John Barrow.

MR. BARROW: I have another question. Going back to separation, could you discuss a little bit about the way you obtain separation going into the control room?

MR. TAJADDODI: Yes. In the Palo Verde design, we have two separate cable spreading rooms feeding the redundant--the control room. We have a train "A" spreading room at the top and train "B" at the bottom. So they are completely separated. The cable for each train is routed to its dedicated train. If it is "A" train, it will be routed to the top and if it is "B" train it will be routed to the bottom. So it maintains the separation requirements that are dictated by the appropriate standards.

MR. VAN BRUNT: How is that handled when they come down from the spreading room or up from the lower spreading room and go into the cabinets. What separation do you have in the cabinets?

MR. TAJADDODI: The separation in the cabinets?

MR. VAN BRUNT: Yes. In some of the cabinets you have got instrumentation for the "A" train and "B" train very close together so how do you maintain adequate separation down through the cabinets once you have come through the ceiling or floor?

MR. TAJADDODI: We try to maintain a six inch separation. If we cannot maintain a six inch separation, we put a barrier. If you are talking about inside the cabinets.

MR. VAN BRUNT: Outside the cabinets, within the control room, before you get into the cabinets?

MR. TAJADDODI: They are routed in raceways. They are either in enclosed raceways or we have met the separation requirements, the minimum separation requirements that are dictated in 384. If not, they are enclosed raceways or we will put barriers up there. Let me go into some detail about what you asked. First of all, as I just mentioned to you, we have two cable spreading rooms. The separation

is obvious. At the channel level, we have separation either by enclosed raceways or when going into the cabinet, as I mentioned, we maintain that separation all the way through. If, for instance, inside the cabinet, we cannot maintain the six inch separation, we provide barriers. But outside of the channel level, the circuits are brought to enclosed raceways. So we have the separation, the minimum separation, requirements as dictated by the Reg Guide 1.75 and IEEE 384 that maintains the necessary separation at the channel level as well as the train.

MR. VAN BRUNT: I understand what you are telling me now. As a general statement, with the exception that Dennis mentioned before, where we have some valves that come close together, we basically have physical separation on all of the electrical systems except when we get into the cabinets.

In the cabinets, it is possible that there are areas where we counted on distance and not physical separation. But everywhere else we have physical separation either by concrete walls or some kind of enclosed conduit or whatever.

MR. TAJADDODI: Even inside the cabinets, we try to maintain six inches. If we cannot maintain six inches--

MR. VAN BRUNT: If you get more than six inches, you

don't have physical separation.

MR. TAJADDODI: If I have got more than six inches.

MR. VAN BRUNT: You don't put barriers.

MR. TAJADDODI: That is right. Only when you are less than six inches, that is where you put the barrier.

MR. VAN BRUNT: So there are some areas where you do not have physical separation?

MR. TAJADDODI: That is correct.

MR. VAN BRUNT: And in those cases, you are equal to or exceed the minimum requirements.

MR. TAJADDODI: That is a true statement.

MR. KEITH: Let me clarify just once again. The physical separation that we have, we meet the physical separation for 384. We do not in all cases meet the physical separation requirements to meet the fire protection requirement but we are working on that problem.

MR. BINGHAM: Any other questions?

MR. VAN BRUNT: Anybody else got any questions? I was going to suggest that we give the Reporter a break, that we take a five minute break. If you have a question that we can kill off now, let's take it now.

MR. KREUTZIGER: Karl Kreutziger. Exhibit 2, manual

interlocks, item six. Would you clarify the manual interlocks on the diesel generators with incoming supply breakers?

MR. TAJADDODI: Yes. The interlocks that are provided are interlocks between the breaker and the offsite breaker here. You can never close the diesel generator breaker when the breaker feeding the offsite power source to the bus is closed or even this breaker. Either of these two breakers in a closed position would prevent you from closing the breaker in the bus.

MR. KREUTIZER: That was my--how do you get parallel on the test?

MR. TAJADDODI: On test, you are allowed to parallel in the mode that you have the offsite power available. You cannot parallel with this breaker closed. That is not permissible in this scheme.

MR. KREUTIZER: You said initially--prior to that statement, you said that either breaker, either offsite breaker when it is closed, you cannot close the diesel generator breaker?

MR. TAJADDODI: That is right.

MR. KEITH: Automatically.

MR. TAJADDODI: Well, even manually you cannot close this one here. Manually you can close only by synchronizing for testing. Automatically you cannot close this breaker when these two are closed, when either of these two are closed.

MR. KREUTZIGER: You are talking about the EFS sequencer automatically closing the DG generator breaker?

MR. TAJADDODI: This has nothing to do with the sequencer. The breaker, contact breaker, cannot close when either of these breakers are closed. It has nothing to do with sequencer.

MR. KREUTZIGER: The question I have; you have a synchronizing switch, right?

MR. TAJADDODI: Yes.

MR. KREUTZIGER: If you place that synchronizing switch in the position to monitor the incoming voltage for that side and the bus voltage for that side?

MR. TAJADDODI: Yes.

MR. KREUTZIGER: Is that what you call the interlock? In other words, with the synchronizing switch in the position to monitor the incoming voltage to the bus from the offsite and the diesel generator voltage, then you can manually close that breaker?

MR. TAJADDODI: Yes, but I would like to emphasize that the only time we can do that is with this breaker. We cannot parallel the diesel generator to the offsite power during testing with this breaker being closed. It will not allow paralleling with this breaker. You are only allowed to parallel with this breaker.

MR. KREUTZIGER: No synchronizing at all can exist when you have the alternate supply?

MR. TAJADDODI: Right. You cannot synchronize with the alternate supply.

MR. KREUTZIGER: Therefore, in the situation we talked about earlier where you had lost the ESF service transformer and you wanted to regain power to the bus, you could not parallel?

MR. TAJADDODI: No.

MR. KREUTZIGER: You would have to have a dead bus transfer. You would have to trip off the breaker to the diesel and then close the breaker from the offsite source.

MR. TAJADDODI: That is right.

MR. VAN BRUNT: John.

MR. BARROW: Just one quick question. The DG generators are not allowed to be paralleled. However, what is to keep

an operator from connecting first the load group one diesel generator to the offsite system through its normally closed breaker and then the load group two diesel generator through that breaker? You would have them paralleled by having them both connected to the offsite system?

MR. TAJADDODI: I just mentioned that you cannot parallel the diesel generator through the alternate breaker.

MR. BARROW: I am not referring to the alternate. I am talking about with a normally closed breaker in both cases, you end up having them paralleled through the startup transformer.

MR. TAJADDODI: The startup transformer?

MR. BARROW: Yes. You end up getting paralleled all the way back here.

MR. TAJADDODI: There is no way you can do that.

MR. BARROW: You just said through the switchyard. You can parallel the diesel generator with the offsite system manually.

MR. TAJADDODI: Right.

MR. BARROW: Now, suppose you did that. Is there anything to keep the operator from -- now that the diesel generator is pumping power out on to the grid -- connecting load group

two diesel generator to the grid also?

MR. TAJADDODI: Through this way?

MR. BARROW: Yes.

MR. TAJADDODI: There is a possibility, yes. You can do that.

MR. BARROW: Doesn't that violate 1.6?

MR. TAJADDODI: That will not violate 1.6 because the failure has got to be within this one here. If you have got a problem with a source in here, okay? You can go through the grid and come back, if that is what you mean by paralleling because we have got a shared switchyard. Having a shared switchyard is allowable.

MR. BARROW: Okay.

MR. TAJADDODI: You are talking about providing power to the switchyard and the switchyard breaker being aligned while you are also testing. But the thing is that you are not allowed to test two diesel generators at the same time. Okay. You are only allowed to test one diesel at a time. You cannot test both diesels simultaneously. But physically that is possible to do. You have administrative controls to prevent testing both diesel generators simultaneously.

MR. BARROW: There are no interlocks to prevent that.

MR. TAJADDODI: That is only done through administrative control. You are not allowed to test both diesel generators simultaneously.

MR. VAN BRUNT: Okay. If there are no other questions at this point, let's take a ten minute break until quarter of.

(Whereupon at 10:35 a.m. a recess was taken.)

MR. BINGHAM: Let's continue with item "C", standby and preferred power systems independence.

MR. TAJADDODI: This is figure 2C-1, requirement for standby and preferred power systems independence. The independence of preferred power systems are maintained by the fact that we have got four undervoltage relays in each bus to sense the lack of voltage when the offsite power is not available and to start a diesel. When the offsite power is available, there is no connection of the diesel generator to the bus by virtue of the fact that there is no initiation of the voltage relay. This scheme provides for the fact that both of these are going to be independently providing power to the systems--not simultaneously. That avoids the interaction between the onsite and offsite power.

As soon as there is a loss of offsite power, the

undervoltage relay actuates the sequencer to start the diesel generator, closes the diesel generator breaker, and starts sequencing the loads in the preferred sequence.

This is figure 2C-2, preferred power supply function. The function for each power supply is to provide loads to the class 1-E systems, in addition to providing non class 1-E loads when you are starting the plant. You see when you start the plant, the start up from the preferred power supply also provides power to the non class 1-E sources by closing this breaker.

As soon as power is provided to the non class 1-E systems, the turbine generator is available. The preferred power supply becomes totally dedicated to the class 1-E systems.

Figure 2C-3, requirement for preferred power supply capability. The equipment forthe class 1-E system for the Palo Verde generating station is sized in such a manner that it is capable of providing the necessary power to start the loads and operate the necessary equipment.

The common failure mode requirement per IEEE 308 is such that the operation of standby and preferred power sources interlocks negates the possibility of having a

common failure mode because of the fact that the equipment is qualified as class 1-E and all of the procedures are followed to make sure that there is no common mode failure.

This is figure 2C-4, protective devices requirement. All of the class 1-E systems have the capability of being monitored in the control room by having annunciation and being alarmed in the control room if there is an abnormal condition. The operation of all of the breakers and the start of the diesel generator is all monitored in the control room and any abnormal conditions are also annunciated and alarmed so that the operator can keep track of the system continuously.

The automatic transfer. We have mentioned before that there is no automatic transfer of loads between the units and between the load groups of each unit.

This is figure 2C-5, isolation of offsite power. The manner in which we isolate the preferred source from the onsite is by the actuation of undervoltage relays by two out of four logic of the relays. We open the breakers incoming to the bus and we start the diesel and close the diesel generator breaker into the bus. That is the manner in which we provide isolation of offsite and onsite power.

MR. BINGHAM: Any questions?

MR. VAN BRUNT: Faust.

MR. ROSA: That no automatic transfer, I understand that is for the class 1-E loads but do you have an automatic transfer between the auxiliary transformer and the startup transformer in the event of turbine trip?

MR. TAJADDODI: Yes, we do.

MR. ROSA: For the normal loads?

ME. TAJADDODI: We do have automatic transfer from here to here to maintain the RCP's and that sort of thing. We don't want to go into detail now unless there is specific questions. We do have automatic transfer of auxiliary bus to the startup bus if there is failure of the auxiliary transformer.

MR. VAN BRUNT: Does anyone else have a question? Karl.

MR. KREUTZIGER: Karl Kreutziger. I have a question. Your undervoltage relays, do they sense a voltage degradation that is something less than normal but not at a trip set point of low voltage. For example, in your low voltage conditions, you will have low voltage that occur on buses when you start large motors for momentary periods, short periods of time. Are they induction relays or a set of instantaneous trips.

MR. TAJADDODI: The relays that are used on the Palo

Verde are induction disc relays with inverse characteristics. So they can sense both instantaneous loss of power and degraded conditions as a function of time. In degraded conditions, the time required to trip the breakers is longer than the one you have for an instantaneous loss of power. So you have a continuous spectrum of time versus voltage conditions which we can actuate the voltage relay. If you have an extended period of degraded voltage on the bus, the induction disc relays are going to actuate the tripping of the breakers and starting the diesel.

MR. FRIED: One question. If you lose a bus and you put the diesel generator on, does it automatically start the sequencer as soon as the undervoltage is sensed and the diesel generator comes on?

MR. TAJADDODI: No, the sequencing of the loads will start as soon as the diesel generator breaker closes.

MR. FRIED: Would it close on the undervoltage alone or does it need another signal to close?

MR. TAJADDODI: No undervoltage condition by itself is going to actuate a full shutdown mode of load sequencing and you don't need a, SIAS or any other kind of signal to do the sequencing.

The sequencer will only function on the LOP which will close the diesel generator breaker. After closing the diesel generator breaker, the sequencing of the load starts.

MR. FRIED: The question I am really trying to get to is that if there is a loss of one bus, does it automatically drop the other bus out?

MR. TAJADDODI: This bus here? No.

MR. FRIED: Is there any problem with one bus going through sequencing start and the other still in its normal mode. Is there a potential for balance being in the wrong direction on two load groups because one is going through a sequencing and the other is standing in its normal operating mode?

MR. TAJADDODI: You will not have an abnormal load in that condition on the other load group to begin with. The one load group is going to initiate your full shutdown load.

MR. FRIED: Is there any operational problem with one load group in its normal operating capacity and the other going through the sequencing? The operator is in the control room and all of a sudden one of its load groups is running through a sequencer and the other is in a normal configuration.

Have we checked to see that valves and redundant trains are not in opposite configurations because of it. I guess that is the real question I am asking.

MR. TAJADDODI: I think --

MR. BINGHAM: Excuse me. Could you try it once more because I am not sure I understand, Shelly.

MR. FRIED: We lost one bus. We closed that diesel and we started a sequencer. We put certain operations on in a certain sequence. The other bus, nothing has happened. It is in the configuration the plant was in at the time it was running. Is there a possibility that because of the one load group running in sequence and the other is running in a normal operation that we can have different load groups redundant components in opposite configurations because of it?

MR. BINGHAM: One moment please.

MR. VAN BRUNT: Let's go off the record.

(Discussion off the record.)

MR. VAN BRUNT: On the record.

MR. TAJADDODI: Under that condition, the valves are not affected because under the full shutdown mode, there are no valves that are going to be actuated.

MR. KEITH: Excuse me. Let me clarify something. The sequencer does not actuate the valves, period, under any

conditions. The sequencer does not actuate valves. The valves have to get a signal.

MR. FRIED: Valves was an i.e., for example, I just wondered if the operational configuration was normal because one is going through the sequencing and the other is not, does it cause an operational problem?

MR. TAJADDODI: You can consider it the same as one of the loads being disabled and you rely on the other to do the job.

MR. FRIED: It was not disabled. One load group was doing one thing and the other load group was doing something else. Could that cause an operational problem.

MR. BINGHAM: Our answer is no, Shelly. We can investigate it further.

MR. VAN BRUNT: I think you ought to. As you know the sequencer has a number of different modes of operation and I do not think that any of us here can visualize all of the combinations that might be involved in what Shelly was suggesting. I would like to ask that you go back and check this particular question and be sure that we do not get ourselves into some kind of situation by the sequencer doing something that is inconsistent with what the normal operating

train is doing.

MR. BINGHAM: As I understand it, there is no other event other than loss of power to one bus.

MR. FRIED: Right.

MR. VAN BRUNT: Go ahead. Are there any other questions.

(No response.)

MR. BINGHAM: If there are no further questions on that, let's move on to item "D", standby power supplies.

MR. TAJADDODI: This is figure 2D-1, standby power supplies, the general requirements are that the standby power supply must have sufficient capacity and capability to provide power to the loads.

The PVNGS design has got equipment -- the onsite power supplies, the diesel generator is sized such that the capacity is adequate to provide power to all of the loads and it is bigger or equal to the sum of the name plate and running loads that are required for mitigating the consequences of an accident. The specific requirements of the standby power supply is that all of the necessary auxiliary equipment that is required to support the diesel generator are connected to the dedicated load group. Each diesel generator has its auxiliary equipment to function independently without being

affected by the other.

This is figure 2D-2, the standby power supply function. The function of the diesel generator is to provide power to the class 1-E load only when the preferred power supply is not available. That is what the sole function of the diesel generator is. The standby power supply availability and the diesel generator is started on loss of offsite power by actuation of the four undervoltage relays and it is readily available after the actuation of the undervoltage relays.

This is figure 2D-3, standby power supply capability. The power supplies are completely independent such that the possibility of a single failure jeopardising both of them is not available. In other words, there is no way that you can have a single failure between the power supplies of the diesel generators.

The power supply, standby energy storage is such that the diesel generator provides enough fuel for a long time to provide the necessary energy to bring the plant to a safe shutdown or to mitigate the consequences of an accident. We have a tank which supplies energy for seven days which is adequate to bring the plant into a safe condition.

MR. VAN BRUNT: There is a tank for each diesel generator?

MR. TAJADDODI: There is a tank for each diesel generator and there is also a day tank. The base tank is for seven days for each diesel generator.

MR. VAN BRUNT: Is there a cross connection between the tanks?

MR. TAJADDODI: Yes, there is.

This is figure 2D-4, diesel generator load rating. The rating of the diesel generator is such that it is sized very conservatively to carry the name plate and/or brake horsepower loads of all of the equipment that is necessary to function during an accident. There is enough margin in the diesel generator presently to be assured that the diesel generator is sized appropriately for the loads that are required to do the function.

The start and accelerate capability of the diesel is such that the diesel is required to be brought up to speed and voltage in a specific period of time. At no time should the voltage and frequency be less than 75% and 95% respectively during the loading sequence. At any time you have got to maintain at least 75% voltage on the bus during sequencing and 95% of speed while you are accelerating the loads.

This is figure 2D-5, diesel generator speed. The setting for the diesel generator speed has got to meet two requirements.

Either it has to be set not to exceed 115% of nominal speed or be set such that it should not exceed 75% of the difference between the nominal and the overspeed set trip whichever is smaller. The test results on the diesel generator have shown that these requirements are met. I believe that right now we are set 115% of nominal speed for the overspeed condition.

The voltages and speeds during sequencing should also be such that during each sequence interval the voltages should not exceed 10% of nominal and frequency should not exceed more than 2% at each step of the sequencing for each 40% of each load sequence interval. In other words, at each interval of sequencing, the voltages should not exceed 10% and frequency should not exceed 2% of the rating.

This figure 2D-6 states the qualification, the reliability of diesel generator and our test results for the Palo Verde plan shows that we meet the requirements as stated in this figure. There is full compliance and in some areas we meet more than these requirements for the diesel generator qualifications.

The use of diesel generator sets for peaking, ICSB-8. You are not supposed to use diesel generators for peaking.

We use them only for providing power to the class 1-E loads. The only time that we have got a condition that might not be used for a class 1-E load is for testing of the diesel generator where we parallel the class 1-E diesel generator with the offsite power.

This is the figure 2D-7, automatic sequencing, requirement from CESSAR. The sequencing of the loads are done in accordance with CESSAR table 8.3.1-4 and those requirements are met. Also the maximum time allowed to close the diesel generator breakers after a signal should not exceed twelve seconds. Our test showed that we exceed that requirement. We can provide power to the Class 1-E loads in less than ten seconds. Also, we meet the requirements of sequencing all of the loads on ESFAS signal and the shedding characteristic of the load and the sequencing of the remainder of the load per the requirement of CESSAR section 8.3.

This is figure 2D-8, automatic sequencing. Again this is a continuation of the previous slide. It requires that when the generator is running and the sequence time for these loads are such that within five seconds we can provide power to the load and we can meet the flow rates as required per CESSAR, the maximum delay in flow rate is 13 seconds

and I5 seconds. We exceed that requirement as we can see. We can provide power within 10 seconds of loss of power from offsite sources.

This is figure 2D-9, continuation of automatic sequencing requirement from CESSAR. If there is an offsite power source available and the ESFAS signal is received, the diesel generator must be started and be run for at least one hour. The design provides for that requirement and we are in full compliance with CESSAR requirements.

If the offsite power is the source of power when ESFAS is generated the loads shall be started by sequencing. The sequencer starts the loads when offsite power is available.

This is 2D-10, standby power supply controls. The operator in the control room has got the option of manually or automatically starting any loads appropriate to the function and the safety of the plant. He has a means to disconnect, start and load the diesel generator per the IEEE-308, as stated in this figure here.

This is figure 2D-11, thermal overload protection. In the design for Palo Verde, we provide thermal overload protection by bypassing the thermal overload during an SIAS. This is a requirement of ICSB 27, one of the requirements. This

is the option we have chosen to adopt.

MR. BINGHAM: Are there any questions on this section.

MR. VAN BRUNT: Anybody got any questions.

MR. FREID: The HVAC system to the diesel is totally separate. Correct?

MR. TAJADDODI: The supporting systems for the class 1-E systems are dedicated to that particular train, yes.

MR. FRIED: You mentioned auxiliary and I just wanted it on the record that everything, in fact, including HVAC was totally separate.

MR. TAJADDODI: Everything, including HVAC, which is part of the supporting systems are dedicated to that particular train.

MR. VAN BRUNT: Carter.

MR. ROGERS: Carter Rogers. I have questions pertaining to the diesel generator fuel oil ystem. Maybe someone else from Bechtel might want to help you.

MR. BINGHAM: Direct the question to me, Carter, and I will get the right person to answer it.

MR. ROGERS: Now, I understood from your presentation that there is a day tank. The day tank is located where for each diesel generator?

MR. KEITH: In the diesel generator room.

MR. BINGHAM: It is right in the room itself.

MR. ROGERS: Now there are other tanks associated with the fuel oil supply. Can you describe those?

MR. BINGHAM: There are two large tanks buried in the ground outside the diesel building, one for each unit. These are the seven day tanks. There is a common tank located out in the water reclamation area that is about a thirty day supply that is used to feed those tanks.

MR. ROGERS: I was told that there is a cross connect between the seven day tanks. Is that correct?

MR. BINGHAM: It is possible to do that. It is an isolated system.

MR. ROGERS: How do those cross connects work. Say that there is a failure to one of the diesel generator systems. Can you pump from either tank in that case. How is it hooked up electrically? Or can you?

MR. TAJADDODI: There is no electrical connection.

MR. ROGERS: You have pumps on the buried tanks, do you not?

MR. BINGHAM: Yes, you do. Carter, we will have to confirm it. My recollection is through administrative controls

you can transfer from one tank to another.

MR. VAN BRUNT: Where does the power source come from to transfer? Does it come off the diesel that the tank is associated with or how does that work so that you have an adequate electrical supply?

MR. KEITH: As I recall, we have two transfer pumps, one off of train "A" and one off of train "B" and I believe we have it piped up so that either pump can take a suction from either tank--I will have to verify that--you know, and pump through the other tank.

MR. VAN BRUNT: That would be an open item.

MR. KEITH: Yes.

MR. VAN BRUNT: Any other questions?

(No response.)

MR. VAN BRUNT: Fred, you talked about the diesel generator and you have margins over all the loads and so forth. How much margin have you got. These are 5500 KW diesels, as I remember.

MR. TAJADDODI: We can show that on our backup slide. (FSAR table 8.3-3). I will show you exactly how much margin we have.

Right now the total load on the diesel generator under the worst condition, which is a LOCA load is about 3751 for train "A" and 4640 for train "B". We have got about 15.6 percent margin in the worst case.

MR. VAN BRUNT: The second question I have is: I note that a number of the criteria or requirements under the diesel come out of CESSAR. Is that correct? How is that information being transmitted to you? How does that get implemented into the design? What, if any, responsibilities for review of the implementation of those criteria or verification that you have, in fact, interpreted or implemented or whatever you want to call it, those requirements properly? That is the first part. Second, there may be requirements for the purchased equipment that gets tied to the diesel bus. Say, motors that you buy or something or other where the motor vendor may specify a certain requirement that then have got to be fed back into the design of the diesel system. How does that get implemented into the design process. What kind of cross check do you have on that?

MR. BINGHAM: Let me take a stab at the first one. With regard to the Combustion Engineering interface requirements we do mention CESSAR. There are also other documents and ways that information is transmitted to us. Let's take this one in particular. This is the manner in which they required the loading of the loads that they have. That information is

put into our drawings and also into our design criteria. That particular information is transmitted to Combustion Engineering for review. They review it formally and respond to us with comments and their concurrence that we have interpreted their intent, the intent of their requirements properly,

MR. VAN BRUNT: Does that get re-done if there is some change in the requirement.

MR. BINGHAM: If there is a change in the requirements, there is a system set up to insure that the change is reviewed and incorporated in the design.

MR. VAN BRUNT: How about other vendors?

MR. BINGHAM: Other vendors, there are similar ways although not as formal as the CE way with the interfaces that become part of the regulatory requirements. A vendor will say, give us some motor data sheets or give us a particular load for a pump. We will incorporate that into the design and independently will check that thru review in our own house. The information, in some cases, will go back to a vendor. We just had a recent example with the auxiliary feedwater pumps. Through our reviews, we did uncover that there was an inconsistency between what we had specified and what the paperwork said was the case. As it turns out, the

hardware was satisfactory. It was just that there were some inconsistencies. In our own house and thru, of course, review with your people, we do pick up in that procedural area.

MR. VAN BRUNT: Following on to this, up to now in the DC power system review and in this system review where we are talking about electrical items, the diesel generator is really the first what I would call mechanical electrical device that we have talked about. So you have an interface here to a mechanical device or an electrical device. How is that interface handled with the specifications. Who takes care of that interface? Do you look at that or is that left to the diesel generator manufacturer and this kind of thing. Then I want to carry that over into driven equipment where you are buying driven pumps. There are some specific questions in that area.

With the diesel, how does the mechanical electrical interface of a, as I understand it, packaged item that has been purchased, the diesel generator, from a manufacturer, how is that electrical mechanical interface handled?

MR. BINGHAM: The specification, of course, is set up for supplying one diesel generator that will meet all of the established criteria. That is, be able to start within a certain time, provide a certain amount of power, have certain

electrical characteristic with it. Actually, we specify mechanical characteristics that we desire also. Based on experience that we have from other plants and from the requirements that are necessary, that information then is used by the particular supplier to integrate the total system. That is to assure that the diesel, for example, matches the generator that is supplied and that the control equipment that is used to start it, synchronize it, essentially monitor all of the perimeters is integrated.

Generally, what we do is go to a proven vendor of diesel generators. That is, someone who has supplied equipment that is presently in use, hopefully of the same size and characteristics required, and rely on them through their quality program and their design to insure that the total integrated system meets the requirements that are specified.

MR. VAN BRUNT: Does Bechtel check that interface, too, to insure that the diesel has the starting requirements or whatever and that gets factored into that interface. Does Bechtel then take a look at those to determine whether the vendor has properly carried out his design responsibility?

MR. BINGHAM: We will look at those -- certainly the interfaces. The important characteristics will be reviewed

and we generally will witness testing of at least the critical parameters. We do have an inspection plan with engineering reviews. In that inspection plan, we list those parameters that are necessary to be verified by the manufacturer and the techniques generally that are used by the manufacturer are reviewed.

In the case of the diesel generator, I think at this time many of them have been predetermined as being acceptable so we are not re-inventing the wheel. We are specifying proven techniques to justify that the equipment does meet the specified parameters.

MR. VAN BRUNT: Let me go over into another area and perhaps I will get more what I was after. Are you purchasing motors with the driven equipment or do you purchase the motors separately?

MR. BINGHAM: It is our general policy to have the pump manufacturer provide the drivers. The manufacturer of the pumps or the diesels would provide the drivers for those.

MR. VAN BRUNT: Do you have anyone who does not?

MR. BINGHAM: I do not know of any on Palo Verde.

MR. VAN BRUNT: Based on my past experience, I remember how it works, if you were buying them separately, the pump

vendor would give you some speed torque curves and various other requirements which would then be transmitted to a motor manufacturer and he would give you a motor to meet those requirements. The guy in the middle would check and make sure it fitted together and the coupling design and all of that kind of good stuff. How does that get handled when you have that all wrapped up in one package. How are you assured that the motor manufacturer does, in fact, give you the right speed torque requirements for the motor and this kind of thing.

MR. BINGHAM: Generally, and let's talk about the class 1-E equipment, since that is what we are focusing on here. Generally the way that we assure ourselves that the characteristics are proper is through testing of the unit when it is assembled. Let's take a pump, for example. We are specifying that it have certain outputs, certain pump characteristics, and certain power requirements. That it can run on, I guess 75 percent voltage.

MR. TAJADDODI: Minimum.

MR. BINGHAM: Minimum. So we test that. That will be tested in the factory. We may test one. We may test them all. That gives you the assurance then that the overall parameters

that were specified for the pump have been met. Of course, there are further tests on a lot of the equipment when it is installed, during functional testing, to assure that again you can confirm in its actual as built condition that it is performing in the manner that it is intended to. So it is an overall review.

Generally we like the manufacturer to have the responsibility of the integrated package and generally we are most concerned that the unit is tested, either type tested, or tested on the individual component, to demonstrate that it meets the established criteria.

MR. VAN BRUNT: Do you get the speed torque curves for the driven equipment?

MR. BINGHAM: Yes, we get all of the motor data sheets, all the vendor data, all of the torque curves, and they come as a package with the equipment. In some cases, I guess, we get equipment information even before the package is shipped. We have particular things that we want to review.

MR. TAJADDODI: In most cases that would be true.

MR. BINGHAM: In most cases.

MR. TAJADDODI: Yes, because we have got to know before the package is shipped that we have all of the pertinent

data before the shipment.

MR. VAN BRUNT: So you do, in fact, get that data?

MR. BINGHAM: Yes.

MR. PAUL: The supplier of the equipment then has to file a specification.

MR. BINGHAM: Yes, that is correct.

MR. VAN BRUNT: What do you stipulate relative to the design, getting back to the pump situation with the service factor on the motor. How much of the service factor are you using in the design of the motor or how are you using the service factor in the design of the motor? Do you specify that or do you determine that through a review of how the motor manufacturer meets the requirements that were given to him by the mechanical equipment guy or what?

MR. TAJADDODI: We do require that motors have a service factor, however, we do specify in the specification that the supplier of motors should not use the service factor for sizing the motor. In other words, the service factor should not be used at all.

MR. VAN BRUNT: For the service condition or for any condition?

MR. TAJADDODI: For any condition.

MR. VAN BRUNT: How about run out?

MR. TAJADDODI: The run out conditions in a few cases might be the exception to the rule but generally they should not be sizing the motor for any condition to use the service factor. In certain conditions, a few motors might exceed it but that is the exception to the rule rather than the rule itself.

MR. VAN BRUNT: And Bechtel reviews to insure that that, in fact, happens. What I am really getting at, you are giving the equipment manufacturer that responsibility to integrate the pieces of equipment together.

MR. TAJADDODI: Yes.

MR. VAN BRUNT: And you are specifying certain requirements that he is supposed to meet in his design. What I am looking for is what is the verification vehicle to be sure that that does, in fact, happen.

MR. TAJADDODI: The data sheets, the motor data sheets should show very clearly that, in fact, if they are using the service factor or not by comparing it to your brake horsepower requirement of the motor under the worst conditions whatever it is.

MR. VAN BRUNT: And you review this?

MR. TAJADDODI: And we review all of the data that is sent by the supplier. We require them to send us these data and we review it to see if they are exceeding the brake horsepower or they are going to the service factor...

MR. ROGERS. What is the timing of that review. Is it on shipment of the motor or prior to release by the manufacturer or when is it?

MR. TAJADDODI: It can vary. It all depends on the size. The big motors, the main essential motors are not supposed to be sent to the job site before verification of that but in some areas they might have shipped equipment already to the job site and then we receive the drawings. We try to check, even at that stage, and make sure, even at that stage, that they are not violating the requirements.

MR. BINGHAM: Carter, what we do, we have a table in the specifications that goes through and lists all of the information that must be received by us or sent to us by the vendor, the technical information, the documentation for the material and so forth and in there we put on the timing when it must be received.

So if you pick a particular component in there, you could go through everything and you would see all of the

information the engineer is required to receive and review. You will also see in there another indication of the information that must go to the field. In other words, must accompany the piece of equipment when it arrives on the site. Now, as Fred said, on some components, like very small metering pumps and that sort of thing, we probably would not have the same level of review and the same requirements you would, say, on a very very large motor or pump combination.

MR. ROGERS: The point that I am trying to get to, Bill, is we got a table here that you presented to us. It says that under the worst condition, we have something like a fifteen percent margin and the question that I am driving to is how reliable is that now at this point in time. Have you gone through that data and verified from actual tests or from actual sizings of motors that these are the power levels that we are going to have for the diesel or are you still in the design stage?

MR. BINGHAM: As I indicated to you, the status of the plant is well along. We have actual data in for just about every component. In fact, I believe we have all of the major equipment on site for unit one. On this little chart, (FSAR Table 8.3-3), which you saw the other half of a minute ago, here are the actual numbers from actual data

and those are what are used to tell us what the margin is. These are the ratings. For example, safety injection pump had a rated horsepower of a thousand. Its actual brake horsepower is 910 and so forth on down the line. So the information that we have, we believe, is firm and we would not expect to see changes now unless there is some modification to existing equipment that would occur for some reason.

MR. VAN BRUNT: So we are going into the operational mode with a significant margin in the design?

MR. BINGHAM: That is correct.

MR. KREUTZIGER: I noticed up there that we did not have anything on that chart with respect to starting currents. On Exhibit 2D-4, it was indicated that an analysis was used to demonstrate the fact that the frequency decrease and the voltage decrease was at acceptable levels. What is done as far as the analysis to assure that we have accurate information not only on the running but on starting conditions. And two, has any testing been done with the diesel generator to verify in any way that the calculation and methods used in the overall analysis are in line with at least the actual conditions? Did we do any actual motor starting?

MR. TAJADDODI: Okay, to start from the very beginning to answer your question. The result of the diesel generator load sequencing was submitted to the diesel generator manufacturer. The diesel generator chose a more conservative load than what we had specified for each sequencing period and they did the testing in accordance with some simulated loads which were more conservative than the loads specified under actual conditions to see if the margin of frequency of voltages, as specified in the specifications were not violated. The test results have been completed and we have looked at the test results and in all conditions, the test results meet or exceed the requirements.

MR. KREUTZIGER: This was actual motor loads or simulated.

MR. TAJADDODI: They were simulated more conservative loads.

MR. BARROW: Along this line, in looking through the standard review plan, page 8.3.1-11, it calls for the reviewer to be able to examine the diesel generator loading profile curve both in the frequency and recovery curves and response time of the load variations. Is that data available or can it be made available as back up slides to go over this material?

MR. TAJADDODI: I did not understand. You covered the whole thing. There are some preoperational tests. There are some --

MR. BARROW: This is just in the review in determining that the diesel generator, indeed, meets the criteria of Reg Guide 1.9.

MR. TAJADDODI: The test results.

MR. BARROW: The test results, not the preoperational tests. These are the qualifications or the load acceptance test results.

MR. TAJADDODI: The test results are available.

MR. BARROW: Are they available in backup slides today so that we can review them.

MR. TAJADDODI: The test results are actually a big thick production of a lot of graphs of different modes of starting and loading, and were not made part of the backup slides. They are available. If it is asked that they be provided, I think we can provide those test data.

MR. BARNOSKI: Mike Barnoski. You mentioned, I think, that LOCA was the governing size. I have seen some data that indicated that perhaps main steam line break condition may be more relevant. Can you confirm that the main steam line break is not appropriate in this case?

MR. TAJADDODI: The actual LOCA that we have, I think, is a main steam line break/LOCA condition and that is the worst condition. We call it LOCA without using the word main steam line break because the loads that are required for the main steam line break are also the same loads as the LOCA loads. So it is a main steam line break/LOCA condition.

MR. BARNOSKI: So that is the maximum demand on the generator.

MR. TAJADDODI: That is the maximum demand on the generator.

MR. BARNOSKI: Do you have non class 1-E loads on the generator. If so, can you identify where they are and give a brief description of why they are used on the diesel?

MR. TAJADDODI: Yes, I would like to expound on that a little bit. Yes, we have got some non class 1-E loads which are manually connected to the diesel generator by the operator after the sequencing of the essential loads are complete. As you can see here, after the sequencing is done automatically by the sequencer, we have got manual connection of loads to diesel generator. Some of the loads are: hydrogen recombiner, pressurizer heaters, and under some conditions, we have got, also, some manual connections

of class 1-E also. We have got non class 1-E connections manually to the diesel generator. We have got essential lighting system which is connected manually to the diesel system.

MR. BARNOSKI: Can you just briefly state why you feel you have to put these non class 1-E systems on the diesel at all?

MR. TAJADDODI: For instance, the pressurizer heaters are required--are deemed to be operable when your offsite power is not available but they essentially are non class 1-E. So we provide power to them by means of isolation devices as we stated before so that we can provide the necessary power for the proper functioning of the class 1-E system.

MR. KEITH: Let me just add to that, Mike, the normal chilled water pump and normal water chiller is on there. In fact, they are sequenced on in, of course, shut down mode. In the shut down mode, we decided in the event of a loss of offsite power, although we do not require for safety purposes to have cooling inside containment, we decided that it was a nice thing to have so that you do not overheat components in the event of a loss of offsite power. So we do have the capability of putting on cooling water, which is not class 1-E.

Those are really the major loads that are non class 1-E that we do include on the diesel.

MR. BINGHAM: Are we through, Mike. Does that take care of your questions?

MR. BARNOSKI: Yes.

MR. VAN BRUNT: Faust.

MR. ROSA: I have a couple or three questions on the diesel auxiliary systems. Starting with the lube oil, could you describe that in some detail. Do you provide prelube while in a standby condition?

MR. TAJADDODI: The lube oil requirement for diesel generators is once a diesel generator is started, you do not need that system to be operable.

MR. ROSA: But is it operable--

MR. TAJADDODI: Prior to the starting of the diesel generator, yes.

MR. ROSA: In the cooling water system, is there commonality between the cooling water systems to the two redundant diesels?

MR. TAJADDODI: They are completely isolated. There is no interconnection. There is no cross linking of the system whatsoever.

MR. BAN BRUNT: There is a train "A" cooling system and a train "B" system. Is that correct?

MR. BINGHAM: That is correct.

MR. VAN BRUNT: And those are matched up with the train "A" diesel and the train "B" diesel.

MR. BINGHAM: Completely separate.

MR. TAJADDODI: Completely separate.

MR. ROSA: Do you have moisture separators and all of the good things that you are supposed to have?

MR. BINGHAM: Yes.

MR. VAN BRUNT: Why don't you elaborate a little bit, Bill?

MR. BINGHAM: All of the systems are designed to meet the established criteria. We could go through them, Faust, if you are interested. They have been reviewed, not only on the CP Units one, two and three with the CP, but also in accordance with Units four and five. We were upgraded, if necessary at that time to insure that we did meet all of the established criteria. There have been some I.E. bulletins that have come out to deal with some of these particular areas like, how do you fill the diesel when it is running and so forth and so on but we are looking at it closely to

assure ourselves that we are not violating those criteria also.

MR. ROSA: The reason I brought it up was because of this NUREG that was prepared by the University of Dayton on the enhancement of diesel generator reliability, that is, CR 0660, NUREG. We are requiring all applicants to review their system and specify the degree of conformance to those recommendations. The position is that unless you have pretty good justification, we will require conformance. So, that is something to look at in some detail.

MR. BINGHAM: Dennis, why don't you lead off on this.

MR. KEITH: Yes. It has been over a year -- that has been out a couple of years, as I recall. We responded -- we did a complete review of it and I cannot recall but if there were any deviations at all, I am sure we justified them. But we did go through that document in detail.

MR. VAN BRUNT: Let me suggest for the record. We will check and verify through the documentation. As I remember, Faust, when we received that document we wrote to Bechtel and asked them to analyze that in light of our specific design. They responded back to us, as Dennis said. We complied or if we did not comply in some area, this is the

reason why. As I remember, we were satisfied that it was adequate. We will provide references or documentation for the record.

MR. BINGHAM: Ed, this is a punch list item.

MR. ROSA: One item on that NUREG that applicants are apt to miss until it is brought to their attention is the training requirements for the diesel maintenance personnel. I think one of the recommendations is that some sort of formal training, equivalent to that provided by a diesel manufacturer, should be provided for diesel maintenance personnel. Are you people going to comply with that.

MR. VAN BRUNT: Norm, can you comment to that right now or not. We are in the process of developing all of those kinds of procedures in the operating department.

MR. HOEFERT: I really do not know at this time.

MR. VAN BRUNT: We will add that to the list. We will verify that as an item whether we are complying with that or not, and if not, why not.

MR. ROSA: I have one more question regarding the AC power distribution system that relates to our degraded grid position. I do not know whether you are going to cover it subsequently or whether this is the appropriate time.

MR. BINGHAM: Why don't you state the question.

MR. KEITH: We have limited capability to deal with the offsite system here today. We came primarily prepared to discuss onsite.

MR. ROSA: I am talking about the system from the switch yard down.

MR. VAN BRUNT: Go ahead and ask your question and we will see what we can do.

MR. ROSA: In order to meet our integrated grid voltage position, you must have had to perform a voltage drop analysis of the complete system. Could you give me the assumptions, the basic assumptions in -- well, first the basic assumptions?

MR. TAJADDODI: The basic assumption is to make sure that we are not going to actuate unnecessarily some equipment due to starting of the motors. First of all, we assumed that the grid voltage was going to be at its minimum 95% of its nominal value. That most of the power plant auxiliary systems were operating full capacity and if, in fact, we had a degraded condition at that level and we start a motor somewhere in the system. We are not going to actuate unnecessary equipment. Now, we are still doing some analysis pertaining to the starting of the RCP motors which might have some effect and make sure that we are not going to have an actuation. Our analysis is not complete yet.

We are going to have a setting in such a manner as to preclude the possibility of such an inadvertent operation due to degraded conditions.

Now, in addition to that, to meet the requirements of degraded conditions, we have special starters, very low pickup to drop out level to make sure you are not going to inadvertently drop out or pick up some loads under those conditions, where you are starting loads and you might drop your voltage below the minimum requirements.

So, under all of those conditions, we try to preclude the possibility of the Millstone syndrome, if that is what you are alluding to.

MR. ROSA: One other question. That degraded grid condition requires some testing to verify the validity of your analysis, some testing preoperation. Can you describe the tests that will be performed and how the test results will be correlated with your analysis results to demonstrate the analysis methods were valid?

MR. VAN BRUNT: Do you want to go off the record?

MR. BINGHAM: Yes.

(Discussion off the record.)

MR. VAN BRUNT: On the record.

MR. BINGHAM: What the test engineer does is write what is called a test guideline that specifies what must be tested in the field in place once the system is built and give acceptance criteria.

That information then is put into a test procedure that is used by the utility to actually make the measurements. In this case, an electrical system, and those results are then reviewed to assure that they are meeting the criteria, the criteria that comes from the calculations. This is our way of assuring that the information is transmitted to the people that do the startup and that a functional test is run. That there is acceptance criteria set that they can judge the system performance against. If it does not meet the acceptance criteria, it must come back to the engineer for a re-review of the system or modifications to correct it.

MR. ROSA: I want to emphasize that fourth step there, which is the demonstration by test of the validity of your previous analysis, is the important thing. We have been getting results from other applicants that vary anywhere from 100% complete and accurate and excellent to practically worthless. Whenever we get something that really does not

demonstrate the validity of the original analysis, the only thing we can do is tell the applicant, well, your testing was not adequate. It is quite an expense to redo that testing since the whole sy stem is involved. I just simply want to emphasize that we are anxious to get good test results to verify the validity of that original voltage drop analysis.

MR. BINGHAM: Maybe, Ed, I would ask that the Board make sure that we understand what a good example might be so that we can make sure we compare and if there are some inadequacies we can modify the tests.

MR. VAN BRUNT: We have noted your comment, Faust, and at this point, I would have to say that we plan to do adequate testing that would meet the requirement and I guess we would be interested in what examples the Commission has found the satisfactory programs are so that we could possibly use that as a model or whatever.

MR. ROSA: We can provide that.

MR. VAN BRUNT: John.

MR. BARROW: John Barrow. Specifically, could you identify where these tests are called out in detail.

MR. ROSA: They will be called out in detail in

questions you are going to get. There are standard questions that address the four parts of the degraded grid voltage position and this is the fourth part, this verification testing. So you would get those questions.

MR. BARROW: What you are saying is that we have not necessarily gotten them yet.

MR. ROSA: I don't believe you have, no. We have not started the review really. I can briefly describe good results or good testing. We have received from some applicants graphs showing the voltage levels at the various buses on a per unit basis and the interconnecting lines between the voltage levels corresponding to the worst load conditions at the highest level of grid voltage range and at the lowest level. So that defines a band. Of course, the loads at each bus are indicated. That is the analysis results. Then superimposed on that, they have run their plant at specified loading, pretty close to full load -- not necessarily full load -- and measured the voltage and current, load current, at the various buses all the way down to the 480 volt level and injected the load numbers into the computer code and arrived at a voltage level at each bus and then compared that with the measured voltage. If it is close -- and the results

we have received on some plants has been very close -- that is an adequate demonstration of the validity of the original analysis.

MR. TAJADDODI: Let me just say something here. If you have reviewed SMUD analysis of that -- which I think is most progressed because they have done the testing -- our procedure will be similar to the one you have reviewed on SMUD.

MR. ROSA: I have not seen that one myself.

MR. TAJADDODI: When I reviewed the results on SMUD, they were okayed by NRC. They had presented the results and how the utility had done the testing.

MR. ROSA: I know the status of that now. That is one of the operating plants.

MR. TAJADDODI: Yes. That is why they have got test results.

MR. ROSA: That is right. That is one of the operating plants. That review is being performed by one of the labs under contract. We will review their review. So we have not gotten to that yet.

MR. TAJADDODI: We have submitted our analysis to you, the detailed analysis as to how we had performed the voltages

at the different levels for different conditions.

MR. ROSA: Okay. It is probably in-house and is being transmitted to the lab and we eventually will get to it.

MR. TAJADDODI: It will be similar.

MR. ROSA: I appreciate your comment.

MR. BINGHAM: We will look into that.

MR. VAN BRUNT: Any further questions? John.

MR. BARROW: I have one other question. Have you verified for us that the diesel generator, the generator on the diesel generator, has class H insulation and what temperature it is rated at.

MR. BINGHAM: Yes, we can verify that.

MR. TAJADDODI: But we do not have the information readily available right now. I cannot tell you.

MR. BINGHAM: We will make a call back at break time.

MR. VAN BRUNT: Why don't we put that on the list.

MR. BINGHAM: Fine.

MR. VAN BRUNT: Are there any other questions that anybody has. I think this would be a convenient time to take a lunch break if nobody has any questions.

MR. BINGHAM: There is a question back there.

MR. HOEFERT: Palo Verde experiences several dust storms

per year. What design provisions have been made to insure the diesel would operate in a dust storm and not be damaged by it?

MR. BINGHAM: There has been an extensive amount of work on that particular issue with tests conducted by APS measuring dust right at the station. Those have been reviewed in detail by the diesel manufacturer and by the generator manufacturer and we do have confirmatory information or letters in-house for these dust loadings which are very conservative that say that things will operate satisfactorily.

MR. VAN BRUNT: Are there any further questions?

(No response.)

MR. VAN BRUNT: Seeing none, why don't we break until 1:00 o'clock. Everybody get back here at 1:00 and we will continue.

(Whereupon, at 12:05 p.m. the meeting was recessed for luncheon break until 1:00 p.m.)

AFTERNOON SESSION

(1:00 p.m.)

MR. VAN BRUNT: On the record.

MR. BINGHAM: Before we continue with the presentation, I would like to indicate that there are copies of handouts available here for those who are observers, if you would like them. If we could take just a second. If you would hold those over there, Ed, for anybody who wants some on that side. Dennis, if there is anybody on that side who wants one.

From some of the questions that were raised earlier, it appears that maybe, Ed, it would be beneficial for me to just spend a minute and go over the basis of the design, the criteria established, and how it was incorporated into the design.

We did present this at the DC meeting and I think it did provide good clarification. For the other people who have not heard it, we tried very hard on this particular project to have one base document that essentially describes the scope and sets the criteria. It is a document that we control. It is one that is revised. It is reviewed. The reviews are documented. It is a document that is reviewed and approved by the customer and it consists of two or three

volumes and is labeled "Design Criteria". It has a general section in it that covers all of the environmental criteria, seismic, wind loadings, tornados. It includes in it all of the response spectra for the seismic loads which we put in our specifications. It includes all of the applicable codes and standards that we use for the systems and it has in it, in addition, all of the commitments to the regulatory guides and it has in it a table that lists the classification of all of the equipment and components. These are the data that go into the SAR.

Besides the general criteria, we have a section for each of the -- what is it -- nine disciplines. The electrical, mechanical, disciplines and it goes through and describes the criteria for all of these systems.

From this particular document then we are provided the information that goes into the SAR's. We provide the information that goes into the technical specifications for procurement of equipment. We also provide the information, of course, for the detailed design of the plant.

From this information, we can make the drawings, purchase the equipment, write the systems description, and tie the whole design of the plant together with the one basic source. It is the one document that we have that has set the criteria.

Now that document is revised. It has been revised many times over the years to include new requirements from codes or new requirements from regulatory revisions, say, the Reg Guides, input from the licensing that we went through for the construction permits for Units one, two, and three. Of course, when we went through the CP work for Units four and five, the results were incorporated in the design that you are hearing about today. That really stems from this set of criteria. We have the general criteria that Ed was asking about. What are your seismic parameters? What are the offsite parameters? How do you handle separation? That is included in the general criteria.

The system criteria covers the AC system for lighting, DC system, the electrical systems and all of the mechanical systems. I think maybe with that background--there may be some questions or clarification that might be necessary but this should give a little bit better understanding of where all of this data that Fred has been presenting comes from.

MR. VAN BRUNT: Does anybody have any questions they want to raise at this point?

MR. ROSA: Does this document have a formal title?

MR. BINGHAM: Yes, it is called PVNGS Design Criteria Manual.

MR. ROSA: I just wanted that for the record.

MR. BINGHAM: You saw, I believe, the books at the DC Review that was the three books at the back.

I think, if there are no other questions, we will continue. The next item is 2E, identification of cables, raceways and terminal equipment.

MR. TAJADDODI: This is drawing 2E-1, identification of cables, raceways, and terminal equipment. The PVNGS design has incorporated distinct means of identifying cables in raceways and equipment to make sure that we meet the separation requirement and the isolation requirement. The cables used in the PVNGS design for the class 1-E system are all color coded. They are colored red, green, yellow and blue for different channels. This provides for easy means of identifying the circuits to make sure they are in the proper raceways and they are not mixed with other redundant circuits.

This is drawing 2E-2, specific requirement for identifying the cables and raceways. IEEE 384 and reg guide 1.75 call for specific ways and means of identifying the raceways and cables in the power plant and these meet that requirement

as far as the intervals, and how often do you have to identify these raceways. The cables are color coded and also the associated cables are identified by striped colors showing red and white for the cables being associated with the red channel. The striped cables are for the third of a kind equipment to identify the fact that they can be fed from either "A" or "B" channel.

Now the identifying means for the third of a kind uses both red, the color code of the appropriate train, while the one for the associated circuit used white as one of the colors to differentiate between the two. Also the equipment is tagged appropriately showing the train that it is associated with by a proper tagging code and it identifies it readily with the kind of tagging.

MR. BINGHAM: Questions?

MR. VAN BRUNT: Tom.

MR. PRICE: My name is Tom Price. I take it that the associated cables are white and red or white and green, etc., because they are analyzed and qualified and looked at as class 1, they are run in class 1 raceways?

MR. TAJADDODI: That is correct.

MR. PRICE: As far as the third of a kind, the red and

green cable, is that run separately all by itself?

MR. TAJADDODI: The only place where we have got a third of a kind is actually the component cooling motor which has got three different -- charging pumps, I am sorry. That is charging pumps. The only place where you have got that piece of equipment is a few feet of conduit where you have got this connection to the charging pumps. That piece of conduit is identified as such. That is the only place where we have got a third of a kind load.

MR. PRICE: So essentially, you are running it all by itself?

MR. TAJADDODI: Right but it is identified to make sure that it is by itself.

MR. KREUTZIGER: Karl Kreutziger. This color cable, is that all applied at the manufacturing facility or is the color applied in some means at the job site by the application of color.

MR. TAJADDODI: Most of the cable coloring is done by the manufacturer. But we might have cases where we might have to resort to color coding at the job site. That might be an exception to the rule. If we find that we have shortages of material, we might have to resort to coloring at the job site

but all of it is purchased colored per the requirement.

MR. KREUTZIGER: Does all cable purchased for the Palo Verde Nuclear Generating Station meet the requirements of 383 or are there different requirements. Are there some black cables at the job site that do not meet those requirements?

MR. TAJADDODI: All cable purchased for Palo Verde is class 1-E cable to meet the flame retardancy requirement of 383. That pertains also to the non class 1-E cable. In other words, all cable that is being used irrespective of whether they are class 1-E or non class 1-E, have to meet the requirements of 383 to insure that they meet the Reg Guide requirements, the fire protection requirement that is called for in 1.120 for all cables.

MR. KREUTIZER: I could conclude that black cable could then be colored in the field and utilized for either or any of the separation groups?

MR. TAJADDODI: Yes, if the need arises for a special cable that we do not have. We could color code that black cable because the black cable is actually a class 1-E cable. There is no problem with that.

MR. KREUTZIGER: The follow up question I have is: what

control and assurance that the proper color cable is utilized. What are the instructions and how does the field pulling crew know and what are the assurance procedures to make sure that if I have a circuit that is for an "A" train that it, in fact, has been pulled utilizing the proper color of cable?

MR. TAJADDODI: We have installation specs for Palo Verde giving specific instructions how the cable has got to be pulled and how each circuit has got to be identified to make sure that the color code is used for the proper circuit and the installation specs provide the means by which the field can follow and ascertain that the color coded cable is, in fact, the one that is supposed to be used for that particular application.

MR. KREUTZIGER: Is there a Q. A. sign off?

MR. TAJADDODI: There is a procedure that field has got to follow and also that engineering issues per the installation specs to ascertain that is done properly.

MR. BINGHAM: Let me clarify that a bit for you, Karl. The installation card that comes from the computer data base for the circuits will specify the color cable. On the back of the card is a place for the QC engineer to sign off that, indeed, that cable was installed properly. In

addition, since both the raceway and the cable are color coded, it is not difficult for an independent auditor, the QA person, or others, the engineer, perhaps, to look at the tray and say, uh oh, there is a blue cable in a red tray. So you really have a double check, the last one being a visual means.

MR. KREUTZIGER: So each individual cable is signed off as it is pulled?

MR. BINGHAM: That is correct.

MR. VAN BRUNT: Yes.

MR. FITZPATRICK: Robert Fitzpatrick. Say you have a unique alphanumeric identification on each cable, how often is that repeated.

MR. TAJADDODI: In accordance with the requirement of IEEE 384, at least every fifteen feet.

MR. FITZPATRICK: Is that printed? Where would that be printed?

MR. TAJADDODI: The raceways are identified every fifteen feet and the cable has got it printed on the jacket.

MR. FITZPATRICK: By the manufacturer? Is that something that you do or what?

MR. BINGHAM: By the manufacturer, yes.

MR. KREUTZIGER: Excuse me. I do not understand. Is that the color code. What is printed on the jacket?

MR. BINGHAM: The type of cable, not the code.

MR. TAJADDODI: The type of cable. If you are talking about a circuit number or the cable code, it is not on the cable. The raceways have got to be identified every fifteen feet. The type of cable, if it is 600 volt cable, is printed on the jacket itself every few feet. As you can see here, the identification is -- it gives you the voltage level of the cable. It gives you the color. Also, it gives you the means of verifying that the raceways -- the raceways are going to be identified every fifteen feet with a proper color to make sure that you have the right cable, the red cable in the red tray, the yellow in the yellow tray, and so forth.

MR. KREUTZIGER: But the identification on the cable itself has nothing to do except for the color.

MR. TAJADDODI: Except for the color.

MR. KREUTZIGER: Except for the color, the cable identification really has nothing more than a standard type of cable.

MR. TAJADDODI: Right.

MR. KREUTZIGER: It is an asbestos type of cable, a certain type, 600 volt, a certain size?

MR. TAJADDODI: You do not have anything else on the cable other than that. If that was what your question was? I gather that was what your intention was in asking.

MR. FITZPATRICK: About the uniqueness of each given cable.

MR. TAJADDODI: Uniqueness insofar as the color code, yes.

MR. FITZPATRICK: But not as far as the load?

MR. TAJADDODI: Oh, no, no. Each cable does not tell you specifically, this is the circuit, for instance -- it does not give you the circuit identification number on it or anything like that. It just identifies it as a class 1-E cable that is red and is 600 volt or 4160 volt or whatever it is.

MR. KREUTZIGER: Is it not correct though -- it is my understanding that Bill mentioned that there is a card on the cable when it is pulled. Isn't there information that is clipped from that card on to the cable ends?

MR. TAJADDODI: That is at the end but not along the cable at intervals.

MR. KREUTZIGER: When you pull a cable, the cable ends will have the identification of a particular circuit. In other words, it will have a scheme cable number which will say that this is a power cable to the MOV on the discharge?

MR. TAJADDODI: At the ends of the cable, we have means of identifying the circuit number for each piece of wire. When it goes to the terminal board, each of those wires has a circuit number on them, at both ends, so you can identify exactly what circuit has been connected but not along the cable.

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

(No response.)

MR. BINGHAM: Let's go on to 2F then, vital supporting systems.

MR. TAJADDODI: This is drawing 2F-1, vital supporting systems. It requires that all of the equipment that are necessary to be operating to support the proper functioning of class 1-E equipment be also of the same safety class as the class 1-E systems. Systems like the HVAC systems that are supposed to be functioning to maintain the class 1-E equipment in proper functioning order are designed to meet the requirement of class 1-E, those electrical portions of

the systems, and they have, in fact, the same qualification requirements as the class 1-E systems that they are supposed to be supporting.

The other requirement is that the supporting system should be also a part of the same distribution system they support. In other words, if the air conditioning system provides support for a channel "A" piece of equipment, that HVAC system has got to be a part of train "A" system. Likewise for train "B". There is no interconnection between the power systems for which they are supposed to be supporting the class 1-E system.

MR. BINGHAM: This is a short section. If there are any questions on that.

MR. VAN BRUNT: Karl.

MR. KREUTZIGER: Karl Kreutziger. I have one question. Do you have two chillers, class 1-E chillers that supply HVAC? I am thinking about all of the electrical equipment that is on "A" train or "B" train. Are there local chillers or is there a main central system which supplies all of the electrical equipment cooling for one train.

MR. TAJADDODI: We have got essential chillers for train "A" and essential chillers for train "B". I think

our loadings of the class 1-E loads, we can show that very distinctly.

MR. KREUTZIGER: I think the question I really had is: a loss of a mechanical chiller, essentially then you have lost all of the cooling to one entire train of electrical equipment. Correct?

MR. TAJADDODI: That is right. You still have train "B" equipment that is functioning. Train "B" will still have essential chillers.

MR. VAN BRUNT: There is no way you can manually cross tie those to use the chiller in one train as back up for the other if you lost the train for some other reason.

MR. TAJADDODI: I don't believe there is such a way of interconnecting. We can check it but I am sure we do not have it.

MR. KREUTZIGER: Is there cooling capacity required on the charging pump, the swing pump.

MR. TAJADDODI: Actually the charging pump -- all three pumps can all be operating at the same time.

MR. KREUTZIGER: Are they in individual rooms.

MR. TAJADDODI: There are individual rooms for "A" and "B" but the third of a kind, I believe, is either in "A" or

"B" I am not so sure about that. We can check. I don't know which one it is.

MR. KREUTZIGER: My question is: "A" or "B" room when you have -- let's say that it is in "A" room. You now have power on "B" supply.

MR. TAJADDODI: Yes.

MR. KREUTIZIGER: The cooling supply for that room, can you then switch the cooling supply to the other train? Is there a double cooling coil, for example?

MR. TAJADDODI: I do not believe so but we can check.

MR. KEITH: Not on that particular one. Let me just say, the HVAC systems vary quite a bit from building to building. It is not quite as straightforward as Fred's answer to you was. For example, in the control building where we have most of the switchgear, normally that is powered off of our normal cooling system which is not a class 1-E system. It is only when we get into a loss of offsite power that we go into the essential chilled water system for that building.

To tackle the other point that you brought up about the charging pumps, we have looked at that particularly. In that case, as I recall, we cannot operate a charging pump continuously without room cooling. However, we can operate it often enough such that we could, if we were in a forced shutdown condition, and were cooling down the primary system, we could be able to operate the charging pump often enough to make up for the shrinkage that you get from the cooldown. There is no problem as far as bringing the plant to a safe shutdown.

MR. VAN BRUNT: Shelly.

MR. FREID: I just wanted to clarify something. The statement was that you could bring the plant to a safe shutdown with no HVAC cooling on that pump.

MR. KEITH: For the charging pump and my answer was yes, you can.

MR. VAN BRUNT: Assuming a little bit further and going back to the discussion on the separation criteria of this morning, in the areas where we do not have physical separations, where we are into shared space. Where you are just using distance as a separation criteria, which I realize is a minimum number, how would the same question that Karl asked you apply. Remember you talked about two valves that were close to each other. How would you handle that from this redundant chilling point, the cooling point.

MR. TAJADDODI: Well, first of all, the valves will not be affected. They are instantaneous operating valves and the air conditioning will not affect their operation.

MR. VAN BRUNT: How about motor operations?

MR. TAJADDODI: What I am saying is that motor operated valves will function only during a very short period of time. HVAC will have practically no impact on the operation of the HVAC. It is not a continuously running motor. So it will not have an impact on motor operated valves.

MR. VAN BRUNT: Is there any equipment that it would have an impact on?

MR. TAJADDODI: The only ones are the HPSI motors and the LPSI motors which are continuously operating and it will have an impact if you lose air conditioning system. Yes, it will have an impact. But they have got their own dedicated HVAC system so if one fails, the other one is independent of the other one.

The valves have got no problem as far as HVAC loss is concerned. It will have no impact on the operation of the valves.

MR. BINGHAM: Could I make one clarification. Even so we have done calculations to demonstrate that for a limited time, you do not exceed the limits, environmental limits, and there is even margin above that which could be looked at for particular trains. So the fact that the chiller is gone does not mean that you necessarily lose the train. It just means that you might start to have some abnormal environments in those particular rooms.

MR. KREUTZIGER: That was my next question. Is that environment identified or monitored? Electrical equipment, I would assume, has been purchased to a 40 degree "C" ambient. Is that correct? Do we have a higher ambient in some cases?

MR. BINGHAM: It depends but that is essentially correct.

MR. KREUTZIGER: Outside of the containment, are all temperatures 40 degrees "C"?

MR. TAJADDODI: There are some areas outside of containment where we have got -- in the penetration rooms we have 50 degree "C". We have purchased equipment to function at 50 degree "C", but essentially all of the rest of the class 1-E equipment is designed and is purchased for 40 degrees "C". There are only a few areas outside

of penetration rooms where we have the 50 degrees "C".

MR. KREUTZIGER: Is all electrical equipment qualified for a forty year life and 40 degrees "C" ambient?

MR. BINGHAM: We are going to be talking in some detail about equipment qualifications. Perhaps --

MR. TAJADDODI: I can respond to that one.

MR. BINGHAM: Let me just make a comment. At the present time, we are trying to obtain a qualified life that is commensurate with the criteria established for the plant. Whether it is forty years or ten years or twenty years, depending on the equipment, we are trying to obtain it.

As you know, I think the Board knows, the equipment qualifications is an area that is still being reviewed and there is some, I think, lack of understanding on the part of the suppliers exactly how to provide the qualification information that we have asked for by the project.

MR. KREUTZIGER: The answer to the question with respect to supporting equipment, particularly HVAC electrical equipment, a loss of the coolant or class 1-E cooling capacity or capability, the unit then would be in a tech

spec condition for a shutdown. There is no intention to monitor the spaces where the electrical equipment is to make sure that the operations continue even though the temperature would be less than the design basis.

MR. BINGHAM: Could we have about three seconds?

MR. VAN BRUNT: Off the record.

(Discussion off the record.)

MR. VAN BRUNT: On the record.

MR. KEITH: We have concerns similar to what you are bringing up. In most areas we have alarms and we have committed at the present time to--if we have an alarm indicating we have lost the HVAC, we will take a portable temperature monitor to that area to monitor conditions and thereby take whatever steps are necessary.

MR. VAN BRUNT: Any other questions along this line?

(No response.)

MR. VAN BRUNT: Fred, go ahead.

MR. TAJADDODI: This is figure 2G-1, system testing and surveillance. The general requirement is that all of the systems have got to meet -- the test capabilities have got to meet GDC 18 and 21. The design of PVNGS allows for testing the class 1-E systems and operation.

You can detect the failures, if there are any problems with the different modes of plant operation. The specific requirements of testing and surveillance of distribution system is that we have provided more than enough means in the control room -- such as annunciation, alarms and computer logging -- to monitor all of the equipment as to their function whether they are in normal or abnormal position. The operator has complete information regarding the equipment.

This is figure 2G-2, preferred power supply surveillance. The design at Palo Verde provides for undervoltage relays that monitor the offsite power. We have provided instruments, annunciations for all of the incoming breakers to monitor the status of the preferred power supply. If it is lost, the undervoltage relays can actuate and annunciate the proper relays in the control room and monitor them.

MR. ROSA: Faust Rosa. Can you tell me something about the mimic bus arrangements in the control room for monitoring the overall status?

MR. TAJADDODI: Essentially, we have a mimic bus showing everything from 4160 volt level up to the load centers and the status of the distribution system. We have a complete mimic bus showing the load centers, transformers, feeders, and breakers and we also have got the arrangement where we show the MCC main feeders breaker position by indicating lines. So up to the MCC level, we show everything on the mimic bus in the control room showing the status of the breakers, the bus, and whether or not it is energized or not, including the diesel generator.

MR. ROSA: How about volt meter indications of the various bus loads?

MR. TAJADDODI: We have ohm meters and volt meters both in the control room and at the switchgear to show the status of the power system, whether it has the voltage levels desired and we can monitor them both locally and in the control room.

MR. ROSA: To what low voltage level do you monitor actual voltage readings?

MR. TAJADDODI: For the class 1-E system up to 480 volts AC systems and also 120 volts regulated source. We monitor those voltages.

MR. ROSA: In the control room?

MR. TAJADDODI: In the control room.

MR. ROSA: Thank you.

MR. TAJADDODI: This is figure 2G-3, system testing and surveillance. The requirements of the IEEE-308, Reg

Guide 1.47, which are actually the same, bypass status requirements. We have got to have essentially all of these indications for the monitoring of the standby power supply which are also continued on the following page through number 3, item (I).

The design on Palo Verde not only provides these monitoring requirements but also exceeds them. You have got additional monitoring to these requirements and they all will be covered later in the presentation in detail.

This is figure 2G-4, startup testing. Reg guide 1.68 requires that we perform operational testing to verify the proper load group assignments and to make sure there is capability in the system to start up the loads and run them. The design right now provides for such a test and also we can monitor them in the control room and do the preoperational testing as required by reg guide 1.68.

This is figure 2G-5, test requirements continuation. The Palo Verde design provides for the distribution system to be tested both with all offsite and onsite power sources disconnected for one load group at one time and ascertain its proper function to make sure that the system can behave as desired under those tests in those conditions.

This is figure 2G-6. It requires that during testing both the DC and onsite AC buses and all of the related loads be monitored. The design that we have provides for annunciations and alarms to monitor the buses whether they are energized or not and to provide adequate information for the operator to verify the absence of voltages to the respective buses.

MR. BINGHAM: Questions?

MR. VAN BRUNT: Shelly.

MR. FRIED: Do we have separate annunciators or alarms on the standby power supply system that lets us know whether there is an alarm that lets us know -- that just says there is something wrong with it and although the system is bypassed versus an alarm that tells you that the diesel generator is inoperative?

MR. TAJADDODI: Yes, we have got specific annunciations telling us what is wrong with the diesel generator.

MR. FRIED: You don't have common annunciator lights to say that there is a fault in the generator system?

MR. TAJADDODI: We have got low priority alarms and high priority alarms that combine a few of these things together. We provide for some of those combination of

alarms.

MR. FRIED: And those alarms distinguish those which do not pertain to the diesel generator versus those that do pertain to the diesel generator?

MR. TAJADDODI: I do not quite understand your question.

MR. FRIED: Those alarms --

MR. TAJADDODI: Yes.

MR. FRIED Those alarms in the non test mode, most of the alarms and announciators that you listed on exhibits 2G-3 and 2G-4 are, in fact, bypassed.

MR. TAJADDODI: During an accident condition?

MR. FRIED: Non test conditions. Those annunciations while they tell you something is wrong do not disable the diesel generator from coming on and loading the bus.

MR. TAJADDODI: They are not bypassed under normal conditions. Most of them are operable under normal conditions. All of those alarms that you have indicated are not bypassed during the test conditions.

MR. FRIED: Not the alarms. But they do not disable the diesel generator from starting?

MR. TAJADDODI: That is right.

MR. FRIED: You do want the operator to know which ones

will actually prevent the diesel generator from loading versus those that just give a degraded diesel generator configuration and are they separated?

MR. TAJADDODI: Let me go into some detail as to how this is done. If the diesel is on the local control, if the operator has turned the switch in the control room to the remote position, the alarms are still available. There is a signal that the diesel generator is going to start. As long as the operator has not put the diesel generator on the off position, all of the annunciations are operable and the diesel generator can start. As soon as he puts it in the off position then you have disabled the whole diesel generator and there is an alarm in the control room saying diesel generator is inoperable.

MR. FRIED: That was not my question. There are a series of alarms that tells you that the diesel generator is in a degraded position but not inoperable. While you get the alarm, it does not disable the diesel generator from operating and there are other alarms and conditions which will actually prevent the diesel generator from starting. Is the operator through the annunciator window able to distinguish those two sets of conditions?

MR. TAJADDODI: The only conditions which will not start a diesel are the two or three trips otherwise there is no inhibitative action on the part of the annunciation to start a diesel. There are only two or three trips that are available.

MR. FRIED: You have a number of alarms that could go off that would not disable the generator.

MR. TAJADDODI: Absolutely. Right.

MR. FRIED: Are there separate annunciator windows so that the operator knows which of these two conditions has occurred?

MR. TAJADDODI: We will discuss later on what those annunciation windows call for, yes. We have got, for instance annunciations for jacket water. We have annunciations for each individual malfunction of a diesel generator which cause the operator --

MR. FRIED: Let's try again. We are not getting to the same place.

MR. KEITH: We have another section coming up on diesel generator alarms. Maybe we ought to wait. It might be clearer, if you do not mind.

MR. TAJADDODI: I don't mind. I don't understand what the intent of his question is.

MR. KEITH: It might be easier after we go through the next one.

MR. VAN BRUNT: Why don't we halt and go through that and if you still not get an answer that you are satisfied with, you can proceed further.

Any further questions?

(No response.)

MR. VAN BRUNT: If not, I have a question. Put up slide 2G-4. You are talking here about system testing and surveillance. Under startup testing, you say, preoperational testing shall verify load group assignments. Over here under design feature you say, design is capable of and consistent with appropriate testing and verification. What is the vehicle to assure that these preoperational tests to verify these load group assignments are done.

MR. TAJADDODI: I believe that we are going to have proper procedures as to how these preoperational procedures are to be done.

MR. VAN BRUNT: Who writes the procedures? Who do they go to and all of that kind of stuff.

MR. BINGHAM: When I talked about it earlier, I indicated that the engineer writes the test guidelines that specifies

what must be tested and sets the criteria for acceptance. From that, the startup operations group will write a procedure to carry that out and, of course, will test it. Those results will be compared with the acceptance criteria established and if they deviate, they will be sent back to the engineer for review.

MR. VAN BRUNT: What is the procedure that assures that this kind of specific requirement is included in the test guidelines.

MR. BINGHAM: There is an engineering procedure on the project that specifies how that is done. There is review by all of the affected disciplines to assure that the specific requirements are incorporated in the test spec and then there is an audit procedure from time to time that demonstrates that we have done what we said we were going to do.

MR. VAN BRUNT: Do you have a question, Karl?

MR. KREUTZIGER: I have a question with respect to transient conditions that could occur during diesel generator testing. What areas have been considered as potential transients that could occur while the diesel generator is parallel to the system. For example, with the diesel generator running -- let's assume we have had a loss of offsite power. The diesel engine obviously would not have the capability to provide the total power that might be parallel to the normal type of buses. What conditions have been considered as transient conditions in the analysis of diesel generator testing and is there adequate protection to insure that the diesel generator remains operable?

MR. TAJADDODI: Okay. Actually there are three conditions under which you can have different kinds of accident signals that can start a diesel. One is on the test mode and the other is under normal conditions. If the diesel generator is parallel to the system, you have three conditions that we consider. First, an SIAS, followed by LOF, then, a condition where LOP occurs first followed by SIAS, and number three, a coincident LOP and SIAS together.

Now, under the condition where you have first LOP then an SIAS, as soon as the diesel generator is parallel with the system, the undervoltage relays cannot detect an undervoltage condition. What will happen is that the diesel generator will be instantaneously overloaded. It will go into an isochronous mode from a droop mode and will initiate a signal to trip this breaker.

Once this breaker is tripped, the undervoltage relays

are going to detect undervoltage conditions and they are going to go into the proper sequence of tripping the breaker in here and closing the diesel generator breaker and start loading the buses.

On the condition where you receive the SIAS first and then an LOP subsequent to that, under the SIAS condition, again, the SIAS signal trips the diesel generator into an isochronous mode immediately. It sends a one second pulse to trip the breaker and to start the sequence as ordinarily. In other words, to sequence the loads.

When you have both SIAS and LOP simultaneously, then that is almost a normal condition where you clear the bus and the voltage relays are going to start the diesel generator, close the breaker, and start loading the bus.

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

MR. ROSA: Do you depend on the undervoltage sensing relays to start the diesel or do you provide a diesel start signal from the SIAS signal or both.

MR. TAJADDODI: There is a diesel generator start signal. The undervoltage relays are going to initiate the diesel generator start signal.

MR. ROSA: How about SIAS? It also is going to?

MR. TAJADDODI: That is right. There is a DGSS signal, start signal.

MR. VAN BRUNT: Are there further questions?

(No response.)

MR. BINGHAM: Let's go on to 2H, other review areas.

MR. TAJADDODI: These are miscellaneous items that are required by SRP and we have put areas of major concern under this heading. This is figure 2H-1. One of the items that is required to be addressed is fire protection. It requires that measures should be taken to minimize or even prevent the possibility of having a fire in the power plant.

One of the major aspecrs of preventing fire is to make sure that cables are purchased to meet the requirements of IEEE-383, fire retardancy tests and meet the requirements of IEEE-384 and Reg Guide 1.75 and the PVNGS design actually meets that requirement. We have purchased all of our cables to meet fire retardancy requirements of IEEE-383 and also meet the separation requirements of 384 and Reg Guide 1.75.

In addition to that, we also have the Branch Technical Position 9.5-1 which addresses the fire protection. We do not want to go into detail on that but we take that into consideration to make sure that we confine the fire and try to minimize the effect of the fire and confine the fire in one area should a fire occur.

Other requirements that can be addressed and are pertinent to be mentioned are that no cable splicing is allowed in class 1-E circuits. All of our class 1-E circuits are actually continuous cables. We do not use armored cable as a means of raceway and we have also mentioned the redundancy and independence requirements of 2A and 2B of this presentation.

Other requirements are to assure that we have got a viable design to make sure that the cables cannot have the possibility of fires, to make sure that they are sized properly and they are routed properly in the trays without having overfill. They are routed in the manner shown in figure 2H-2.

The 5 and 15 KV cables are routed in raceways in a maintained spacing manner per the requirements of ICEA P-54-440.

The 600 volt power cables are randomly filled up to 30 percent of the tray.

The control and instrumentation cables are also randomly filled up to 40 percent of the tray.

Now, the ampacity of the cables are taken into consideration assuming 100 percent load factor with 90 degrees C conductor temperature as the maximum temperature the cables are designed for.

In addition to that, we make sure that the cables which are routed in ducts and conduits are sized in accordance with the appropriate ICEA standards and the NEC standards for conduit fill.

The arrangement of the cable is such that the higher voltage level cables are routed at the top and subsequent to that the 5 KV, 600 volt power, and 600 volt power and control and finally instrumentation cables in that order. This is figure 2H-2.

This is figure 2H-3. Other requirements that are pertinent to be discussed are seismic classifications of class 1-E systems. All of the class 1-E equipment is designed to meet the safe shutdown earthquake requirement and meets the appropriate spectra that are dictated by that kind of earthquake.

Item 3, electrical penetration design. The design meets 1.63 for short circuit duration. For primary short circuit duration we use the actual time of the opening of the breaker rather than the one dictated by the Reg Guide. We use the characteristics supplied by the vendor to ascertain the

opening time of the primary breakers. For backup protection of penetration seal protection, we use the breakup breaker for the medium voltage cable and low voltage load center cable. In the case of the reactor coolant pumps we use the main feeder breaker as a backup breaker. The time for the opening of the breaker is the time to make sure the penetration seal has maintained its integrity.

Now, the two breakers get their power from different batteries. Each breaker has its own independent battery even though they are not class 1-E.

The feeder breaker for the RCP gets its power from a different non class 1-E battery than the one which provides the power to the 13.8 kv bus.

In the case of 480 volts, there is no control power requirement for the breaker. We just specified the opening time of the backup breaker which is this breaker in here. The backup breaker opening time is this one here. For the MCC's we have a design such that for wire size No. 8 and smaller we have conductors with capability of withstanding the maximum fault current based on thermal fusing of the field cables in one-half of the time, as a maximum, of the fusing time of the penetration conductor.

We do insure that under all circumstances, the penetration maintains an integrity as far as the pressure boundry of the containment is concerned and it opens and isolates the fault before the conductors that are inside the penetration start fusing.

MR. ROSA: Doesn't that violate reg guide 1.63 that requires redundant protection, overcurrent protection? I mean you cannot take credit for the fusing of field cables providing one.

MR. TAJADDODI: The tests done by penetration manufacturer showed that the circuit opens before anything happens. You reach the isolability of the penetration conductor which is the one that is crucial. So you maintain the integrity of the cables for the backup.

MR. ROSA: I am aware of that but I believe the latest position of reg guide 1.63 does not allow credit for that any more. Am I correct in that?

MR. TAJADDODI: Is this the new reg guide? Which reg guide is this? Which revision is that?

MR. ROSA: It goes back a number of years.

MR. TAJADDODI: It does not say specifically we do not allow fusing to the best of my recollection. It just makes

sure that the time for the backup opening is such that it maintains the integrity of the penetration.

MR. ROSA: I believe the latest revision, which I think is probably about three or four years old, specifically does not permit fusing as backup protection. I think we ought to check that. I know we have been requiring recent OL's to add a redundant overcurrent protection on some of those circuits that originally were designed to use field cable fusing as a backup.

MR. TAJADDODI: That is essentially what we have in here but I was looking for the reg guide itself.

MR. VAN BRUNT: Faust, why don't we put that on the list of items we will check and will specifically respond to this particular point whether we do or do not comply.

MR. KOPCHINSKI: Gerry Kopchinski. In our FSAR section 1.8, we have addressed reg guide 1.63, revision 2, and say we meet it as interpreted below. Part of that interpretation involves this subject right here. It is all spelled out in our response.

MR. ROSA: Well, if that is the case, we would find it unacceptable.

MR. VAN BRUNT: We will look into this particular item.

MR. TAJADDODI: Finally, the quality aspects. We are committed to quality assurance that meet the requirement of IEEE-336, reg guide 1.30 or per the requirements of 10CFR50, appendix B, for all of the class 1-E equipment. We have got a manual that pretty much delineates how that is done.

MR. VAN BRUNT: Faust Rosa.

MR. ROSA: Could you briefly give us a description of how quality control applies to the offsite power system that is not class 1-E. There is no requirement per appendix B, QA program for that system but we feel there should be some quality control applied to it.

MR. VAN BRUNT: Faust, we do not have anybody here who could really deal with that question today. The design of the switchyard and the -- I should say the responsibility for the switchyard and the offsite transmission system rests with the Salt River Project. With regard to the switchyard and Westwing line and the Kyrene line. It rests with the Arizona Public Service Company with regard to the Saguaro line and the Southern California Edison Company with regard to the Devers line. However, we will add a punch list item and provide some information relative to quality control and other aspects that are included in the specs for the manufacturer and/or installation of those particular systems.

MR. ROSA: I am particularly interested in the installation and testing of that portion of the offsite power circuits between the safety buses and the switchyard primarily.

MR. TAJADDODI: Are you talking about the whole --

MR. ROSA: Right.

MR. BINGHAM: We have a drawing. Maybe we can handle it. Which part here?

MR. ROSA: Actually, I think the other one is better.

MR. TAJADDODI: He is talking about the onsite --

MR. ROSA: Part of it is there also but I am not too concerned with the overhead transmission lines.

MR. TAJADDODI: I think this is the one that he is talking about. If I am right --

MR. ROSA: From the very top all the way down to right there.

MR. TAJADDODI: I do not know exactly what kind of procedures we have as far as --

MR. BINGHAM: What part is overhead.

MR. TAJADDODI: This part is overhead.

MR. BINGHAM: What part do you want?

MR. ROSA: I would have you address all of it between

the input to the startup transformer, say --

MR. BINGHAM: From here?

MR. ROSA: Yes, all the way down to the safety buses.

MR. TAJADDODI: You are talking of quality control.

MR. ROSA: Just what quality control you do apply toward the installation.

MR. BINGHAM: Let's take a stab at it.

MR. BAN BRUNT: I think Bill can deal with that, Faust. When you said offsite, in our terminology, offsite is from the switchyard on out.

MR. ROSA: Right. In my terminology it is up to there.

MR. VAN BRUNT: The responsibility for that aspect does lie with Bill's people and I will let him deal with that.

MR. BINGHAM: I would have to check on the qualifications but that part of the system is in our overall plan of quality. We may have given it a quality class "S" which means normal equipment and with that we have a specification. We have established criteria for this kind of equipment and we have installation procedures, installation requirements on how to install that to the classification level that we set.

All of that appears -- at least the classification

appears in the SAR. Inspection procedures are not as detailed generally as the quality class item. We do not necessarily have as many hold points but we still have those that are necessary for the intended application and we do have inspection. We have inspection plans. We do have field engineering check that the installation is in accordance with the drawing specifications. All of the elements are the same. It is just that we do not put the pedigree on it.

MR. ROSA: That is all I wanted to get on the record. We look for that. We know that most -- in fact, all -- utilities have them. Sometimes it is not clearly recorded.

MR. VAN BRUNT: Okay.

MR. BINGHAM: Are there any other questions.

MR. VAN BRUNT: Are there some other questions? I have one.

Fred, would you go back to exhibit 2H-1. I don't have a question, I just want to make a comment for the record.

You indicated up there under cable splices that no cable splices are allowed in any class 1-E raceways. That is, in fact, the spec. for the cable and all of the rest of the items. I just wanted to note for the record that we have filed a 50.55(e) relative not to splices but what are

called factory repairs or one factory repair that we found in the field. We are presently investigating that aspect. I did not want anybody to get confused that this 50.55(e) was in conflict with that particular statement.

MR. VAN BRUNT: Any further questions?

MR. ROSA: With regard to seismic qualifications of raceways, will you address that?

MR. TAJADDODI: Yes, I will address that portion. In general, all of the raceways, including the supports for the raceways are supposed to meet the seismic requirements for the plant, seismic spectra requirement supports and the type of raceways that we have procured have to meet industry standards. The supports for the raceway systems are analyzed and actually designed to meet the requirement of the seismic spectra for the level for which they are installed. These are done by the civil structural group for special type of supports. For the different parts of the raceway systems they make sure that the design actually meets -- make sure the raceways actually do not fall under seismic conditions.

MR. ROSA: Does that apply to both class 1-E and non class 1-E raceways.

MR. TAJADDODI: They are done throughout the plant.

MR. BINGHAM: Let me make a comment, Faust. Fred said supposed to. They do follow the established criteria. Bechtel has done a considerable amount of work in testing over the last few years particularly on quality of cable tray supporting systems and they are designed to assure that they have the proper design.

Each of the "Q" systems are looked at and calculations are made for them. Generally standard types of hangers for a particular application are used and the design has been confirmed through testing and, as a matter of fact, on this plant, we have shown that the designs that we have are very conservative based on test data. We have not chosen to make any substantial changes on this vintage plant.

As far as the non "Q", there are standard designs that are supplied for use by the raceway designer depending on the tray configuration and the location in the plant.

We do look at the two over one concept to assure that there will not be any trays or tray supports that do not remain functional following a SSE if they are located over a class 1-E piece of equipment. We do not have many of those because of the layout of the plant.

MR. VAN BRUNT: Are there any further questions? Yes.

MR. HOEFERT: Are there any --

MR. BINGHAM: We can't hear you, Norm, speak a little louder.

MR. HOEFERT: Are there any instances where failure of a non class 1-E component, because of its proximity to a class 1-E component, could cause the failure of the class 1-E component by falling on it and damaging it somehow? Would that be possible?

MR. TAJADDODI: We do have cases where, as you say, there might be proximity of non class 1-E but we analyze and make sure that the supports of that are such that even if it falls, it will not fall on class 1-E equipment. We may have cases where the non class 1-E cabinets might be close to the class 1-E cabinets but it is designed and physically separated in such a manner so that even if it falls, it will fall in such a manner that it will not hit a class 1-E piece of equipment.

All of the class 1-E equipment is looked at and analyzed to make sure that the failure of class 1-E, redundant class 1-E or non class 1-E not jeopardize its function or its physical aspects.

MR. HOEFERT: Would this include --

MR. BINGHAM: We can't hear you.

MR. HOEFERT: Would this include a piping system failure, a leak, as well.

MR. BINGHAM: Yes.

MR. TAJADDODI: Are there any more questions?

MR. VAN BRUNT: Fred, you have been talking here about a lot of things. You have talked about some tests that were run and analysis that had been done and ultimately the result of all of this is some hardware that has been put together. What is your program that assures that all of these basic design parameters and everything else get factored into this actual procured piece of equipment.

MR. BINGHAM: Why don't I respond to that.

MR. VAN BRUNT: I thought you would.

MR. BINGHAM: If I understand your question correctly it was how do we get from the design criteria to the as built equipment in the plant.

MR. VAN BRUNT: And how do you assure that the as built equipment, in fact, reflects the design criteria?

MR. BINGHAM: I did discuss earlier the fact that we had several systems to assure ourselves that the criteria did get reflected in the design and in the documents that go to the vendors, in other words, to procure the equipment. So with that system that we have for review, we then can demonstrate through the review of the tests of the piece of equipment in the factory and through inspection, at least have reasonable assurance that the piece of equipment that was shipped to the site does, indeed, meet the specifications.

We all know that there are some variances to that. We pick them up all of the time through subsequent reviews by the various levels that we have in our program.

How do we know that it meets the intent and function? I discussed earlier that there is a test spec or test guideline that is written by engineering that says this is what the system is supposed to do. Also there are acceptance criteria. From that, procedures are written and the actual piece of equipment is given a functional test in the field. If not a functional test, a subcomponent or partial test will be conducted.

The results then are compared with the criteria and if it does not meet the intended functional spec, that is, if it does not put out the flow for the conditions it is supposed to put out for a pump then that information must be made available to the engineer for review. It may turn

out in actual application, it is only off a percent or two and that may be acceptable. Or it may be that major modifications are required. So the end result, from the viewpoint of the engineer, the test that is performed in the as built condition in the field. That is, that whatever the piece of equipment is, that it does meet the required criteria.

So, we specify what it has to do. Then the startup operation group tests and verifies that it does, indeed, perform its intended function.

MR. VAN BRUNT: Are there any other questions?

MR. HOEFERT: I would like to clarify something. Bill mentioned that the engineer writes the guidelines. Is it not correct that a separate group writes the guidelines and the engineers, I believe, review them? I do not believe they actually write the test guidelines.

MR. BINGHAM: No, that is not correct, Norm. The engineer is responsible for it. On this particular project because of the resources, we have asked our startup people to actually do the actual writing but the approval and review is by the engineer and the responsibility is the engineers.

MR. HOEFERT: The actual writing is done by a separate

startup group then and reviewed by the engineer.

MR. BINGHAM: The approval and review. He specifies, he sets the criteria and these people just take the criteria and put it in a document. That is just for convenience.

Any other questions? Faust.

MR. ROSA: In this writing and reviewing and approving of test procedures, what part does the utility play in that, if any?

MR. BINGHAM: The utility reviews the procedures also. For example, after the procedure is ready for review, at that same time it is reviewed by the utility's operation startup group and engineering group. Those comments come back to us and are incorporated as well as the comments from the engineer and our own startup organization. All of those comments are incorporated into the test guidelines when it is issued.

So there is a review by all parties. All comments are resolved, documented, you can trace the comments through just as you can on any other documents. That forms the basis for an approved test spec.

The utility gets involved again because they will be the ones that actually write the procedures to perform the test

and will actually conduct the test and compare the test results with the acceptance criteria and will get their engineer involved again if there is some discrepancy between the test results and the acceptance criteria.

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

(No response.)

MR. VAN BRUNT: Why don't we take about five minutes and give the young lady a break and then we will get back at it, say, 3:30.

(A brief recess was taken.)

MR. BINGHAM: That concluded the item 2 standard review plan presentation. We would now like to discuss the diesel generator instrumentation and control.

MR. TAJADDODI: This is figure 3-1. It is a list of all of the diesel generator local alarms. As you can see there are quite a bit of alarms locally. I don't think it would be advisable to go through each one of them. I am only going to refer to the electrical portion of this figure and if there are any questions, just ask the question for each line.

Now the electrical diesel generator undervoltage and diesel generator underfrequency, this is only at the time

that you are paralleling with the system. In addition to that, we have got loss of field and reverse power generator load unbalance, and generator differential which are alarmed locally.

This is figure 3-2. It shows the annunciation in the control room. It essentially duplicates some of the alarms already covered for the local portion. Again, we have got undervoltage, underfrequency, loss of field, loss of DC control power, local-remote switch in local or off position alarm, generator differential -- this is neutral overvoltage instead of just overvoltage. This should be corrected. Negative-phase sequence overcurrent, diesel generator field ground detector, and high priority alarm which includes some of the electrical trip functions under accident conditions.

This is figure 3-3. It shows the generator protective functions, during a non accident condition while you are testing your diesel generator. It again has got some of the trips that we mentioned before, electrically speaking. You have got loss of field, generator differential, generator neutral overvoltage, generator voltage, restrained overcurrent, reverse power, and underfrequency, in addition to some of the diesel related trips.

This is figure 3-4. It shows the generator protective functions under accident conditions. The only time that we actually trip the diesel generator under accident conditions is when you have got one or more of these trips. One is engine overspeed and the other is generator differential. These are the two which are required by NRC.

In addition to that, NRC requires that if you are going to have additional trips that those have coincident logic and Bechtel has chosen to provide one out of two, taken twice logic for low lube oil pressure condition.

Now, we have control indication in the control room and the following indications are provided in the control room among which we have got amps, voltz, hertz, watts, vars, and other requirements such as the remote manual synchronization, remote manual frequency and voltage regulation, manual governor droop and voltage droop selection, and some others.

This is figure 3-5. Again these are local indications in the diesel generator rooms and, as we can see, again some of the electrical indications are manual exciter field removal and reset, three position maintained contact switch for normal exhaust fan which is a non class 1-E. Two position switch for the essential exhaust fan and we have

modified this portion of our design. Instead of having two emergency stop push buttons, we now have only one emergency stop push button instead of two.

In addition to those, we have have got the current, voltage, watts, vars indication also in the local diesel generator rooms.

MR. BINGHAM: Questions?

MR. VAN BRUNT: Are there any questions? I have one.

MR. FREID: I think this presentation makes it a little bit clearer the question I asked before and that was on the annunciator -- not the individual annunciator -- but the local alarms, we do distinguish between those that are not bypassed, the ones that you referred to on exhibit 3-4. Those are on a separate annunciator panel versus the ones that are grouped, versus those on 3-3. Those would be on separate alarms.

MR. TAJADDODI: Under accident conditions --

MR. FREID: That is not the one I want.

MR. TAJADDODI: Is this the one that you want?

MR. FREID: No, what I am saying is: are there separate annunciator windows for the ones that are in exhibit 3-3 and the ones that are in 3-4?

MR. TAJADDODI: Okay. These are trip functions which are exhibited in the high priority alarm. Okay.

MR. FRIED: Yes.

MR. TAJADDODI: I am sorry. This is not class 1-E. You are talking about the accident trip functions, right?

MR. FRIED: I am saying do the annunciator windows distinguish these two types of alarms?

MR. TAJADDODI: Yes, these alarms are under high priority alarms. The others -- anything other than these are low priority alarms.

MR. BARROW: John Barrow. Let me try to make what Shelly is saying a little bit more clear because he has raised a question in my mind. For instance, this picture has engine overspeed. Now if you go to 3-3, it also has engine overspeed. Both of them say generator differential on both of those. Those are the same window in each case, right?

MR. TAJADDODI: That is right. They are the same window.

MR. BARROW: Yes.

MR. TAJADDODI: But in an accident condition, you will bypass this one. You will not bypass the other one and it will go into high priority alarm showing you that you are

under accident conditions. You have these trips.

MR. BARROW: Under accident conditions, it will actually trip. Under non accident conditions -- let's see, those would trip in either case.

MR. TAJADDODI: They will trip in either case, yes.

MR. BARROW: Okay.

MR. VAN BRUNT: Shelly, are you satisfied?

MR. FREID: Yes.

MR. VAN BRUNT: Let me ask you another question. In this whole section 3 here, you are talking about local alarms, and --

MR. TAJADDODI: And remote alarms.

MR. VAN BRUNT: And remote alarms, etc. and these are all alarms that appear somewhere on the board and give you a visual indication?

MR. TAJADDODI: That is right.

MR. VAN BRUNT: We have a lot of CRT capability as well. Are there other types of signals and stuff that is not listed here that the operator can call up if he so desires?

MR. TAJADDODI: I think we have listed almost everything.

MR. VAN BRUNT: You have listed everything.

MR. TAJADDODI: We have listed everything even the ones which are not electrical. We have listed the diesel related alarms. Everything is indicated here. This is the whole thing.

MR. BARROW: John Barrow. On Exhibit 3-2, the bypass and inoperability status indication is on the safety equipment status panel?

MR. TAJADDODI: Yes.

MR. BARROW: And into that is incorporated every one of these settings whether it is remote switch in the off position or trips or anything, they are all indicated.

MR. TAJADDODI: They are all indicated on the SESS panel. Every one of those trips is indicated in bypass condition.

MR. VAN BRUNT: Carter.

MR. ROGERS: On exhibit 3-5, you stated that -- or shows two emergency stop push buttons, each with mechanically interlocked reset buttons, and you stated that this has been changed so that you can stop the diesel generator with just one button. What led to that and does that reduce the safety aspect.

MR. TAJADDODI: Actually the circuitry was complicated and also the fact that we are providing a cover. The reason for the two emergency stop push buttons was that we were afraid that the operator would inadvertently lean against it and push it and start an undesirable sequence of events. But one push button with a cover eliminates that possibility. Also the circuitry is simplified and we do not have to resort to that kind of a philosophy to cope with the accident.

MR. ROGERS: This is a circuitry simplification primarily, is it?

MR. TAJADDODI: Circuitry simplification and also we are precluding the possibility of inadvertently leaning against by providing a hard cover over the push button to make sure that if there is going to be a button pushed, it is going to be done intentionally and not accidentally.

MR. ROGERS: Does this hard cover have a spring or something to keep the button covered?

MR. TAJADDODI: I don't --

MR. ROGERS: Or like gravity.

MR. TAJADDODI: It is a lid, I believe, and you lift it to push the button if anything happens.

MR. ROGERS: The concern that I have is that the cover is not over the button.

MR. TAJADDODI: The cover is over the button all of the time. It is over the button all of the time so that if you have to push it, you have to lift the cover and push the button.

MR. ROGERS: It is a two step kind of thing?

MR. TAJADDODI: Yes, so you cannot do it inadvertently.

MR. VAN BRUNT: Are there any other questions?

MR. LU GOW: Yes. Lu Gow. You have several items here under non accident conditions that can remove the generator from use. Have you identified how long it takes to maintain -- how long you can operate in this condition, continue normal operations?

MR. TAJADDODI: That is a procedure -- that depends on what kind of problems you have. For instance, if you have a generator line to ground fault, overvoltage conditions, you can operate it up to a certain point without damaging the generator. That has also got to be part of the operating procedure for the operator to take appropriate action at some time after the accident to cut it down. But it does not have to be done simultaneously, I mean, same time. In other words, some abnormalities of the diesel generator function can be tolerated up to a certain point. Some others cannot be tolerated. If you have got a solid bolted fault you have got to shut down the diesel generator and this arrangement will take care of that.

MR. VAN BRUNT: Any other questions?

(No response.)

MR. BINGHAM: Okay. That brings us to the final item which is the IE bulletins, circulars and information notices.

MR. TAJADDODI: This is figure 4-1. Actually what we have done on this is to respond briefly to some of the concerns of NRC which are relayed by means of different bulletins, circulars, and information notices. We have summarized some of them very briefly in here and will go with the circulars first. There was a circular 78-09 regarding the arcing of General Electric size 2 contactors. We have been using these type of contactors. However, GE has corrected the concern and the problem that we had with those contactors.

On the 79-02, failure of 120 volt vital AC power supply. This was brought about because of the fact that the inverters being used on that particular utility had two feeds, one from the DC and one from the AC, and the AC side had a common mode failure that caused all four to trip. In our

design, we do not have a double feed to the inverters. We have got one feed from the DC batteries which acts like a surge tank and not all four inverters can be affected irrespective of what kind of AC disturbance is encountered. So we have a different design from the one described in 79-02.

79-05, there was an IE bulletin, circular, I should say, regarding the qualification of the terminals and how they should be qualified. Actually, we are trying to qualify all of the terminal blocks for LOCA and mainsteam line break inside containment. We are going to have these terminal blocks inside the terminal boxes to preclude the possibility of any adverse affect and qualify the terminal blocks with the terminal boxes.

In the case of the transmitters, we are going to use solid conductors passing through qualified seals to preclude the possibility of humidity going through the wire.

This is figure 4-2. It addresses the IE bulletins issued since 1977. The bulletins in order are 77-02, failure of Westinghouse AR relay. We are not using the AR relay that failed. Actually the one that failed was a latch type and we are using the magnetic only type and I understand

even that one has been rectified by now by Westinghouse.

77-05 and 05A pertaining to -- this is an electrical connector instead of generator. This is a typing error. It should be electrical connector assemblies. Now the connector type which is used on Palo Verde is different from the one that caused the failure under 77-05 and 05A. We are using a different design.

78-01, flammable contact arm retainer in GE CR120A relay. We actually do not have this relay that failed. We are not using CR120A in our design.

78-02, terminal block qualification. I stated briefly before that they will be qualified to meet 323-1974 and we are going to use NEMA type 12 enclosures for control and instrumentation cables.

78-05, auxiliary contact mechanism failure on GE CR105X, we are actually using CR205X instead of CR105X, so we should not have any problem. We are using that for both class 1-E and non class 1-E portions of the electrical system.

78-06 calls for the problem with defective Cutler-Hammer type M relays. We are not using any Cutler-Hammer relays in our design.

This is figure 4-3, loss of non-class 1-E instrumentation and control power bus during operation. I understand this portion of the bulletins was addressing the design that did not have any redundancy in the non class 1-E portion. We actually have got 2 ungrounded non class 1-E instrument distribution panels and 4 ungrounded vital class 1-E panels. Some of the functions of the non class 1-E are duplicated in a portion of class 1-E. So any failure of any one of those is not going to degrade the system.

Finally there was an information notice of 79-04, degradation of ESF. This portion of the column was addressed I believe by the ACRS presentation some time ago. We have shown that our design cannot cause a single event that will bring the whole unit down.

MR. BINGHAM: Questions?

MR. DUNNING: You say that all non 1-E instrumentation has a 1-E counterpart.

MR. TAJADDODI: A good portion of them have because it provides for 2 ungrounded non class 1-E and 4 ungrounded class 1-E. This is a requirement of CE to make sure that we have got --

MR. KEITH: This was a very poorly worded response. I wonder if you mean -- it seemed like you skipped over that

one.

MR. VAN BRUNT: Why don't you take a stab at it, Dennis.

MR. KEITH: I am not familiar with the subject of the bulletin. The way that is written, obviously we do not have, you know, normal chilled water system has instrumentation that is non 1-E. We do not have a 1-E counterpart for that.

MR. TAJADDODI: Let me elaborate on the wording. It might be confusing. There are some non class 1-E instrumentation which are vital to the operation of the plant and is part of the 1-E system. Now, they are not duplicate systems but they are like a support system that are required to be functional and they are redundant also. You have two class 1-E portions. So if one portion of the class 1-E fails the other portion of the non class 1-E is available to back up those systems and it is not meant as a duplicate of the class 1-E portion of the instrumentation but they are necessary for the function of the system. I think here the CE is here to -- if there is any contradiction in my remarks to either elaborate on that or refute that.

MR. BINGHAM: Okay, Tom.

MR. PRICE: This is Tom Price. I think what was

addressed recently, just now, was the control circuits. We have a redundant control scheme with reliability that is non class 1-E. To maintain 100 percent power, full operation, you need one or the other of the control schemes but that is not the 1-E circuit nor is it necessary for the safe shut-down protection of the plant. I think that is what you were addressing but I am not sure.

MR. TAJADDODI: That is right. That is what we intended. The bulletin was on a plant -- I don't remember exactly which one it was -- a failure of a non class 1-E caused the plant to shut down. All we are trying to say here is that we have got that but we have two redundant ones.

MR. VAN BRUNT: Karl.

MR. KREUTZIGER: Karl Kreutziger. Could you describe briefly the non class 1-E DC system and non vital AC system? You have been referring to that throughout the presentation and I would like to have a clarification of the non class 1-E vital AC and how it backs up the DC. Are there two non class 1-E 125 volt batteries?

MR. TAJADDODI: No. The 120 volt system is not a battery system. It is a regulated AC system which is fed from the non class 1-E transformer source of power.

MR. KREUTZIGER: We talked about medium voltage switch gear having control power. We said that control power came from a non class 1-E battery.

MR. TAJADDODI: That is right. We have two non class 1-E batteries.

MR. KREUTZIGER: That is what I wanted to clarify was what the non class 1-E system -- could you just clarify -- are there two 125 volt batteries?

MR. TAJADDODI: There are two 125 volt non class 1-E batteries serving the plant for miscellaneous use of the non class 1-E portion of the system.

MR. KREUTZIGER: But there are no inverters that go to 120 volt non class 1-E vital AC system?

MR. TAJADDODI: Right.

MR. KREUTZIGER: They are strictly a regulated transformer?

MR. TAJADDODI: The two that we are mentioning in here are strictly regulated transformers, ungrounded secondary transformers that are not fed from the inverter. They are fed from the non class 1-E source of power without any battery backup for it. There are no inverter backup sources for those two systems.

MR. VAN BRUNT: Did you get your question answered satisfactorily? I am not sure you did.

MR. DUNNING: Well, I would ask, was it someone from Combustion Engineering speaking to instrumentation power loss?

MR. VAN BRUNT: yes.

MR. DUNNING: Is there a corresponding -- I would imagine there is a corresponding complement of equipment in the balance of the plant for which Bechtel would respond?

MR. TAJADDODI: I do not understand the question.

MR. DUNNING: Has there been a look to see what instrumentation you lose if you lose a bus? The concerns here have been primarily associated with the B&W plant and some integrated control systems and some of the problems they have had. The Crystal River event was addressed in a circular letter but in those instances, their problem was that the loss of the bus caused the loss of a great deal of instrumentation and the question is: to what degree have you looked at the normal power plant operations. Are you going to totally rely on safety systems on the loss of a bus and have you looked at that from both aspects, both as to the C-E supplied equipment and utility supplied equipment. Is that

an item that this Board can involve itself with?

MR. VAN BRUNT: Do you want to comment.

MR. KEITH: Yes, I can say the same thing that CE stated, mainly that all of the equipment required to safely shut down the plant, in the balance of the plant, is powered off of class 1-E power. But that is not addressing everything that you --

MR. DUNNING: If it is on the same bus that does not help you if you lose that bus. That is the concern, have you looked to see that it is distributed so that a single bus loss does not leave you in a blind condition.

MR. KEITH: As far as our class 1-E instrumentation, that is distributed. We have four different instrumentation power supplies.

MR. TAJADDODI: Four redundant, I should say, four completely redundant instrumentation power supplies.

MR. KEITH: Yes.

MR. TAJADDODI: So actually if you lose one of them you are going to actuate a shutdown, accident condition. It is two our of four but you should have at least three to be able to operate. So we have a completely redundancy in the class 1-E portion. The non class 1-E portion also

has got two different sources of AC system. For mitigating an accident, we have got enough redundancy to meet the requirement.

MR. DUNNING: These were not particularly accidents. They started out by the loss of a bus for controlling one kind of implied condition. It left the operator without much guidance as to what condition the plant was in. It was not a question of whether safety systems are going to work because you have redundancy and things like that. It is what you have tied on to some of these buses.

MR. TAJADDODI: You have only one instrumentation bus, right?

MR. DUNNING: I don't have --

MR. TAJADDODI: You see --

MR. VAN BRUNT: Just a minute.

MR. KREUTZIGER: Could I clarify -- I would like to speak, not on the project operations but in my capacity as Chief Electrical Engineer, Bechtel Power Corporation's offices in Norwalk. I am aware of the information that has been distributed with respect to the Crystal River operation. Within the Bechtel Power Corporation, within the Los Angeles Office, the Chief Electrical Engineer reviews as much literature

as is received. We produce what we call electrical bulletins. I have issued to all projects in the last I think about two months ago the requirement to review the criteria that I think was stated in that circular. Specifically to review the non nuclear aspects of operations with respect to transient conditions that could occur that could cause a similar happening as it did in the B&W plant. That information to my knowledge has not yet been responded to by the project Bechtel team to me as the chief engineer. All projects within the Los Angeles Power Division were asked to review in accordance with those NRC criteria that was received to determine whether or not a condition could occur -- if a transient condition could occur -- that could be detrimental to potential plant safety requirements. This project has not yet responded to that bulletin.

MR. DUNNING: I guess what I am getting at is that a presentation is being made on Palo Verde with respect to addressing the bulletin and I kind of get that when the presentation was made, it was basically there is no problem. I was just wondering if that is what the Board's assessment is or if that should be a part of this review process?

MR. TAJADDODI: Karl, we have looked at that evaluation

for Palo Verde and essentially on the CE System 80, we do not have a problem because of the fact that our instrumentation circuits are all split among redundant buses. That is the reason we have redundant buses. But on the other jobs, I am not so sure whether we have a response of that kind but for Palo Verde, we have looked into that and we have ascertained that we cannot have a complete failure of the whole thing because of one bus losing its power. Because of the fact that we have a redundant 125 volt system and the CE NSSS system with two ungrounded sources.

MR. KREUTZIGER: You are saying you have reviewed that and provided an input back?

MR. TAJADDODI: We have reviewed it but whether or not we have provided an input to you officially is a different story.

MR. VAN BRUNT: Let me just comment from the applicant's side of this particular situation. As a matter of course, when all of these IE bulletins come out whether they require action or not, we, as a normal matter, submit that to both Combustion and Bechtel or any other appropriate contractor, if that is necessary. We ask them to evaluate that and comment upon it as it relates to Palo Verde. We did, in fact, do that with this particular item. The project team from Bechtel has, in fact, responded to us. I honestly do not remember the details of that response at this moment. I think Carter wants to comment relative to that. I would like to add this as a punch list item and we will make some comment or make some specific response to your request on this particular issue.

MR. ROGERS: Carter Rogers. The question on Crystal River is one that I am familiar with. I raised it at the last Safety Board meeting and it was discussed at that meeting with regard to the DC power systems. The failure that occurred at Crystal River was initiated by a non class 1-E DC system when there was a ground fault on that system.

Because of the DC power implications, I raised the issue at the Safety Board. Prior to doing that, I had been to a presentation made by the plant manager at Crystal River and been through the total sequence of events with him. I compared that to the Palo Verde design and I am satisfied myself that our design is sufficiently different that an incident of that type would not give us a problem.

MR. VAN BRUNT: But we will verify that and make some reference to the specific detail engineering response that

we receive from Bechtel.

MR. BINGHAM: Ed, you did receive a response from us.

MR. VAN BRUNT: Yes.

MR. TAJADDODI: We have got a three page letter to you.

MR. VAN BRUNT: Yes, absolutely. I just do not remember.

MR. TAJADDODI: That is why I am saying that we have responded but you may not be aware of this because you did not get a copy of it.

MR. VAN BRUNT: Are there any further questions. I have one myself. Carter.

MR. ROGERS: Going back to another page, exhibit 4-2, there are a number of bulletins in there where the responses you have given to those bulletins are such as, 'the design does not have GE CR120A relay' or this 'connector type is not used in containment' and so on and so forth. Now, obviously the design is still proceeding and we are still going on with the purchase of new equipment. How can we be sure that someone does not put one of these faulty pieces into the design after you have made that statement?

Secondly, how did you go about determining that we did not have that equipment?

MR. BINGHAM: I will see if I can respond with an overview

to that.

MR. ROGERS: Okay.

MR. BINGHAM: As you know, when a letter comes in, our procedure is to send a subsequent letter to each of the suppliers involved. Sometimes it is just one or it may be several to make sure that in their piece of equipment that particular component is not used or if it is specified by Bechtel that it was not the piece of equipment that was used.

Let's assume that we have identified that there are no pieces of equipment. There would be no reason to assume that piece of equipment in since we have not specified it. In addition, the QC for installation in the field, we do check the installation against the drawings and when startup comes, we make sure that they have everything that they are supposed to have that is on the drawings.

Let's take the other case, Carter, that we did find that there was one of these components. We would then make the appropriate changes to remove it or repair it or make a disposition in some fashion. Depending upon whether this was a component that was defective as a result of a Part 21 on another vendor which we have seen, we would process it and write a deficiency evaluation report to demonstrate that we

had dispositioned it in the proper manner. So, we have another system that we use if it was one of these kind of components. That is briefly how we cover it. Maybe you need some amplification and clarification on it.

MR. ROGERS: Let's go through one more time. Let's say that a bulletin comes out 80-whatever and it says, don't use piece of equipment "X". So we go through with an analysis and we determine that we do not have that piece of equipment in the plant design at this time. So we make a statement and the statement appears at a hearing such as this or a presentation like this that we don't have it.

MR. BINGHAM: We have done more than that. We have gone on record to the utility that it is not included in the design.

MR. ROGERS: But as changes happen, say, something comes about later after you have made this review, how do we insure that piece of equipment "X" is not put into the design later?

MR. BINGHAM: Well, first of all, if we were going to have to have this piece of equipment, we would have to procure it.

MR. ROGERS: Yes.

MR. BINGHAM: That would mean that we would have to write some sort of procurement document to go out and buy this particular piece of equipment. It seems to me that there are probably two levels of defense. First of all, we would presume that the manufacturer that provided the faulty pieces of equipment would no longer be providing it and would control that through their own QA program so that we could no longer order it.

Second level would be that we would be relying on the specifying engineer that designed it to make sure that in his particular discipline, say electrical, that that particular piece of equipment would not be procured and that as a backup system from the bulletins that Karl mentioned earlier where the chiefs send out a technical bulletin that says, 'don't do this.' and give direction and training to the technical people to preclude this from happening. So there are several areas of this whole umbrella of assurances that that would not happen. You have the vendor, you never procured it, and you have people who review the procurement specs, you have the bulletins and directions from the chief, and then the individuals working who have this knowledge that you should not use this piece of equipment.

MR. ROGERS: Bill, you are responsible for home office

engineering. Assume that field decides to buy this piece of equipment.

MR. BINGHAM: I am responsible for all permanent plant equipment.

MR. ROGERS: All right, what does that mean?

MR. BINGHAM: It means that if it is part of the permanent design that I am responsible for it. If it is a temporary piece of equipment or fixture that will be removed and not be part of the permanent design then that is something else.

MR. ROGERS: Can field purchase permanent plant equipment?

MR. BINGHAM: Field can purchase permanent plant equipment but specifications are reviewed by the engineer.

MR. ROGERS: Does that include a licensing review?

MR. BINGHAM: Yes, if applicable.

MR. TAJADDODI: If it is a piece of class 1-E equipment, it has to be. If it is non class 1-E --

MR. BINGHAM: If applicable.

MR. TAJADDODI: -- if applicable.

MR. VAN BRUNT: Bill, following Carter's question a little more, what about sub tier vendors? Take the case of Combustion which may be an even more difficult situation where we send

this to them and say, you know, do you have any of these in your supply and, if they say they do not have an item, they manufacture it, and that is probably fine, but when C.E. goes out and buys something maybe down two or three tiers, how are we assured then that this relay or whatever the questionable item is does not appear in a sub tier supply?

MR. BINGHAM: As you know, in our other meetings, Ed, we have talked about how to preclude this from happening and Bechtel has taken on the task of independent review of such suppliers as Combustion Engineering to assure that indeed they have done a thorough job in assuring that even their sub tier vendors don't have this piece of equipment.

Again, I would like to indicate that things that have come as a result of a bulletin, generally, are as a result of a reportable deficiency to Compliance (IE) and vendors through their own programs and through the NRC Compliance (IE) reviews really say, hey, fellows, you just cannot provide that component any more and essentially it is not available to anybody to incorporate. I think that would probably be the first line of defense.

MR. TAJADDODI: Unless the deficiency is rectified.

MR. BINGHAM: Yes, if it is rectified, it is not a

deficiency.

MR. ROGERS: Bill, in your answer to one of my questions a moment ago, you said that there was a licensing review of applicable pieces of equipment. I assume there is some sort of criteria that states what is applicable and what is not. Is that correct.

MR. BINGHAM: Yes, there are criteria, procedures, and special block for review by the licensing group on all changes, all design changes.

MR. ROGERS: So that is an auditable type of review?

MR. BINGHAM: It is auditable, absolutely.

MR. VAN BRUNT: Are there any other questions?

(No response.)

MR. VAN BRUNT: Fred, before you finish, I have one other here.

You talked about a number of items here where you just say, the reason this particular IE Bulletin is not a problem is because we do not have any. Is there any analysis made of what the root problem was within the relay. Just because it is not a GE relay GR120 or whatever, Westinghouse may make a relay that has the same problem with a different number that nobody has really had a problem with yet. So,

does somebody take a look at the category of the relay or the characteristics of the relay or what the root problem was and then take a look at the relays that we have specified and determine whether we ought to be doing something about a relay that has not failed yet?

MR. TAJADDODI: No, we have not done that. Actually, we have addressed the IE Bulletins the way they are without going and doing a lot more work than the IE Bulletins ask us to do. If there is a generic problem common to all kinds of relays of the same kind then NRC will address the generic problem and at that time we are going to look into the actual construction of the equipment. But as far as the IE Bulletins are concerned, we only address the IE Bulletins the way they ask us to address them.

MR. VAN BRUNT: I understand that is what you are asked to do but --

MR. TAJADDODI: We do not look into that, no. We have not looked to see whether other equipment of a similar nature has a problem.

MR. VAN BRUNT: I guess I am questioning whether we should.

MR. BINGHAM: In some particular areas, if there are

generic issues across the corporation, these are looked at through the chief's offices and there are subsequent information that come to the groups.

MR. TAJADDODI: But if they are generic.

MR. BINGHAM: Yes, that is right.

MR. TAJADDODI: But if there is an AR relay problem, we don't go out and see whether GE has a similar problem or Cutler-Hammer has a similar problem. We just see whether we are using that particular relay or we are not using that particular relay.

MR. VAN BRUNT: I guess I should address this question to Karl. In your capacity within Bechtel, would you do that kind of review?

MR. KREUTZIGER: Bechtel has a program called Problem Alert Program that is coordinated between all of the Bechtel Power Division offices, Gaithersburg, Ann Arbor, San Francisco, Houston, and Los Angeles. Each discipline has a designated chief engineer in one of the offices who is responsible to systematically review LER's, circulars, bulletins, and other information that we get back from startup reports, problem reports, etc. and to determine whether or not in comparing design deficiencies exist. If a design deficiency is

determined to exist through the review of the chief engineer and his staff, it is then issued to all of the Bechtel Power Corporation offices as a problem alert. Each chief engineer then is required to canvas all of his nuclear projects and to have them respond and have documents on file in the chief engineer's office whether or not that is atypical to each project that has been designed by Bechtel. We primarily concentrate our efforts in design areas and not manufacturing areas. We do issue through bulletins, as I mentioned earlier, manufacturer problems or manufacturing problems.

Our problem alert system is primarily involved with design problems if Bechtel has responsibility in specifying designs. That would include things in our specifications. We review our specifications, our drawings, our standards, to determine if a deficiency exists. But we do not systematically take every failure report and try to do an across the board analysis if a generic product problem might exist between one manufacturer and another. Although we have found instances where that has occurred and we have flagged that through a problem alert, we do not have -- there is not a systematic program that we try to do that.

MR. BINGHAM: Any other questions, Ed?

MR. VAN BRUNT: Yes.

MR. ROSA: Take 78-05 there. It looks like you substituted the GE 105 to the 205.

MR. TAJADDODI: Just the other way around, the 205 for the 105.

MR. ROSA: Okay, the other way around. So that is probably a very similar thing. So now would you find something in Bechtel that shows the difference there.

MR. TAJADDODI: The similarity is only in the identifying features and not in the number. The construction of the relay is not -- it might be similar in 50 percent of the case but not similar in the area that failed. So just the number does not really constitute similarity because the number in a CR is common to both of the relays. It can be a completely different item. Just because they both have CR and 05X does not constitute similarity necessarily and they are different in design. If there is a problem with the 105X, we look at it and find out if 205X does not have the same failure mechanixm.

MR. KREUTZIGER: I might clarify one other aspect. GE has a service advice bulletin that they circulate not only through architect engineers but the utilities. As Bill

Bingham indicated, if a problem is found in a GE type of relay, they -- to my knowledge, we receive all of the GE service advice -- would tell us specifically what the problem was. In many instances, they will tell us this was a problem during a manufacturing date of so many months. It was shipped during a certain period and there might be a repair that you could make to that relay itself and they would tell you that a repair kit is obtainable through a certain part number or a certain office. So the manufacturers do take the primary lead in distributing to the industry, through their product information bulletins, the problems and identifying the scope, the manufacturing date where the problem occurred, and whether or not the relay has a suitable alternative or whether or not it can be adequately repaired. So, I think that is utilized by utilities and all of the industry to make sure that we then survey our equipment to insure that we have not used defective material.

MR. BINGHAM: Are there any other questions, Ed?

MR. VAN BRUNT: Does anybody have any other questions at this point about any of the matters that have been presented thus far.

(No response.)

MR. VAN BRUNT: Bill, do you have any comment? Does

anybody have any comments they want to make? I want to go back through and verify that we have all of the items that we punch listed as we went along and everybody has agreement so Bill's people know which items they have to respond to.

MR. BINGHAM: That completes our presentation.

MR. VAN BRUNT: Faust, do you want to make any comment or does anybody want to make any comment?

MR. ROSA: No, I do not think I have any more comments. If there are any members of my branch here who have something that they would like to have clarified, this is the opportunity.

MR. VAN BRUNT: Hearing nothing, Bill, will you slowly read off the list that you got. I think Dennis has been taking a list for Bechtel. Would you verify that you have the same list and we can compare lists and make sure we cover all of the items.

MR. QUINN: Yes, Bill Quinn. The first item that I have is: was a spare ESF transformer purchased? This was in reference to figure 1-5.

The second item was Mr. Ban Brunt's question: what is the degree of separation between electrical and mechanical systems on the same train. That was Ed's question and he

may feel now that his question has been answered.

MR. VAN BRUNT: I think as far as that item is concerned, I was satisfied. Later on, it was dealt with and I am satisfied with the answer. I don't think that requires any additional information.

MR. QUINN: The third item is in reference to figure 1-4. Is there a door on the double walls on the top of this figure? If so, are there security annunciations on the door?

The fourth item is: are there any operational problems that may develop due to the sequencing of one load group if the second load group if still operating in the normal mode? This was in reference to the section 2-C in the presentation.

The fifth item is: where does the power source originate which would supply power to the pumps that is to supply suction to the two diesel generator storage tanks? Also can these tanks be cross connected and, if so, how is the power supply supplied to the pump in a cross connect mode?

The sixth item was in reference to SRP page 8.3.1-11. That item was: could Bechtel provide diesel generator loading profile curves, voltage and frequency recovery characteristics curves and response time of excitation system to load variations.

MR. VAN BRUNT: Okay, Bill, with regard to that question, my recollection is that the answer was yes. In response to a question from me they indicated if they wanted that information, they would request it but no further action was required right now.

MR. TAJADDODI: Let me make a comment on that one. You mentioned the response time of the excitation system. I do not believe we have the test pertaining to that because they are not really relevant. What you would like to have is actually the response of voltage and frequency and not the excitation system. Of course, the excitation system has to be fast enough to do the job that was required for the voltage to come up but I do not believe we have a test for the excitation system response time. I think that is a confusing part of that question.

MR. QUINN: The SRP specifically says that the NRC reviewer has to review those items.

MR. TAJADDODI: I am not so sure that the requirement --

MR. ROSA: I believe that the interpretation of that is that if the voltage and frequency response is in accordance with the requirements, the excitation system response characteristics are acceptable.

MR. TAJADDODI: That is the way it should be addressed

and not to have the excitation response test. We don't have anything like that.

MR. VAN BRUNT: I think the end result is that no further action is required right now. But if the Commission does require -- does request that information, we can provide it.

MR. TAJADDODI: For that particular item.

MR. VAN BRUNT: No further action is required.

MR. QUINN: Bill Quinn. The seventh item was to provide the results of Bechtel's review of document CR 0660 entitled Enhancement of Diesel Generator Reliability.

The eighth item was to verify the insulation class and temperature rise for the diesel generator. This was in reference to section 2D of the presentation.

Item nine is in reference to exhibit 2H-4, item 2H-B, does reg guide 1.63 allow thermofusing of field cables.

MR. KEITH: I don't know that that is so much an open item on the presentation.

MR. TAJADDODI: Irrespective of whether it does or not, Faust Rosa has made the position quite clear on that.

MR. VAN BRUNT: Well, I think that we owe a response. Faust has indicated his interpretation of what the particular reg guide -- I don't remember the number -- said.

MR. ROSA: 1.63.

MR. VAN BRUNT: 1.63 said and I think what I asked was that you go back and verify what our position was and that you communicate that either through letter or whatever vehicle we use and we will have to resolve the issue. So it is an item that was raised here and does require a response.

MR. QUINN: Bill Quinn again. The last item I had, item 10, was to provide the results of Bechtel's review of NRC IE Bulletin 79-27 relating to design of the design of PVNGS and has Bechtel looked at conditions brought about by failure of a non class 1-E bus. This item referred to exhibit 4-3 of the presentation.

MR. VAN BRUNT: Are there any other items that you have on your list, Bennis?

MR. KEITH: Yes. One was the concern raised by Faust Rosa on the training of the diesel generator maintenance personnel. That would be APS, would it not? You know, rather than a Bechtel item.

I had another. I have "check the NRC testing requirements" and that is drawing a blank with me as to what that is related to.

MR. ROSA: That is the preoperational testing of the

overall AC power distribution system to verify that the analysis that calculated the voltage drops were valid.

MR. VAN BRUNT: I think, Faust, in that connection you indicated there was some standard questions we were going to get about that.

MR. ROSA: Right.

MR. VAN BRUNT: Could we give you an action item to get us that question as quickly as we possibly can.

MR. ROSA: Yes, we will get that to you.

MR. KREUTZIGER: Are those the standard questions from NRC.

MR. ROSA: Yes.

MR. KREUTIZER: We have a copy.

MR. TAJADDODI: Let me clarify a second. There is a bulletin which was sent to the operating utilities, the one covering design which has thirteen point criteria on how you are supposed to do your analysis.

MR. ROSA: That amounts to the same thing except in much greater detail.

MR. TAJADDODI: Yes.

MR. ROSA: For operating license, we use our standard questions -- our standard grid position which is in four

parts and that fourth part in general terms requires that the original analysis and the models used and so forth be verified by test measurements with the system in operation. Now, you respond to that and forget about what was sent out to the operating plants because it amounts to the same thing but it so happens that the Division of Operating Reactors when they were handling operating plants sent those out to operating plants and the Division of Operating Reactors is no longer in existence. The Division of Systems Integration now handles both operating problems and license reviews. Therefore, we are applying the license review version of that position.

MR. TAJADDODI: Do I understand that that particular position has been rescinded or integrated into the new ones.

MR. ROSA: For operating plants that still has to be responded to.

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

MR. KEITH: No.

MR. VAN BRUNT: If that is the complete list, I believe that we are finished with this discussion for today.

I will declare this meeting closed. Thank you all for your participation.

(Whereupon the meeting was closed.)

PALO VERDE NUCLEAR GENERATING STATION
AC POWER SYSTEM REVIEW BOARD

BETHESDA, MD
JULY 9, 1980

AC POWER SYSTEM REVIEW BOARD AGENDA

1. SYSTEM OVERVIEW

2. STANDARD REVIEW PLAN PRESENTATIONS

   A. SYSTEM REDUNDANCY REQUIREMENTS

   B. SINGLE FAILURE CRITERION

   C. STANDBY AND PREFERRED POWER SYSTEMS INDEPENDENCE

   D. STANDBY POWER SUPPLIES

   E. IDENTIFICATION OF CABLES, RACEWAYS, AND TERMINAL EQUIPMENT

   F. VITAL SUPPORTING SYSTEMS

   G. SYSTEM TESTING AND SURVEILLANCE

   H. OTHER REVIEW AREAS

3. DIESEL GENERATOR INSTRUMENTATION AND CONTROL

4. IE BULLETINS, CIRCULARS, AND INFORMATION NOTICES

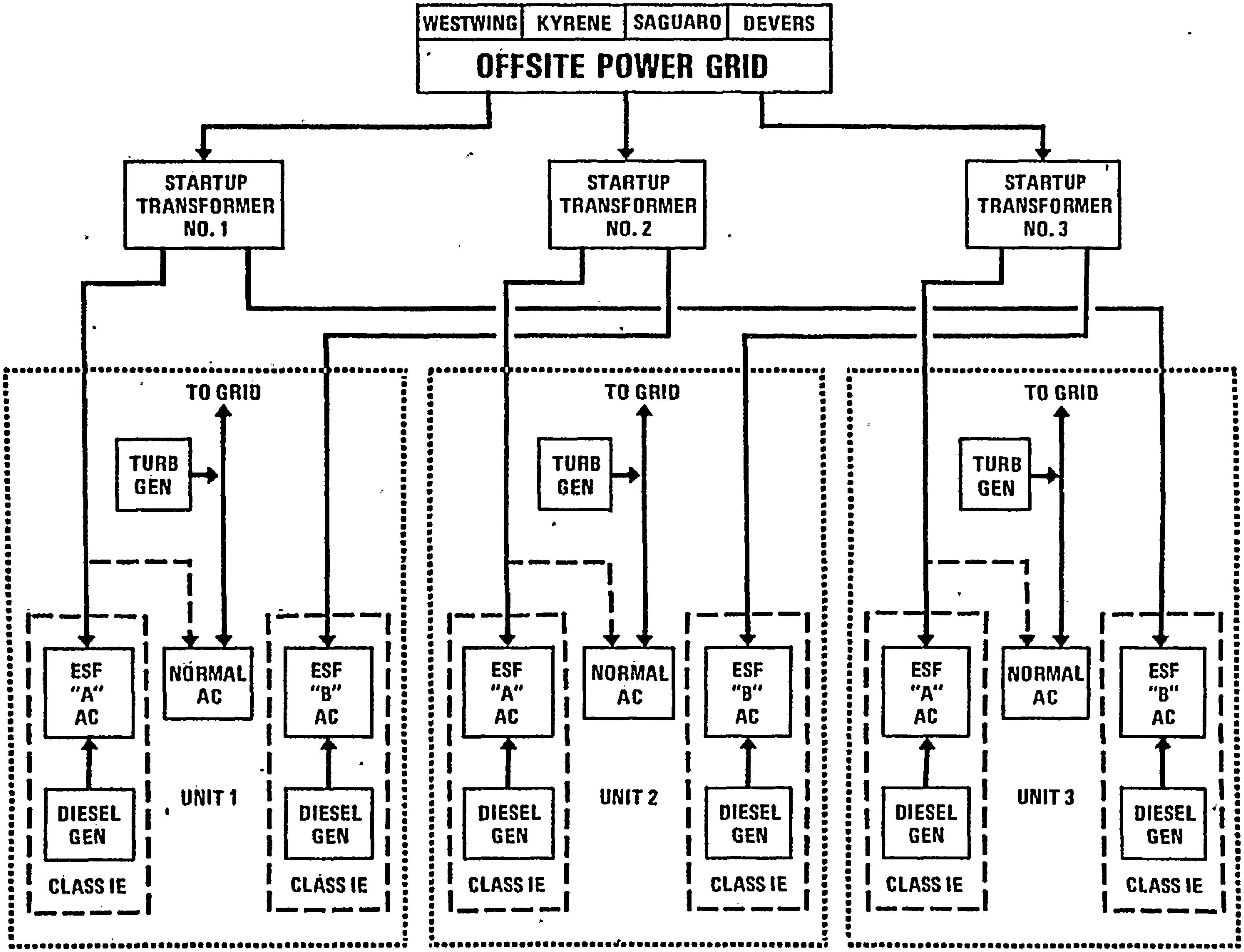
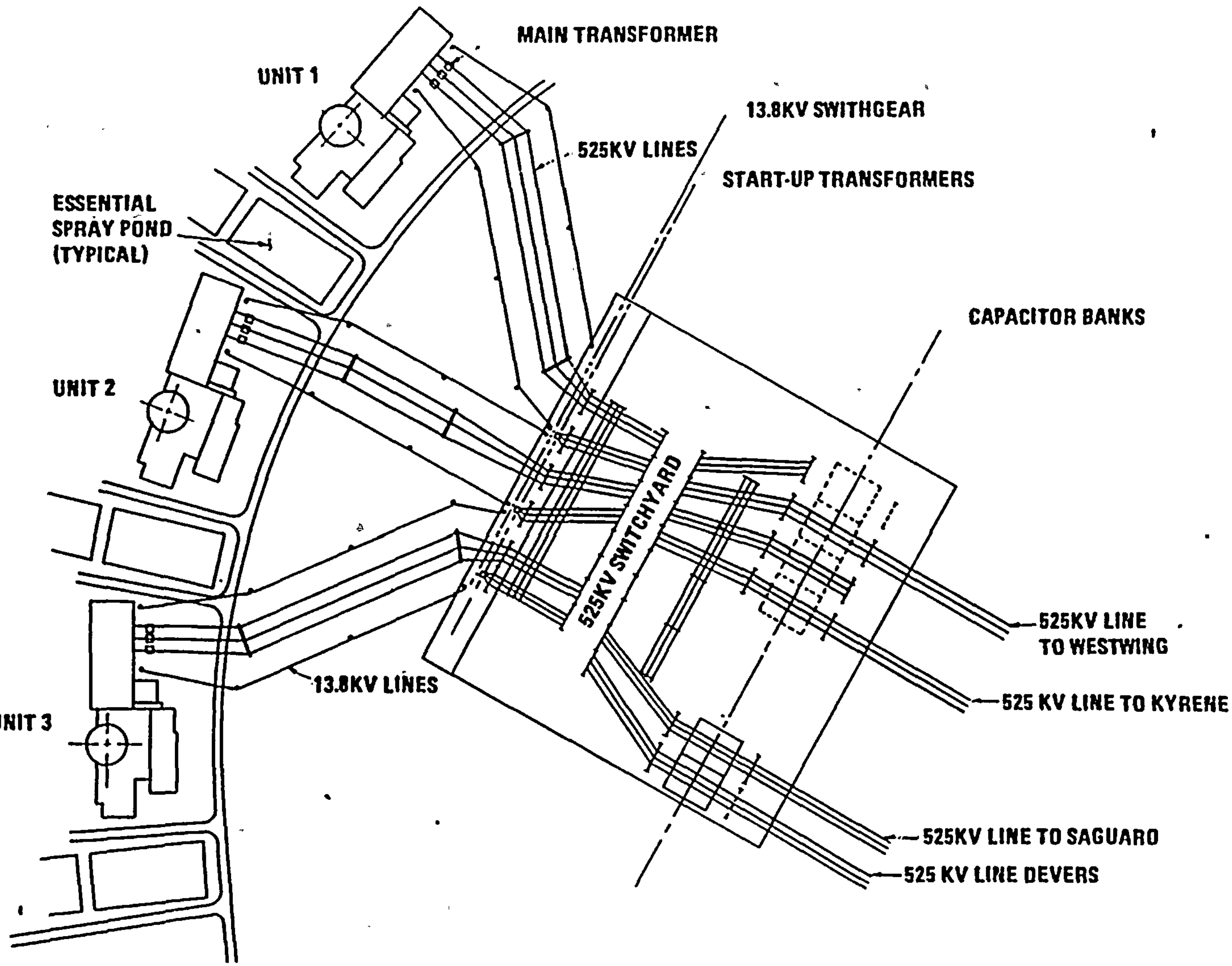
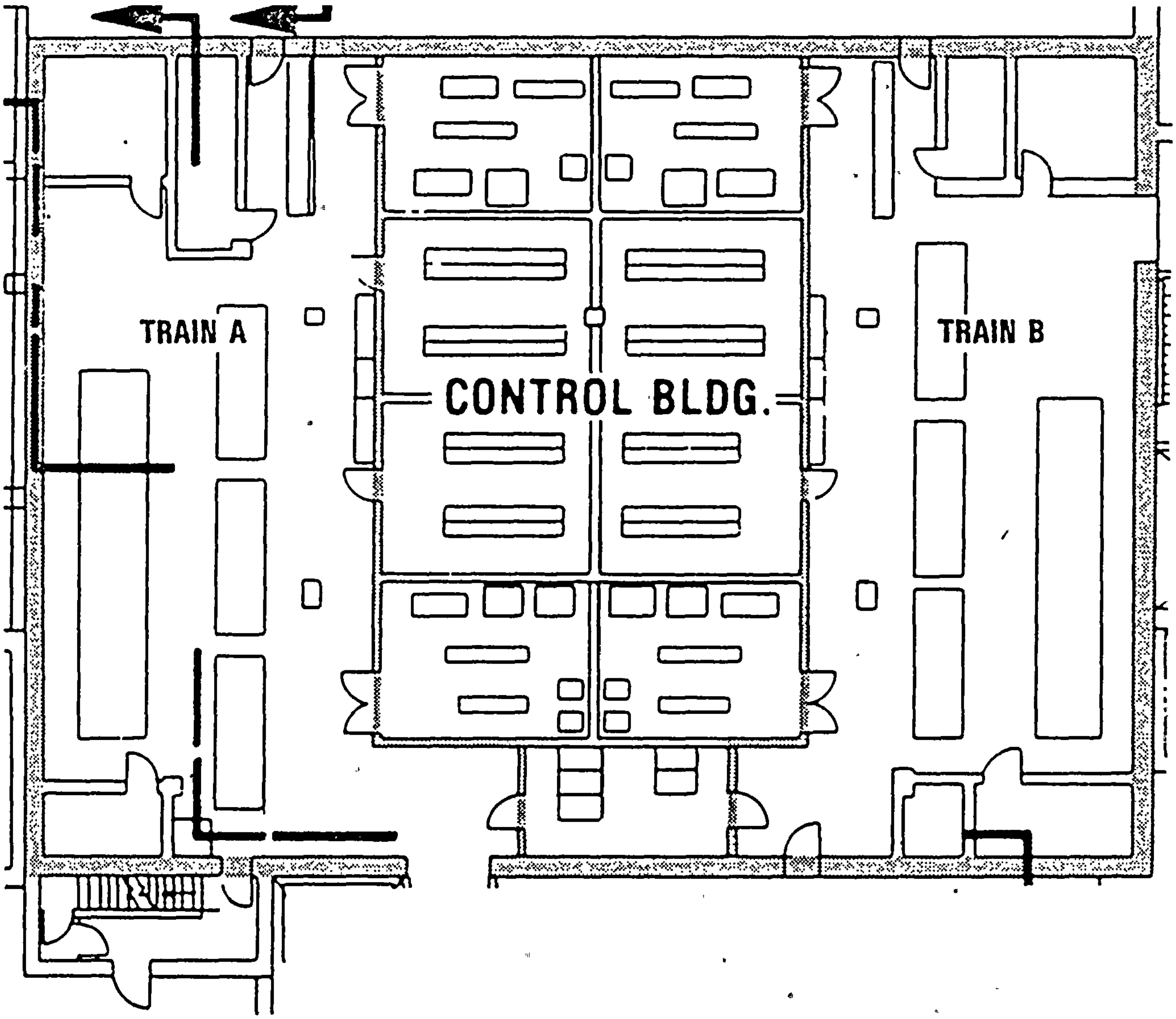

WESTWING
KYRENE
SAGUARO
DEVERS
OFFSITE POWER GRID
STARTUP TRANSFORMER NO. 1
STARTUP TRANSFORMER NO. 2
STARTUP TRANSFORMER NO. 3
TO GRID
TURB GEN
ESF "A" AC
NORMAL AC
ESF "B" AC
DIESEL GEN
CLASS IE
UNIT 1
UNIT 2
UNIT 3

FIGURE 1-1



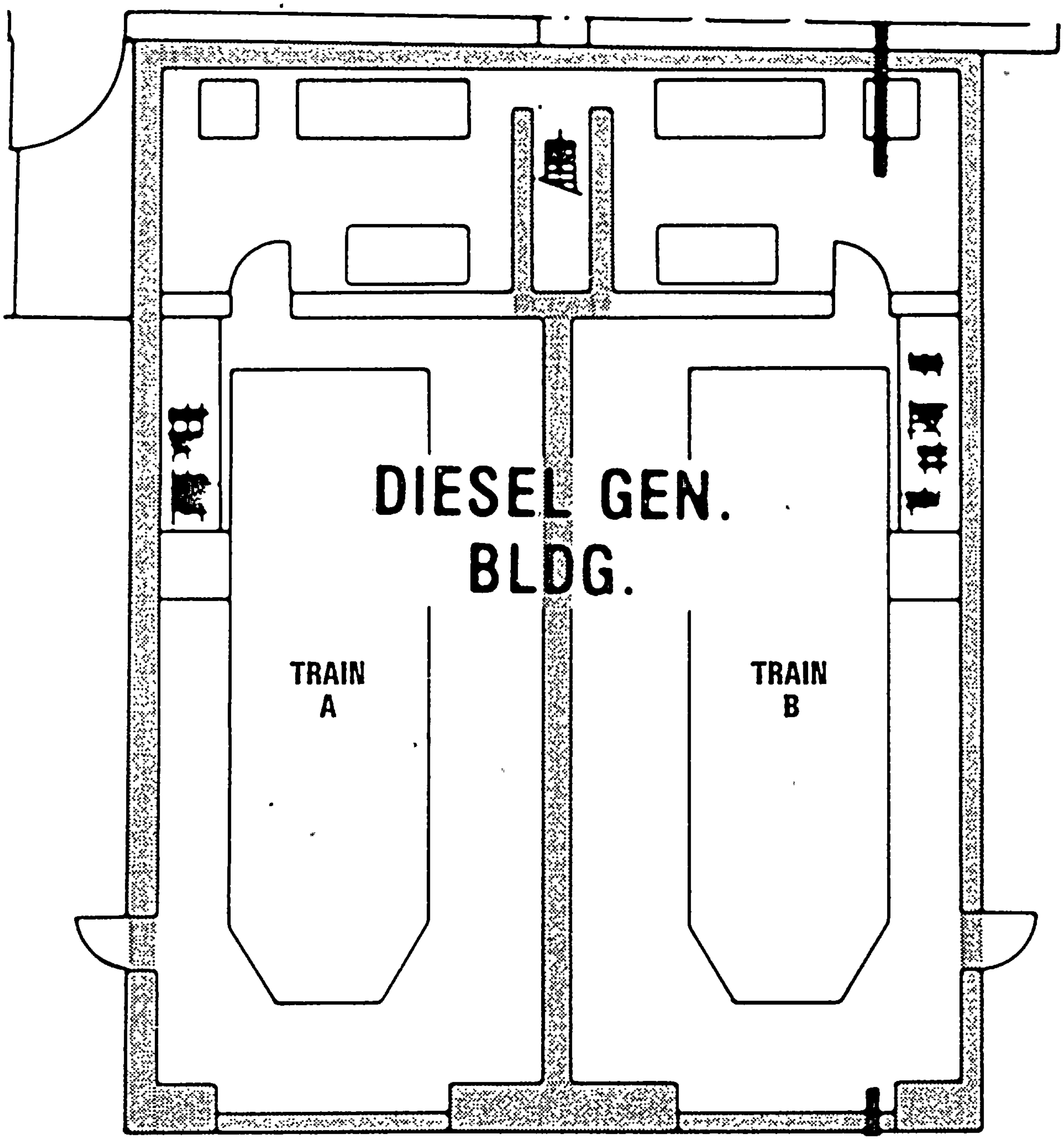
PALO VERDE NUCLEAR GENERATING STATION
AC POWER SYSTEM
FIGURE 1-2



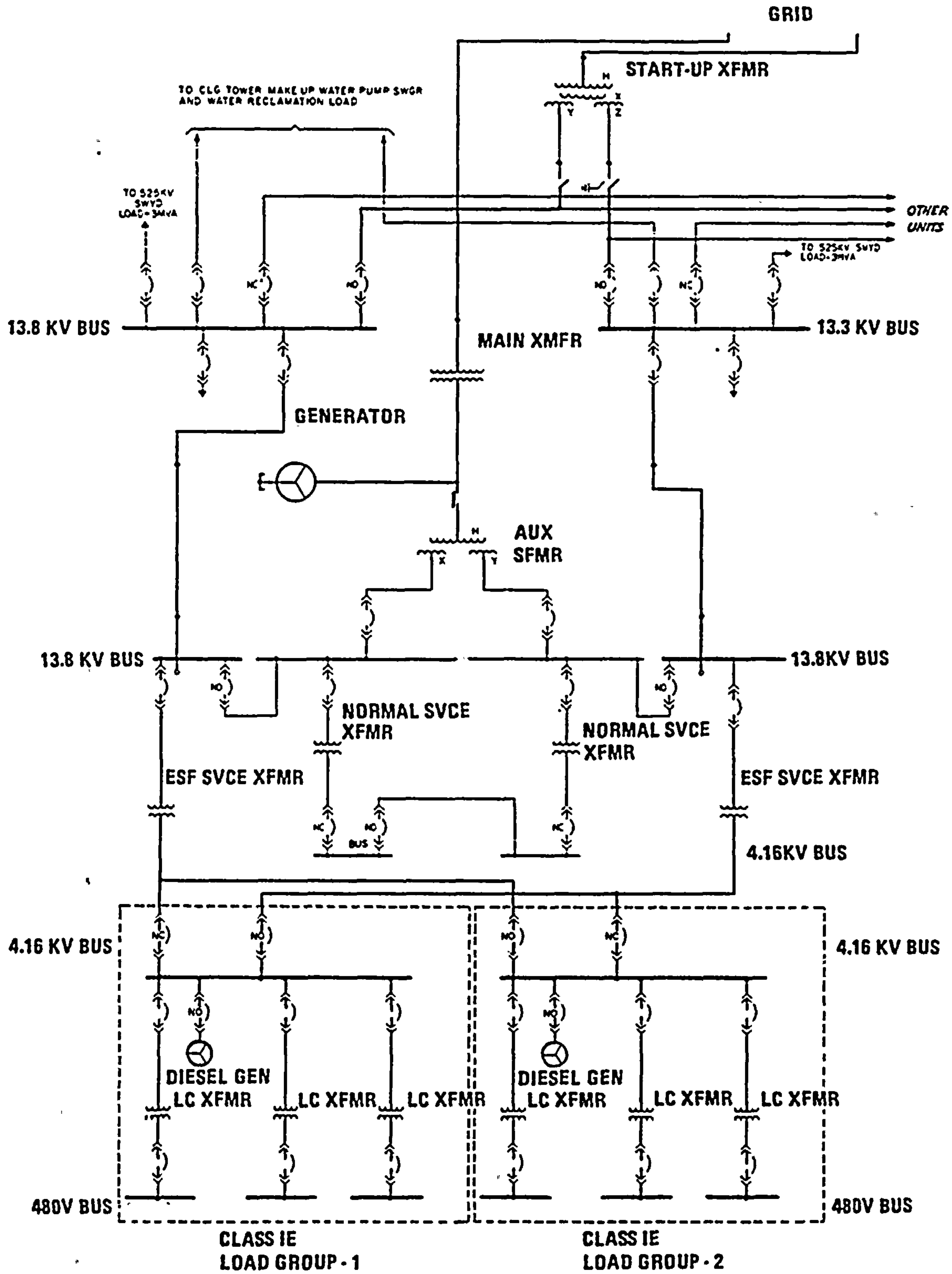
PALO VERDE NUCLEAR GENERATING STATION

AC POWER SYSTEM

FIGURE 1-3



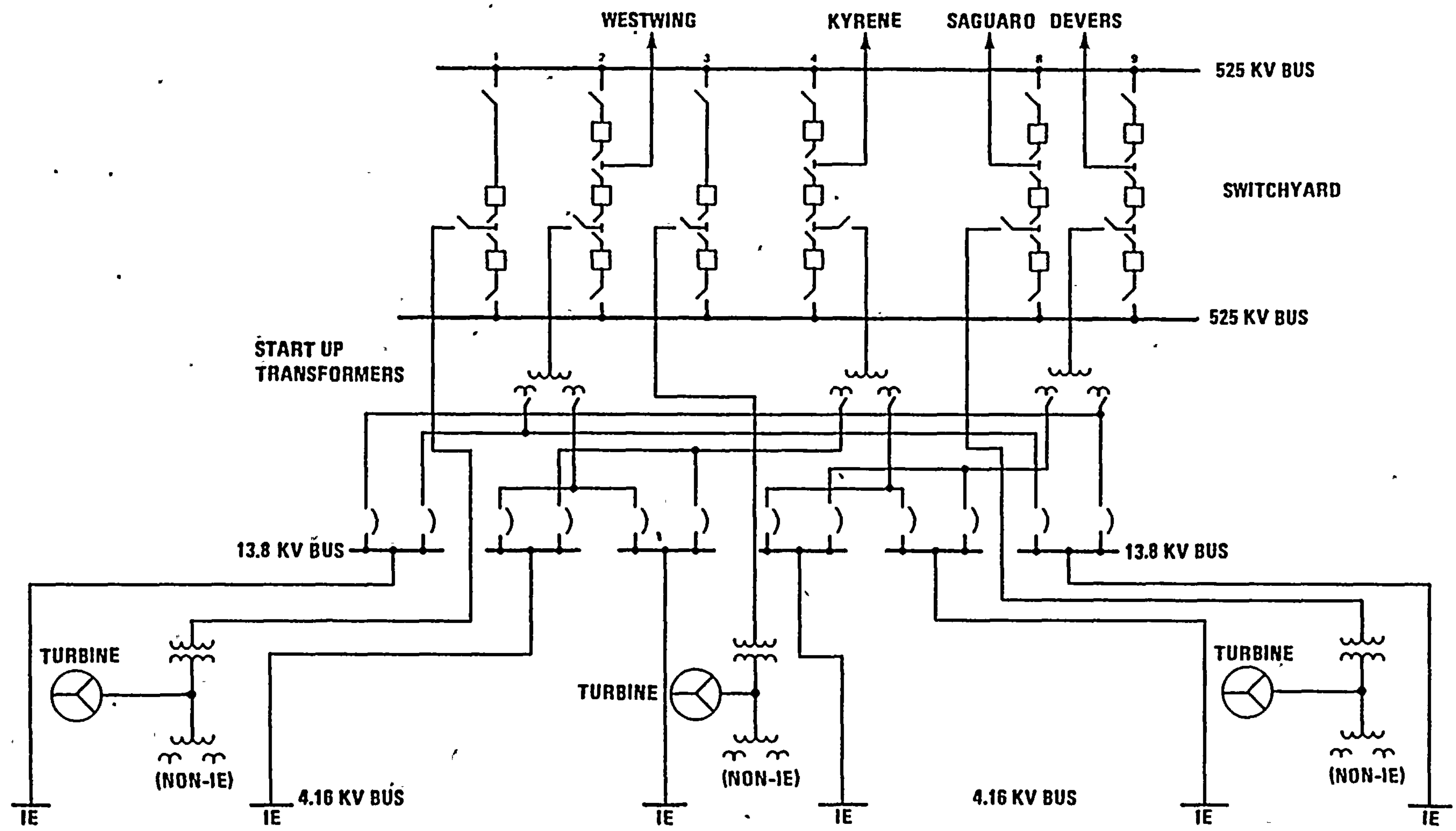
PALO VERDE NUCLEAR GENERATING STATION
AC POWER SYSTEM
FIGURE 1-4



PALO VERDE NUCLEAR GENERATING STATION

AC POWER SYSTEM

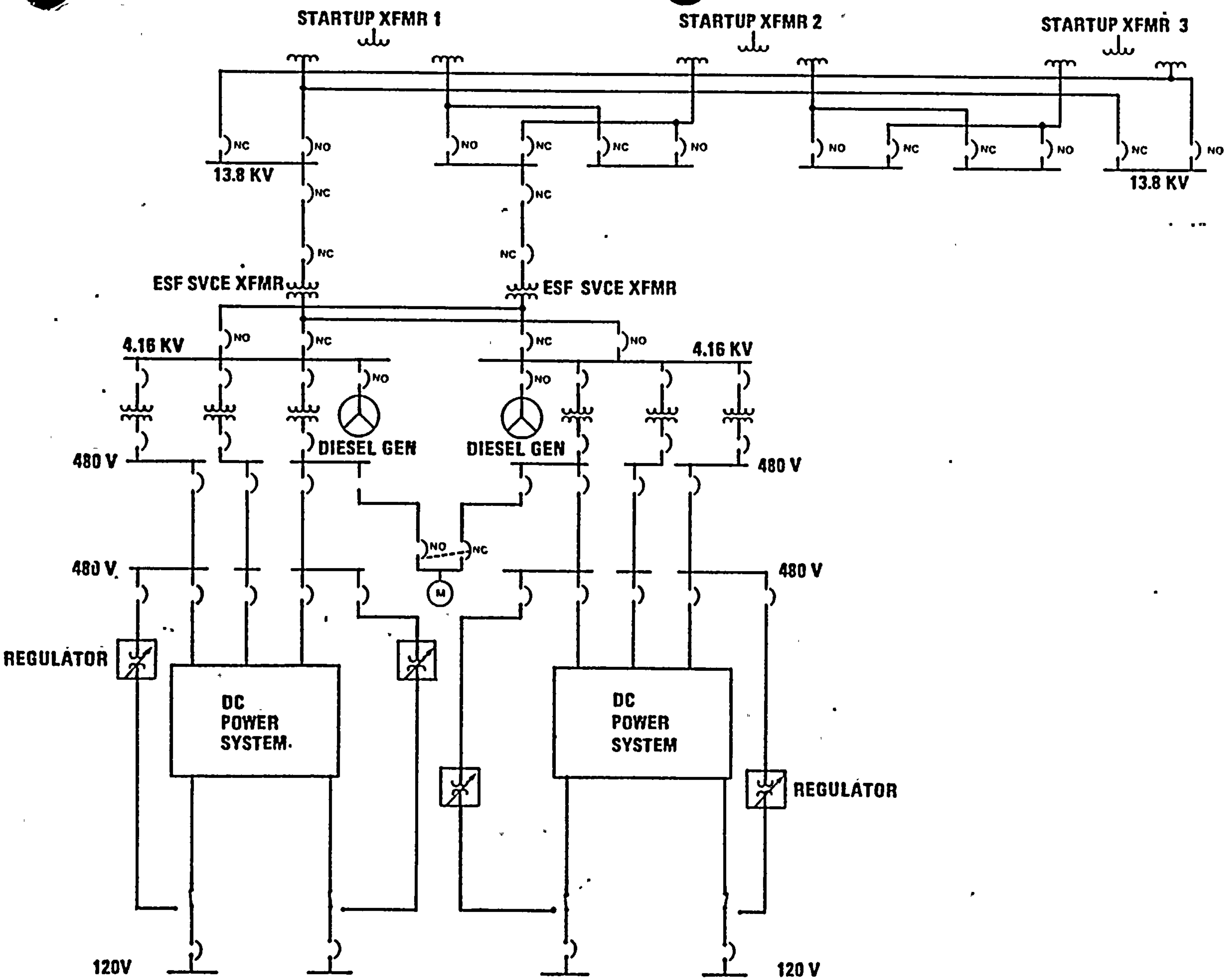
FIGURE 1-5



PALO VERDE NUCLEAR GENERATING STATION

AC POWER SYSTEM

FIGURE 1-6



PALO VERDE NUCLEAR GENERATING STATION

AC POWER SYSTEM

FIGURE 1-7

2. SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
A. SYSTEM REDUNDANCY REQUIREMENT	
GENERAL: ENGINEERED SAFETY FEATURE (ESF) SYSTEMS PROVIDED TO MEET GENERAL DESIGN CRITERIA 33, 34, 35, 38, 41, AND 44 SHALL BE REDUNDANT SUCH THAT A SINGLE FAILURE IN CONJUNCTION WITH A LOSS OF OFFSITE POWER (LOP) SHALL NOT IMPAIR SAFETY SYSTEM FUNCTION.	PVNGS HAS REDUNDANT ESF SYSTEMS. EACH ESF SYSTEM HAS ACCESS TO A DEDICATED ONSITE STANDBY POWER SOURCE AS WELL AS TWO OFFSITE (GRID) SOURCES.
SPECIFIC REQUIREMENTS.	
1. REDUNDANT LOAD GROUPS (IEEE-308, R.G. 1.6, CESSAR GDC 17)	
THE ELECTRIC LOADS SHALL BE SEPARATED INTO TWO OR MORE REDUNDANT LOAD GROUPS	TWO REDUNDANT LOAD GROUPS ARE PROVIDED

REQUIREMENT A. SYSTEM REDUNDANCY REQUIREMENT	DESIGN FEATURE
2. SAFETY ACTIONS (IEEE 308)	
THE SAFETY ACTIONS BY EACH GROUP OF LOADS SHALL BE REDUNDANT AND INDEPENDENT OF THE SAFETY ACTIONS PROVIDED BY ITS REDUNDANT COUNTERPARTS	EACH GROUP HAS ITS OWN INDEPENDENT SAFETY ACTIONS
3. POWER SUPPLY (IEEE-308, R.G. 1.6 R.G. 1.32 GDC 17)	
EACH OF THE REDUNDANT LOAD GROUPS SHALL HAVE ACCESS TO BOTH A PREFERRED AND A STANDBY POWER SUPPLY. EACH POWER SUPPLY SHALL CONSIST OF ONE OR MORE POWER SOURCES.	EACH LOAD GROUP HAS ACCESS TO TWO OFFSITE SOURCES (ONE IMMEDIATE AND ONE DELAYED) AND ONE ON-SITE STANDBY POWER SUPPLY

REQUIREMENT A. SYSTEM REDUNDANCY REQUIREMENT	DESIGN FEATURE
4. COMMON POWER SUPPLY (IEEE-308, GDC 17)	
TWO OR MORE LOAD GROUPS MAY HAVE A COMMON POWER SUPPLY IF THE CONSEQUENCES OF THE LOSS OF THE COMMON POWER SUPPLY TO THE LOAD GROUPS UNDER DESIGN BASIS CONDITIONS ARE ACCEPTABLE.	NO COMMON POWER SUPPLIES ARE PROVIDED.
5. PREFERRED POWER SUPPLY DESCRIPTION (IEEE-308, R.G. 1.32, GDC 17)	
THE PREFERRED POWER SUPPLY SHALL CONSIST OF ONE OR MORE CIRCUITS FROM THE TRANSMISSION NETWORK OR EQUIVALENT SOURCE OF ELECTRIC ENERGY TO THE CLASS 1E DISTRIBUTION SYSTEM INPUT TERMINALS.	TWO CIRCUITS FROM THE OFFSITE SOURCE SERVE AS PREFERRED SOURCE OF POWER.

REQUIREMENT

A. SYSTEM REDUNDANCY REQUIREMENT

DESIGN FEATURE

6. PREFERRED POWER SUPPLY AVAILABILITY
(IEEE-308, R.G. 1.32, GDC 17)

A MINIMUM OF ONE CIRCUIT FROM THE TRANSMISSION NETWORK NORMALLY SHALL BE AVAILABLE DURING OPERATION. IF ONLY ONE CIRCUIT FROM THE TRANSMISSION NETWORK IS NORMALLY AVAILABLE, THE DESIGN SHALL INCLUDE A PROVISION FOR ALTERNATE ACCESS TO THE TRANSMISSION NETWORK. THE CIRCUIT THAT IS NORMALLY AVAILABLE SHALL BE DESIGNED TO BE AVAILABLE WITHIN AN ACCEPTABLE TIME FOLLOWING A LOSS-OF-COOLANT ACCIDENT.

THE DESIGN PROVIDES FOR TWO IMMEDIATE CIRCUITS FROM THE TRANSMISSION SYSTEM.

REQUIREMENT

A. SYSTEM REDUNDANCY REQUIREMENT

DESIGN FEATURE

7. OFFSITE AND ONSITE POWER (R.G. 1.6, R.G. 1.32)

EACH A-C LOAD GROUP SHOULD HAVE A CONNECTION TO THE PREFERRED POWER SOURCE AND TO A STANDBY (ONSITE) POWER SOURCE. THE STANDBY POWER SOURCE SHOULD HAVE NO AUTOMATIC CONNECTION TO ANY OTHER REDUNDANT LOAD GROUP. AT MULTIPLE NUCLEAR UNIT SITES, THE STANDBY POWER SOURCE FOR ONE GROUP MAY HAVE AN AUTOMATIC CONNECTION TO A LOAD GROUP OF A DIFFERENT UNIT. A PREFERRED POWER SOURCE BUS HOWEVER MAY SERVE REDUNDANT LOAD GROUPS.

EACH REDUNDANT LOAD GROUP HAS ACCESS TO TWO OFFSITE SOURCES OF POWER AND ONE ONSITE (DIESEL-GENERATOR). THERE IS NO AUTOMATIC CONNECTION BETWEEN THE REDUNDANT LOAD GROUPS OF EACH UNIT. CONNECTIONS TO THE ALTERNATE OFFSITE SOURCE ARE MADE MANUALLY UNDER ADMINISTRATIVE CONTROLS. THERE ARE NO INTERCONNECTIONS BETWEEN UNITS.

REQUIREMENT

A. SYSTEM REDUNDANCY REQUIREMENT

DESIGN FEATURE

8. INDEPENDENCE AND REDUNDANCE (CESSAR)

REQUIREMENT	DESIGN FEATURE
FOUR PHYSICALLY AND ELECTRICALLY INDEPENDENT 120 VOLTS 60 HZ SINGLE PHASE UNGROUNDED VITAL INSTRUMENT SOURCES ARE REQUIRED TO PROVIDE POWER TO NSSS INSTRUMENTATION USED FOR PROTECTION VOLTAGE AND FREQUENCY SHOULD BE REGULATED TO WITHIN ±0.5 HZ AND 2% RESPECTIVELY FOR A POWER FACTOR GREATER THAN 0.8.	FOUR UNGROUNDED INSTRUMENT BUSES FED FROM CLASS 1E INVERTERS ARE PROVIDED WITH THE REQUIRED TOLERANCES FOR VOLTAGE AND FREQUENCY.

REQUIREMENT

A. SYSTEM REDUNDANCY REQUIREMENT

DESIGN FEATURE

9. THIRD OF A KIND LOADS
(CESSAR)

REDUNDANT "THIRD OF A KIND" COMPONENTS ARE INCLUDED AS PART OF SAFETY SYSTEM DESIGN, IT IS REQUIRED THAT THESE COMPONENTS BE CAPABLE OF RECEIVING POWER FROM EITHER OF THE REDUNDANT EMERGENCY BUSES. THE TRANSFER SHALL BE ACCOMPLISHED MANUALLY WITHIN 2 HOURS AFTER LOSS OF OFFSITE POWER.

ONLY ONE "THIRD OF A KIND" LOAD IS IDENTIFIED. THE LOAD RECEIVES POWER FROM ONE SOURCE ONLY WITH THE SOURCE CONNECTED WITHOUT A BREAKER. UPON LOSS OF THE NORMAL SOURCE THE BREAKER IS TRANSFERRED TO THE ALTERNATE SOURCE.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
B. CONFORMANCE WITH SINGLE FAILURE CRITERION	
GENERAL: ELECTRICAL AND PHYSICAL INDEPENDENCE OF ESF POWER SUPPLIES AND DISTRIBUTION CIRCUITS SHALL BE SUCH THAT A SINGLE FAILURE WILL NOT PREVENT PROPER SAFETY SYSTEM FUNCTION.	PVNGS HAS REDUNDANT, INDEPENDENT AND SEPARATE ESF SYSTEMS. A SINGLE FAILURE CANNOT DISABLE 2 ESF TRAINS. (REFER TO FSAR TABLE 8.3-5 FOR THE FAILURE MODE AND EFFECT ANALYSIS OF PVNGS AC POWER SYSTEM.)
SPECIFIC REQUIREMENTS (REFER ALSO TO RELATED REQUIREMENTS PRESENTED IN 2A)	
1. DISTRIBUTION SYSTEM INDEPENDENCE (IEEE-308, CESSAR) IEEE-384, R.G. 1.75, GDC 17)	
DISTRIBUTION CIRCUITS TO REDUNDANT EQUIPMENT SHALL BE PHYSICALLY AND ELECTRICALLY INDEPENDENT OF EACH OTHER.	THE REDUNDANT LOAD GROUPS ARE ELECTRICALLY INDEPENDENT AND PHYSICALLY SEPARATE PER IEEE 384 & R.G. 1.75.

REQUIREMENT	DESIGN FEATURE
2. DISTRIBUTION SYSTEM CAPABILITY (IEEE-308), GDC 17	
EACH DISTRIBUTION CIRCUIT SHALL BE CAPABLE OF TRANSMITTING SUFFICIENT ENERGY TO START AND OPERATE ALL REQUIRED LOADS IN THAT CIRCUIT.	THE DISTRIBUTION SYSTEM IS SIZED AND DESIGNED TO BE CAPABLE OF TRANSMITTING THE REQUIRED ENERGY TO START AND OPERATE ALL REQUIRED LOADS.
3. DISTRIBUTION SYSTEM AUXILIARY DEVICES (IEEE-308)	
AUXILIARY DEVICES THAT ARE REQUIRED TO OPERATE DEPENDENT EQUIPMENT SHALL BE SUPPLIED FROM A RELATED BUS SECTION TO PREVENT THE LOSS OF ELECTRIC POWER IN ONE LOAD GROUP FROM CAUSING THE LOSS OF EQUIPMENT IN ANOTHER LOAD GROUP.	INDEPENDENT AUXILIARY DEVICES ARE PROVIDED ON THE APPROPRIATE BUS FOR RELATED EQUIPMENT.

REQUIREMENT	DESIGN FEATURE
4. DISTRIBUTION SYSTEM FEEDERS (IEEE-308)	
FEEDERS BETWEEN CLASS 1E POWER SYSTEMS LOCATED IN SAFETY CLASS STRUCTURES AND SYSTEMS LOCATED IN NON-SAFETY CLASS STRUCTURES SHALL BE PROVIDED WITH CIRCUIT BREAKERS LOCATED IN THE SAFETY CLASS STRUCTURE.	NON-CLASS 1E CABLES FED FROM CLASS 1E SYSTEMS HAVE THE BREAKERS (ISOLATION DEVICE) IN SAFETY CLASS STRUCTURE.
5. PARALLEL OPERATION (R.G.1.6)	
STANDBY SOURCE OF ONE LOAD GROUP SHOULD NOT BE AUTOMATICALLY PARALLELED WITH THE STANDBY SOURCE OF ANOTHER LOAD GROUP UNDER ACCIDENT CONDITION.	STANDBY SOURCE IS WITHIN A LOAD GROUP. NO AUTOMATIC PARALLELING IS PROVIDED BETWEEN LOAD GROUPS.

REQUIREMENT	DESIGN FEATURE
6. MANUAL INTERLOCKS (R.G.1.6)	
IF MEANS EXIST FOR MANUAL CONNECTION OF LOADS, AT LEAST ONE INTERLOCK SHOULD BE PROVIDED TO PREVENT PARALLEL OPERATION.	MANUAL CONNECTION OF REDUNDANT LOAD GROUPS IS PROVIDED WITH CIRCUIT BREAKER INTERLOCK SUCH THAT DIESEL GENERATORS ARE NOT PARALLELED. A SINGLE FAILURE IN THE INTER-CONNECTION BETWEEN THE PREFERRED SOURCE AND THE ONSITE SYSTEM WILL NOT PREVENT THE CONNECTION OF AT LEAST ONE STANDBY SOURCE TO ITS LOAD GROUP.
7. ISOLATION DEVICES (R.G.1.75, R.G.1.32)	
ISOLATION DEVICES ACTUATED ONLY BY FAULT CURRENT ARE NOT CONSIDERED TO BE ISOLATION DEVICES.	ISOLATION DEVICES ARE ACTUATED BY SIAS SIGNAL IN ADDITION TO FAULT CURRENT FOR POWER CIRCUITS.

REQUIREMENT	DESIGN FEATURE
8. SEPARATION (R.G.1.75, R.G.1.32, CESSAR)	
LOCATE REDUNDANT CIRCUITS AND EQUIPMENT IN SEPARATE SAFETY CLASS STRUCTURE.	REDUNDANT EQUIPMENT IS LOCATED IN SEPARATE SAFETY CLASS STRUCTURES AND CIRCUITS ARE PROVIDED WITH ADEQUATE SEPARATION AND ISOLATION.
9. ASSOCIATED CIRCUITS (R.G.1.75, IEEE-384)	
ASSOCIATED CIRCUITS INSTALLED SHOULD BE SUBJECT TO ALL REQUIREMENTS PLACED ON CLASS 1E CIRCUITS.	ASSOCIATED CIRCUITS ARE TREATED AS CLASS 1E UP TO ISOLATION DEVICES. AFTER THE ISOLATION DEVICE THEY ARE TREATED AS NON-CLASS 1E. SOME ASSOCIATED CIRCUITS DO NOT HAVE ISOLATION DEVICES BECAUSE THE NATURE OF THE CIRCUIT AND CONNECTED EQUIPMENT PREVENTS ADVERSE CONSEQUENCES TO CLASS 1E CIRCUITS.

REQUIREMENT	DESIGN FEATURE
10. REDUNDANT CIRCUIT ROUTING (R.G.1.75, IEEE-384)	
REDUNDANT CIRCUITS SHOULD NOT BE ROUTED IN CONFINED SPACES SUCH AS TUNNELS.	ALL CLASS 1E REDUNDANT CIRCUITS ARE ROUTED IN VENTILATED AREAS. TUNNELS ARE NOT UTILIZED IN ROUTING CLASS 1E CIRCUITS.
11. SHARED SYSTEMS (R.G.1.81)	
ONSITE AC ELECTRIC SYSTEMS SHOULD NOT BE SHARED BETWEEN UNITS.	ONSITE AC ELECTRIC SYSTEMS ARE NOT SHARED BETWEEN UNITS.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
C. STANDBY AND PREFERRED POWER SYSTEMS INDEPENDENCE	
GENERAL: DESIGN PROVISIONS TO ISOLATE THE STANDBY POWER SYSTEM FROM THE PREFERRED POWER SUPPLY MUST MEET GDC17 REQUIREMENTS FOR INDEPENDENCE.	AN UNDERVOLTAGE (OR FAULT) CONDITION ON THE PREFERRED POWER SUPPLY AUTOMATICALLY ISOLATES THE PREFERRED POWER SUPPLY FROM THE CLASS 1E BUSES AND ACTUATES THE STANDBY POWER SUPPLY.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
SPECIFIC REQUIREMENTS	
FOR SINGLE FAILURE REQUIREMENTS AND FEATURES REFER TO SECTION 2.B.6.	
1. PREFERRED POWER SUPPLY FUNCTION (IEEE-308)	
THE PREFERRED POWER SUPPLY SHALL FURNISH ELECTRIC ENERGY FOR THE SHUTDOWN OF THE STATION AND FOR THE OPERATION OF EMERGENCY SYSTEMS AND ENGINEERED SAFETY FEATURES. THIS DOES NOT PRECLUDE ITS USE FOR OTHER FUNCTIONS	EACH PREFERRED SOURCE OF POWER SERVES AS PRIMARY SOURCE OF POWER TO THE CLASS 1E SYSTEM AND IN ADDITION PROVIDES STARTUP POWER FOR BOP LOADS.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
2. PREFERRED POWER SUPPLY CAPABILITY (IEEE-308)	
THE PREFERRED POWER SUPPLY SHALL BE CAPABLE OF STARTING AND OPERATING ALL REQUIRED LOADS.	EACH PREFERRED POWER SUPPLY HAS THE CAPABILITY OF STARTING AND OPERATING THE REQUIRED LOADS.
3. COMMON FAILURE MODE (IEEE-308)	
THE PREFERRED AND THE STANDBY POWER SUPPLIES SHALL NOT HAVE A COMMON FAILURE MODE BETWEEN THEM. IN ADDITION THE REDUNDANT GENERATING SOURCES OF THE STANDBY POWER SUPPLY SHALL NOT HAVE A COMMON FAILURE MODE FOR ANY DESIGN BASIS EVENT.	THE OPERATION OF THE STANDBY AND PREFERRED SOURCE BREAKER INTERLOCKS ARE SUCH THAT THERE IS NO COMMON MODE FAILURE BETWEEN STANDBY AND PREFERRED POWER SUPPLY. ALL CLASS 1E BREAKERS ARE ENVIRONMENTALLY QUALIFIED AND PHYSICALLY LOCATED SO AS TO PRECLUDE COMMON MODE FAILURE.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
4. PROTECTIVE DEVICES (IEEE-308)	
PROTECTIVE DEVICES SHALL BE PROVIDED TO LIMIT THE DEGRADATION OF THE CLASS 1E POWER SYSTEMS. SUFFICIENT INDICATION SHALL BE PROVIDED TO IDENTIFY THE ACTUATION OF A PROTECTIVE DEVICE.	PROTECTIVE RELAYS AND ANNUNCIATION OF THE CLASS 1E BUSES AND EQUIPMENT IS PROVIDED TO MONITOR THE STATUS OF THE CLASS 1E SYSTEM.
5. AUTOMATIC TRANSFER (R.G. 1.6)	
NO AUTOMATIC TRANSFER OF LOADS BETWEEN REDUNDANT POWER SOURCES.	NO AUTOMATIC TRANSFER OF LOADS IS PROVIDED.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
6. ISOLATION OF OFFSITE POWER (R.G. 1.41) THE PLANT ELECTRIC POWER SYSTEM NOT NECESSARILY INCLUDING THE SWITCHYARD AND THE STARTUP AND AUXILIARY TRANSFORMERS SHOULD BE ISOLATED FROM THE OFFSITE TRANSMISSION NETWORK. ISOLATION SHOULD BE EFFECTED BY DIRECT ACTUATION OF UNDERVOLTAGE RELAYS WITHIN THE ONSITE SYSTEM.	 THE DISTRIBUTION SYSTEM IS DESIGNED SUCH THAT AN UNDERVOLTAGE CONDITION ON LOAD GROUP TRIPS AND ISOLATES THAT LOAD GROUP FROM THE OFFSITE SOURCE BY UNDERVOLTAGE RELAYS. (2 OUT OF 4 LOGIC)

REQUIREMENT	DESIGN FEATURE
D. STANDBY POWER SUPPLIES	
GENERAL: EACH STANDBY POWER SUPPLY MUST H^VE SUFFICIENT CAPACITY AND CAPABILITY TO RELIABLY SUPPLY POWER TO DRIVE MINIMUM SAFETY SYSTEM FUNCTIONS.	EACH REDUNDANT DIESEL GENERATOR HAS CAPACITY AND CAPABILITY TO SUPPLY MINIMUM SAFETY SYSTEM REQUIREMENTS. RELIABILITY HAS BEEN VERIFIED ADEQUATE BY TESTING.
SPECIFIC REQUIREMENTS:	
1. STANDBY POWER SUPPLY DESCRIPTION (IEEE-308)	
THE STANDBY POWER SUPPLY SHALL CONSIST OF ALL COMPONENTS FROM THE STORED ENERGY TO THE CONNECTION TO THE DISTRIBUTION SYSTEM'S SUPPLY CIRCUIT BREAKER (FOR EXAMPLE, PRIME MOVERS; GENERATORS AND EXCITATION EQUIPMENT; CONTROL SYSTEMS; STARTING SYSTEMS; INSTRUMENTATION AND PROTECTIVE SYSTEMS; ENERGY STORAGE; CONVEYANCE AND CONVERSION EQUIPMENT; ALL AUXILIARY SYSTEMS AND APPURTENANCES).	DIESEL GENERATOR WITH ALL ITS AUXILIARY EQUIPMENT IS CONNECTED TO THE CLASS 1E BUS THROUGH A BREAKER.

REQUIREMENT	DESIGN FEATURE
2. <u>STANDBY POWER SUPPLY FUNCTION</u> (IEEE-308, R.G.1.32)	
THE STANDBY POWER SUPPLY SHALL PROVIDE ELECTRIC ENERGY FOR THE OPERATION OF EMERGENCY SYSTEMS AND ENGINEERED SAFETY FEATURES DURING AND FOLLOWING THE SHUTDOWN OF THE REACTOR WHEN THE PREFERRED POWER SUPPLY IS NOT AVAILABLE. THIS DOES NOT PRECLUDE ITS USE FOR OTHER FUNCTIONS.	THE STANDBY POWER SUPPLY IS USED SOLELY TO PROVIDE POWER TO ESF EQUIPMENT DURING EMERGENCY CONDITIONS WHEN OFFSITE POWER IS NOT AVAILABLE.
3. <u>STANDBY POWER SUPPLY AVAILABILITY</u> (IEEE-308, CESSAR)	
THE STANDBY POWER SUPPLY SHALL BE AVAILABLE FOLLOWING THE LOSS OF THE PREFERRED POWER SUPPLY WITHIN A TIME CONSISTENT WITH THE REQUIREMENTS OF THE ENGINEERED SAFETY FEATURES AND THE SHUTDOWN SYSTEMS UNDER NORMAL AND ACCIDENT CONDITIONS.	THE STANDBY POWER SUPPLY IS STARTED UPON A LOSS OF VOLTAGE OR DEGRADED GRID CONDITIONS.

REQUIREMENT	DESIGN FEATURE
4. STANDBY POWER SUPPLY CAPABILITY (IEEE-308)	
A FAILURE OF ANY UNIT OF STANDBY POWER SOURCE SHALL NOT JEOPARDIZE THE CAPABILITY OF THE REMAINING STANDBY POWER SOURCE OR SOURCES TO START AND RUN THE REQUIRED SHUTDOWN SYSTEMS, EMERGENCY SYSTEMS, AND ENGINEERED SAFETY FEATURE LOADS.	THE STANDBY POWER SUPPLIES ARE COMPLETELY INDEPENDENT SO THAT FAILURE OF ONE WILL NOT JEOPARDIZE THE REDUNDANT UNIT.
5. STANDBY POWER SUPPLY ENERGY STORAGE (IEEE-308)	
STORED ENERGY AT THE SITE SHALL HAVE THE CAPACITY TO OPERATE THE STANDBY POWER SUPPLY WHILE SUPPLYING POST-ACCIDENT POWER REQUIREMENTS TO A UNIT FOR THE LONGER OF THE FOLLOWING: (A) SEVEN DAYS (B) TIME REQUIRED TO REPLENISH THE ENERGY FROM SOURCES AWAY FROM THE GENERATING UNIT'S SITE FOLLOWING THE LIMITING DESIGN BASIS EVENT.	A TANK IS PROVIDED TO SUPPLY THE ENERGY REQUIREMENT FOR SEVEN DAYS.

REQUIREMENT	DESIGN FEATURE
6. D.G. LOAD RATING (R.G.1.9)	
DIESEL GENERATOR SHOULD HAVE A CONTINUOUS LOAD RATING EQUAL TO OR GREATER THAN THE SUM OF CONSERVATIVELY ESTIMATED LOADS.	THE CONTINUOUS RATING OF DIESEL GENERATOR IS GREATER THAN THE SUM OF NAMEPLATE AND/OR BRAKE HORSEPOWER OF THE LOADS.
7. START/ACCELERATE CAPABILITY (R.G.1.9)	
SHOULD BE CAPABLE OF STARTING AND ACCELERATING THE LOADS AT THE REQUIRED SEQUENCE. AT NO TIME SHOULD THE LOAD AND FREQUENCY DECREASE TO LESS THAN 75% OF NOMINAL AND 95% OF NOMINAL RESPECTIVELY.	ANALYSIS OF D.G. DEMONSTRATES THAT THE DIESEL GENERATOR IS CAPABLE OF ACCELERATING THE LOADS. AT EACH STEP OF LOADING THE VOLTAGE AND FREQUENCY DOES NOT DECREASE TO LESS THAN 75% AND 95% OF NOMINAL VALUES.

REQUIREMENT	DESIGN FEATURE
8. D.G. SPEED (R.G.1.9)	
THE SPEED OF THE DIESEL GENERATOR SET SHOULD NOT EXCEED 75% OF THE DIFFERENCE BETWEEN NOMINAL SPEED AND THE OVERSPEED TRIP SET POINT OR 115% OF NOMINAL WHICHEVER IS LOWER.	TEST RESULTS INDICATE THAT THESE REQUIREMENTS ARE MET.
9. VOLTAGES DURING SEQUENCING (R.G.1.9)	
VOLTAGE SHOULD BE RESTORED TO WITHIN 10% OF NOMINAL AND FREQUENCY TO WITHIN 2% IN LESS THAN 40% OF EACH LOAD SEQUENCE INTERVAL.	THE TEST RESULTS INDICATE COMPLIANCE WITH THIS REQUIREMENT.

REQUIREMENT	DESIGN FEATURE
10. DIESEL GENERATOR RELIABILITY QUALIFICATION (BTP ICSB2)	
A. TWO FULL LOAD AND MARGIN TESTS	TEST COMPLETED. FULL COMPLIANCE.
B. 300 VALID START & LOAD TESTS A - NO MORE THAN 3 FAILURES ALLOWED B - 90% COLD START - 10% HOT START	
C. FAILURE RATE NOT TO EXCEED ONE PER HUNDRED	
11. USE OF DIESEL GENERATOR SETS FOR PEAKING (BTP ICSB8)	
DIESEL GENERATOR SETS SHALL BE USED ONLY AS A STANDBY POWER SUPPLY.	A DIESEL GENERATOR IS ONLY CONNECTED TO OFFSITE POWER MANUALLY FOR TESTING.

REQUIREMENT	DESIGN FEATURE
12. AUTOMATIC SEQUENCING (CESSAR)	
A. ESF LOADS SHALL BE SEQUENCED IN ACCORDANCE WITH CESSAR TABLE 8.3.1-4.	LOADS ARE SEQUENCED IN ACCORDANCE WITH CESSAR TABLE 8.3.1-4.
B. A MAXIMUM OF 12 SECONDS DELAY IS ALLOWED TO CLOSE THE D.G. BREAKERS BEFORE SEQUENCING THE LOADS AFTER ESFAS SIGNAL.	THE TIME DELAY ALLOWED WILL BE LESS THAN 10 SECONDS.
C. IF STANDBY GENERATOR IS ALREADY PROVIDING POWER TO ESFAS LOADS A SUBSEQUENT ESFAS SHALL NOT SHED THE RUNNING LOADS BUT SEQUENCE THE ADDITIONAL LOADS.	IF LOADS ARE ALREADY CONNECTED TO D.G., A SUBSEQUENT ESFAS WILL NOT SHED THE LOADS, BUT SEQUENCE THE REMAINDER OF THE REQUIRED LOADS.

REQUIREMENT	DESIGN FEATURE
12. AUTOMATIC SEQUENCING (CESSAR)	
D. IF OFFSITE POWER IS LOST AT SOME TIME AFTER THE SUMMARY GENERATORS ARE UP TO RATED VOLTAGE AND SPEED AND AFTER ESFAS EQUIPMENT IS RUNNING THE FOLLOWING REQUIREMENTS SHALL BE MET:	WITH THE GENERATOR RUNNING AND THE SEQUENCE TIME FOR THESE LOADS BEING WITHIN THE FIRST 5 SECONDS, POWER WILL BE AVAILABLE WITHIN A MAXIMUM OF 10 SECONDS FOR THESE LOADS.
(1) INTERRUPTED ECCS FLOW TO THE CORE SHALL BE FULLY RE-ESTABLISHED WITHIN 13 SECONDS	
(2) INTERRUPTED EMERGENCY FEED-WATER FLOW TO THE STEAM GENERATORS SHALL BE FULLY RE-ESTABLISHED WITHIN 15 SECONDS.	

REQUIREMENT	DESIGN FEATURE
12. AUTOMATIC SEQUENCING (CESSAR)	
E. IF OFFSITE POWER IS AVAILABLE AND THE STANDBY GENERATORS ARE STARTED ON AN ESFAS INITIATED BY A PLANT CONDITION ACTUALLY REQUIRING OPERATION OF THE ESF LOADS, THE STANDBY GENERATORS SHALL BE LEFT RUNNING FOR A PERIOD OF ONE HOUR.	FULL COMPLIANCE.
F. IF OFFSITE POWER IS THE SOURCE OF POWER WHEN ESFAS IS GENERATED THE LOADS SHALL BE STARTED BY SEQUENCING.	WITH OFFSITE POWER AVAILABLE THE ESFAS LOADS ARE CONNECTED SEQUENTIALLY.

REQUIREMENT	DESIGN FEATURE
13. STANDBY POWER SUPPLY CONTROLS (IEEE-308)	
AUTOMATIC AND MANUAL CONTROLS SHALL BE PROVIDED TO:	AUTOMATIC AND MANUAL CONTROLS ARE PROVIDED TO SELECT THE PROPER POWER SOURCE DISCONNECT APPROPRIATE LOADS AND START AND LOAD THE DIESEL GENERATOR.
(1) SELECT THE MOST SUITABLE POWER SUPPLY TO THE DISTRIBUTION SYSTEM.	
(2) DISCONNECT APPROPRIATE LOADS FROM THE CLASS 1E POWER SYSTEMS WHEN THE STANDBY POWER SUPPLY IS REQUIRED.	
(3) START AND LOAD THE STANDBY POWER SUPPLY, MANUAL CONTROLS SHALL BE PROVIDED TO PERMIT THE OPERATOR TO SELECT THE MOST SUITABLE DISTRIBUTION PATH FROM THE POWER SUPPLY TO THE LOAD.	

REQUIREMENT	DESIGN FEATURES
14. THERMAL OVERLOAD PROTECTION	
THE DESIGN OF MOTOR OPERATED SAFETY RELATED VALVES SHALL MEET THE THERMAL OVERLOAD CRITERIA OF BTP (ICSB) 27.	THERMAL OVERLOADS ARE BYPASSED UNDER SIAS.

REQUIREMENT	DESIGN FEATURE
E. IDENTIFICATION OF CABLES, RACEWAYS AND TERMINAL EQUIPMENT	
GENERAL: VISUAL IDENTIFICATION THAT PROVIDES A MEANS TO DISTINGUISH A CIRCUIT OR RACEWAY ASSOCIATED WITH A PARTICULAR VOLTAGE OR FUNCTION OR CHANNEL OR LOAD GROUP SHOULD BE PROVIDED.	UNIQUE ALPHANUMERIC IDENTIFICATION AS WELL AS DISTINCTIVE SEPARATION GROUP COLORATION (RED, GREEN, YELLOW OR BLUE) ALLOWS EASY VISUAL IDENTIFICATION OF CIRCUITS OR RACEWAYS.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
SPECIFIC REQUIREMENTS	
THE IDENTIFICATION OF REDUNDANT CABLES, RACEWAYS AND EQUIPMENT SHOULD BE IN ACCORDANCE WITH IEEE 384 AND R.G. 1.75.	IDENTIFICATION PER IEEE 384 AND R.G. 1.75 HAS BEEN PROVIDED AS NOTED IN FSAR 8.3.1.3. REDUNDANT 1E CABLES ARE SOLIDLY COLORED WITH THE APPROPRIATE SEPARATION GROUP COLOR. ASSOCIATED CIRCUITS AND THIRD OF A KIND CIRCUITS ARE COLORED WITH ALTERNATING COLOR BANDS. NON 1E CABLES ARE COLORED BLACK. RACEWAYS AND EQUIPMENT ARE APPROPRIATELY IDENTIFIED BY LOAD GROUP/ CHANNEL TAGGING.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
F. VITAL SUPPORTING SYSTEMS	
1. INSTRUMENTATION, CONTROL AND ELECTRICAL EQUIPMENT THAT SUPPORTS THE PROPER FUNCTIONING OF CLASS 1E EQUIPMENT SHOULD ALSO BE CLASS 1E.	VITAL SUPPORTING EQUIPMENT IS CLASS 1E AND SAFETY GRADE. DESIGN DETAILS FOR HVAC SYSTEM COMPONENTS ARE PROVIDED IN FSAR SECTION 9.4.
2. SUPPORTING SYSTEMS SHOULD BE POWERED FROM THE SAME DISTRIBUTION SYSTEM THAT THEY SUPPORT. THIS CRITERION SHOULD INCLUDE VITAL SUPPORT SERVICES FOR THE STANDBY POWER SUPPLIES.	SUPPORTING SYSTEMS ARE POWERED FROM THE SAME DISTRIBUTION SYSTEM THAT THEY SUPPORT. VITAL SUPPORT CRITERION IS MET.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
G. SYSTEM TESTING AND SURVEILLANCE	
GENERAL: TEST CAPABILITIES THAT MEET GDC 18 AND 21 SHOULD BE INCORPORATED INTO THE DESIGN.	THE DESIGN HAS CAPABILITY FOR PERIODIC TESTING OF THE AC POWER SYSTEM FOR PROPER OPERATION OR TO DETECT FAILURE DURING ALL MODES OF PLANT OPERATION.
SPECIFIC REQUIREMENTS	
1. DISTRIBUTION SYSTEM SURVEILLANCE (IEEE-308)	
THE DISTRIBUTION SYSTEM SHALL BE MONITORED TO THE EXTENT THAT IT IS SHOWN TO BE READY TO PERFORM ITS INTENDED FUNCTION.	NECESSARY ANNUNCIATION, ALARM AND COMPUTER LOGGING IS PROVIDED TO MONITOR THE STATUS OF THE CLASS 1E SYSTEM.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
2. PREFERRED POWER SUPPLY SURVEILLANCE (IEEE-308)	
THE PREFERRED POWER SUPPLY SHALL BE MONITORED TO THE EXTENT THAT IT IS SHOWN TO BE READY TO PERFORM ITS INTENDED FUNCTION.	INSTRUMENTS, ANNUNCIATION AND ALARMS ARE PROVIDED IN THE CONTROL ROOM TO MONITOR THE STATUS OF THE PREFERRED POWER SUPPLY.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
G. SYSTEM TESTING AND SURVEILLANCE	
3. STANDBY POWER SUPPLY SURVEILLANCE (IEEE-308, R.G. 1.47)	
STATUS INDICATORS SHALL BE PROVIDED TO MONITOR THE STANDBY POWER SUPPLY CONTINUOUSLY. THE INDICATORS MAY BE LOCATED AT THE STANDBY POWER SUPPLY OR IN THE STATION CONTROL ROOM. ANNUNCIATORS SHALL BE PROVIDED IN THE CONTROL ROOM TO MONITOR AND ALARM THE STATUS OF THE STANDBY POWER SUPPLY. THE INDICATORS MAY INCLUDE: (A) BUS VOLTAGE (B) FREQUENCY (C) CIRCUIT BREAKER POSITION (D) ENERGY SUPPLY (E) STARTING POWER STATUS (F) BATTERY VOLTAGE	THESE STATUS INDICATORS AND OTHERS ARE PROVIDED IN THE CONTROL ROOM.

REQUIREMENT	DESIGN FEATURE
G. SYSTEM TESTING AND SURVEILLANCE	
3. STANDBY POWER SUPPLY SURVEILLANCE (CONTINUED)	
(G) LUBRICATING OIL TEMPERATURE (H) COOLANT TEMPERATURE (I) LUBRICATING OIL LEVEL	
4. STARTUP TESTING (R.G. 1.68)	
PREOPERATIONAL TESTING SHALL VERIFY LOAD GROUP ASSIGNMENTS AS WELL AS THE CAPACITY AND CAPABILITY OF CLASS 1E SYSTEM.	DESIGN IS CAPABLE OF AND CONSISTENT WITH APPROPRIATE TESTING AND VERIFICATION.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
5. TEST REQUIREMENTS (R.G. 1.41, R.G. 1.108, R.G. 1.118)	
THE ONSITE ELECTRIC POWER SYSTEM SHOULD BE FUNCTIONALLY TESTED ALL OFF- AND ONSITE AC POWER SOURCES FOR ONE LOAD GROUP AT A TIME COMPLETELY DISCONNECTED. EACH TEST SHOULD INCLUDE INJECTION OF SIMULATED ACCIDENT SIGNALS, STARTUP OF THE ONSITE POWER SOURCES AND LOAD GROUPS UNDER TEST, SEQUENCING OF LOADS AND FUNCTIONAL PERFORMANCE OF THE LOADS.	THE DISTRIBUTION SYSTEM IS DESIGNED SUCH THAT THE REQUIRED TESTS CAN BE PERFORMED WITH ALL OFFSITE AND ONSITE AC POWER FOR ONE LOAD GROUP DISCONNECTED.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
6. TEST MONITORING (R.G. 1.41)	
DURING EACH TEST, THE DC AND ON-SITE AC BUSES AND RELATED LOADS NOT UNDER TEST SHOULD BE MONITORED TO VERIFY ABSENCE OF VOLTAGE AT THESE BUSES.	ANNUNCIATORS AND ALARMS ARE PROVIDED FOR ALL DC AND AC BUSES.

SRP ACCEPTANCE CRITERIA

REQUIREMENT	DESIGN FEATURE
H. OTHER REVIEW AREAS	
1. FIRE PROTECTION GENERAL: MEASURES SHOULD BE INCLUDED IN THE DESIGN THAT REDUCE THE LIKELIHOOD OF A FIRE OR REDUCE THE CONSEQUENCES OF A FIRE.	ALL CABLES HAVE BEEN PROCURED TO MEET OR EXCEED THE FLAME RETARDANCY REQUIREMENTS OF IEEE-383-1974. SEPARATION PER IEEE-384 AND R.G. 1.75 HAS BEEN INCORPORATED IN THE DESIGN TOGETHER WITH FIRE DECTECTION AND SUPPRESSION TO REDUCE THE LIKELIHOOD OF EXTENSIVE DAMAGE.
SPECIFIC REQUIREMENTS	
A. CABLE SPLICES (R.G. 1.75) CABLE SPLICES IN RACEWAYS SHOULD BE PROHIBITED.	NO SPLICES ARE ALLOWED IN ANY CLASS 1E RACEWAYS.
B. RACEWAYS (R.G. 1.75) INTERLOCKED ARMORED CABLE SHOULD NOT BE CONSTRUED TO BE A RACEWAY.	NO INTERLOCK ARMORED CABLE IS CONSIDERED AS A RACEWAY.

C. REFER ALSO TO REDUNDANCY AND INDEPENDENCY REQUIREMENTS OF SECTIONS 2A AND 2B.

H. OTHER REVIEW AREAS

1. FIRE PROTECTION

D. GENERAL CABLE SIZING AND RACEWAY INSTALLATION FEATURES

1. CABLE DERATING & CABLE TRAY FILL

A) 5 & 15KV - ONE DIAMETER MAINTAINED SPACING ICEA P-54-440
B) 600 VOLT POWER - RANDOM FILLED FOR 30% OF TRAY
C) 600 VOLT CONTROL & INSTRUMENTATION - RANDOM FILLED FOR 40% OF TRAY
D) POWER CABLES SIZED FOR 100% LOAD FACTOR WITH 90°C CONDUCTOR TEMPERATURE

2. CABLES IN DUCTS & CONDUIT

AMPACITY IN ACCORDANCE WITH ICEA P-46-426
CONDUIT FILL IN ACCORDANCE WITH NEC-1975

3. CABLE TRAY ARRANGEMENT

TRAYS ARE ARRANGED IN FOLLOWING ORDER (TOP TO BOTTOM)

15KV POWER
5 KV POWER
600V POWER (LOAD CENTER)
600V (POWER & CONTROL)
INSTRUMENTATION CABLES

REQUIREMENT	DESIGN FEATURE
H. OTHER REVIEW AREAS	
2. SEISMIC CLASSIFICATION (R.G. 1.29) CLASS 1E SYSTEMS SHOULD BE DESIGNED AS SEISMIC CATEGORY I AND SHOULD WITHSTAND THE EFFECTS OF SSE AND REMAIN FUNCTIONAL.	ALL CLASS 1E SYSTEMS ARE DESIGNED AND PROCURED TO MEET SSE.
3. ELECTRICAL PENETRATION DESIGN	
A. SHORT CIRCUIT DURATION (R.G. 1.63) THE PROVISIONS PERTAINING TO THE DURATION OF THE MAXIMUM SHORT CIRCUIT CURRENT SHOULD BE 0.033 SECONDS FOR MOLDED CASES BREAKERS AND 0.066 FOR AIR CIRCUIT BREAKERS.	THE DURATION USED FOR MAXIMUM SHORT CIRCUIT CURRENTS IS THE ACTUAL OPENING TIME FOR MOLDED CASE BREAKERS AND AIR CIRCUIT BREAKERS.

REQUIREMENT	DESIGN FEATURES
H. OTHER REVIEW AREAS	
B. ELECTRICAL PENETRATION DESIGN (R.G. 1.63) THE ELECTRIC PENETRATION ASSEMBLY SHOULD BE DESIGNED TO WITHSTAND WITHOUT LOSS OF MECHANICAL INTEGRITY THE MAXIMUM SHORT-CIRCUIT CURRENT VS TIME CONDITIONS THAT COULD OCCUR GIVEN SINGLE RANDOM FAILURE OF THE OVERLOAD PROTECTION DEVICE.	THE CIRCUIT BREAKER ASSOCIATED WITH THE LOAD IS BACKED UP BY THE MAIN BUS FEEDER BREAKER FOR MEDIUM VOLTAGE & LOADCENTER LOADS. THE PENETRATION WITHSTANDS THE AVAILABLE FAULT CURRENT AND TIME DURATION FOR THE MAIN BUS FEEDER BREAKER WHICH ACTS AS A BACKUP BREAKER. THE PRIMARY AND BACKUP CIRCUIT BREAKERS ARE EACH PROVIDED WITH INDEPENDENT DC CONTROL POWER FROM TWO DIFFERENT NON-CLASS IE BATTERIES FOR MEDIUM VOLTAGE BREAKERS. NO DC POWER IS NEEDED FOR LOADCENTER BREAKERS. FOR MCC LOADS WITH FIELD WIRE SIZES NO. 8 AWG AND SMALLER, THE PENETRATION CONDUCTORS HAVE THE CAPABILITY OF WITHSTANDING THE MAXIMUM FAULT CURRENT BASED ON THERMAL FUSING OF THE FIELD CABLES IN ONE-HALF THE TIME, AS A MAXIMUM, OF THE FUSING TIME OF THE PENETRATION CONDUCTOR.

REQUIREMENT	DESIGN FEATURES
H. OTHER REVIEW AREAS	
4. QUALITY ASSURANCE (IEEE-336, R.G. 1.30) CLASS 1E EQUIPMENT SHALL BE DESIGNED, MANUFACTURED, INSTALLED, AND OPERATED IN ACCORDANCE WITH 10CFR50 APPENDIX B.	FULL COMPLIANCE

1. LOCAL ALARMS

LUBE OIL PRESSURE, LOW
LUBE OIL TEMPERATURE, HIGH OR LOW
JACKET COOLANT TEMPERATURE, HIGH OR LOW
GENERATOR UNDERVOLTAGE
START FAILURE
JACKET COOLANT PRESSURE, LOW
FUEL OIL LEVEL, LOW-LOW IN DAY TANK
FUEL OIL LEVEL, HIGH-HIGH IN DAY TANK
FUEL OIL STRAINER DIFFERENTIAL PRESSURE HIGH
DIESEL - GENERATOR UNDERFREQUENCY
FUEL OIL PRESSURE TO ENGINE LOW
JACKET COOLANT LEVEL, LOW IN EXPANSION TANK

STARTING AIR PRESSURE, LOW
CRANKCASE PRESSURE, HIGH
ANY SWITCH NOT IN AUTO POSITION
ENGINE OVERSPEED
LOSS OF FIELD
LUBE OIL FILTER HIGH DIFFERENTIAL PRESSURE
DIESEL GENERATOR HIGH VIBRATION
BEARING TEMPERATURE, HIGH
GENERATOR LOAD UNBALANCE
REVERSE POWER
GENERATOR DIFFERENTIAL
DAY TANK ROOM EXHAUST FAN OFF

DIESEL GENERATOR

INSTRUMENTATION & CONTROL DESCRIPTION

2. REMOTE (CONTROL ROOM) ANNUNCIATION

- DIESEL GENERATOR RUNNING
- COMMON ALARM FOR ANY LOW PRIORITY TROUBLE
- UNDERVOLTAGE
- UNDERFREQUENCY
- TRIP
- LOSS OF FIELD
- STARTING AIR LOW PRESSURE
- LOSS OF DC CONTROL POWER
- LOCAL-REMOTE SWITCH IN LOCAL OR OFF POSITION
- GENERATOR DIFFERENTIAL
- ENGINE OVERSPEED
- LOW LUBE OIL PRESSURE
- OVERVOLTAGE
- NEGATIVE-PHASE SEQUENCE OVERCURRENT
- DIESEL GENERATOR FIELD GROUND DETECTOR
- BYPASS AND INOPERABILITY STATUS INDICATION (IN ACCORDANCE WITH NRC REGULATORY GUIDE 1.47)
- HIGH PRIORITY TROUBLE (SINGLE CONTACT WHICH IS GROUPING OF DIESEL GENERATOR TRIP FUNCTIONS).

3. GENERATOR PROTECTIVE FUNCTIONS (NON-ACCIDENT CONDITION)

START FAILURE TRIP
ENGINE OVERSPEED TRIP
HIGH JACKET COOLANT TEMPERATURE
TURBO-CHARGER THRUST BEARING FAILURE
LOW LUBE OIL PRESSURE TRIP (ONE OUT OF TWO TAKEN TWICE)
TURBO-CHARGER LOW LUBE OIL PRESSURE
LOSS OF FIELD
GENERATOR DIFFERENTIAL
GENERATOR NEUTRAL OVERVOLTAGE
GENERATOR VOLTAGE RESTRAINED OVERCURRENT
REVERSE POWER
UNDERFREQUENCY

DIESEL GENERATOR
INSTRUMENTATION & CONTROL DESCRIPTION

4. GENERATOR PROTECTIVE FUNCTIONS (ACCIDENT CONDITION)

ENGINE OVERSPEED
LOW LUBE OIL PRESSURE (ONE OUT OF TWO TAKEN TWICE LOGIC)
GENERATOR DIFFERENTIAL

5. CONTROL & INDICATION IN THE CONTROL ROOM

REMOTE MANUAL STARTING AND STOPPING
REMOTE MANUAL SYNCHRONIZATION
REMOTE MANUAL FREQUENCY AND VOLTAGE REGULATION
MANUAL GOVERNOR DROOP AND VOLTAGE DROOP SELECTION
AUTOMATIC OR MANUAL VOLTAGE REGULATOR SELECTION
AMPS INDICATION
VOLTS INDICATION
HERTZ INDICATION
WATTS INDICATION
VARS INDICATION
DAY TANK FUEL OIL INDICATION

DIESEL GENERATOR
INSTRUMENTATION & CONTROL DESCRIPTION

6. LOCAL CONTROL & INDICATION

- MANUAL STARTING AND STOPPING
- MANUAL FREQUENCY AND VOLTAGE REGULATION
- AUTOMATIC OR MANUAL REGULATION SELECTION
- MANUAL EXCITER FIELD REMOVAL AND RESET
- MANUAL GOVERNOR AND VOLTAGE DROOP SELECTION
- LOCAL-REMOTE CONTROL SELECTION (KEY LOCK)
- FUEL OIL TRANSFER PUMP CONTROL
- HVAC SYSTEM START CONTACT (ENGINE SPEED ABOVE 280 R/MIN AND TWO POSITION MAINTAINED CONTACT SWITCH (CLASS IE)
- THREE POSITION MAINTAINED CONTACT SWITCH FOR NORMAL EXHAUST FAN (NON-CLASS IE)
- TWO POSITION SWITCH FOR THE ESSENTIAL EXHAUST FAN MOMENTARY CONTACTS, SPRING RETURN TO NEUTRAL (IE)
- TWO EMERGENCY STOP PUSHBUTTONS, EACH WITH MECHANICALLY INTERLOCKED RESET BUTTON
- CURRENT, VOLTAGE, WATTS, VARS INDICATION

4. IE BULLETINS, CIRCULARS AND INFORMATION NOTICES

CIRCULARS

• 78-09 ARCING OF GENERAL ELECTRIC SIZE 2 CONTACTORS	G.E. HAS CORRECTED THE COPPER TIP SUPPORT BINDING IN SIZE 2 CONTACTOR
• 79-02 FAILURE OF 120 VOLT VITAL AC POWER SUPPLY	DESIGN HAS PARALLEL BATTERY AND CHARGER WITH STATIC TRANSFER SWITCH.
• 79-05 MOISTURE LEAKAGE IN STRANDED CONDUCTORS	1. TERMINAL BOXES WITH TERMINAL BLOCKS ARE QUALIFIED FOR LOCA/MSLB 2. SENSOR TRANSMITTERS UTILIZE SOLID CONDUCTORS PASSING THROUGH QUALIFIED SEALS

IE BULLETINS, CIRCULARS AND INFORMATION NOTICES

BULLETINS

• 77-02 FAILURE OF WESTINGHOUSE AR RELAY	RELAY TYPE BEING USED IS MAGNETIC ONLY. FAILED RELAY WAS LATCH TYPE
• 77-05 & 05A ELECTRICAL CONNECTOR ASSEMBLIES	CONNECTOR TYPE IS NOT USED IN CONTAINMENT
• 78-01 FLAMMABLE CONTACT ARM RETAINER IN GE CR120A RELAY	DESIGN DOES NOT HAVE GE CR120A RELAY
• 78-02 TERMINAL BLOCK QUALIFICATION	SAFETY RELATED T.B. WILL BE QUALIFIED PER IEEE 323-1974. NEMA TYPE 12 ENCLOSURES WILL BE USED FOR CONTROL AND INSTRUMENTATION CABLE
• 78-05 AUXILIARY CONTACT MECHANISM FAILURE ON GE CR105X	THE DESIGN UTILIZES CR205X FOR BOTH 1E AND NON-1E INSTEAD OF CR105X
• 78-06 DEFECTIVE CUTLER-HAMMER TYPE M RELAYS WITH DC COILS	THE DESIGN DOES NOT UTILIZE CUTLER-HAMMER RELAYS

IE BULLETINS, CIRCULARS AND INFORMATION NOTICES

BULLETINS

• 79-27. LOSS OF NON-CLASS 1E INSTRUMENTATION AND CONTROL POWER BUS DURING OPERATION	THE DESIGN PROVIDES FOR 2 UNGROUNDED NON-1E INSTRUMENT DISTRIBUTION PANELS AND 4 UNGROUNDED VITAL (CLASS 1E) PANELS ALL NON 1E INSTRUMENTATION HAS A 1E COUNTERPART TO PROVIDE CONTINUOUS CONTROL ROOM READOUT OF ALL PARAMETERS EVEN WITH A TOTAL LOSS OF ALL NON 1E INSTRUMENTATION.

INFORMATION NOTICE

• 79-04 DEGRADATION OF ESF.	THE DESIGN IS SUCH THAT A SINGLE EVENT CANNOT CAUSE THE LOSS OF MORE THAN ONE ESF BUS AT ANY UNIT (ACRS PRESENTATION)

Table 8.3-3

AUTOMATIC LOADING OF CLASS IE BUSES
(Sheet 1 of 4)

Equipment	Rated HP	BHP	Motor Efficiency	Motor Power Factor	Load (kW)	Motor % LRC	Forced Shutdown (Note b) Train A (kW)	Forced Shutdown (Note b) Train B (kW)	LOCA (Note c) Train A (kW)	LOCA (Note c) Train B (kW)
Step 1										
Time to Start 0.5 Sec (Note a)										
HP Safety Injection Pump M-SIA(B)-P02	1,000	910	.948	.922	716	600	-	-	716	716
HPSI Pump Room Air Cool. Units M-HAA(B)-Z01	5	2.7	.782	.73	2.6	400	-	-	2.6	2.6
Diesel Fuel Oil Trans. Pump M-DFA(B)-P01	N.A.	N.A.	-	.819	2.5	340	2.5	2.5	2.5	2.5
Control Bldg. Battery Rm Ess. Exhaust M-HJA(B)-J01A, B	1	0.2	0.8[e]	0.8[e]	.186	665	0.4	0.4	0.4	0.4
120V Non-Class IE Instr. Pnl. E-NNA-V13 (E-NNB-V14)	25 kVA	-	0.85	0.91	25	N.A.	25	25	25	25
Elect. Pent. Room Ess. Air Cooling Unit M-HAA(B)-Z06	3	1.7	.799	.777	1.6	589	1.6	1.6	1.6	1.6
Motor Operated Valves (Non-Cl. IE)	10 kVA	-	-	0.85[e]	8.5	344	8.5	8.5	-	-
Control Bldg. ESF. Swgr. Ess. Air Cooling Unit M-HJA(B)-Z03	7.5	5.1	.832	.844	4.6	600	4.6	4.6	4.6	4.6
ECW Pump Room Air Cool. Unit M-HAA(B)-Z05	3	1.6	.799	.777	1.5	589	1.5	1.5	1.5	1.5
C.S. Pump Room Air Cool. Unit M-HAA(B)-Z03	3	1.6	.799	.777	1.5	589	-	-	1.5	1.5
LPSI Pump Room Air Cool. Unit M-HAA(B)-Z02	3	1.6	.766	.71	1.6	446	-	-	1.6	1.6
Motor Operated Valves, (Class IE)	150 kVA	-	-	0.85[e]	127.5	753	127.5	127.5	127.5	127.5
Ctmt. Reactor Cavity Cool. Fans M-HCN-A03A, C (B,D)	50	38	.91	.826	31.15	550	62.3	62.3	-	-
Aux. FW Pump Rm. ACU Fan M-HAB-Z04	5	2.7	.782	.73	2.6	400	-	2.6	-	2.6
Condensate Transf. Pump M-CTA(B)-P01	5	3.3	.849	.817	2.9	649	2.9	2.9	2.9	2.9
Diesel Gen. Ctmt. Rm. Essen Air Handling Unit M-HDA(B)-A01	20	15	.822	.844	13.6	600	13.6	13.6	13.6	13.6
Spray Chemical Add Pump M-SIA(B)-P05	3	3	.799	.777	3.3	589	-	-	3.3	3.3
Normal Chiller Aux. Pwr. Pnl. J-WCN-E01A	10 kVA	-	-	0.8[e]	8	N.A.	8	-	-	-
Essen. Chiller Aux. Pwr. Pnl. J-ECA-E01 & J-ECB-E02	10 kVA	-	-	0.8[e]	8	N.A.	8	8	8	8
Control Rm. and Remote Shutdown Panel Essen. Ltg. E-QBA-V01 & E-QBB-V02	25 kVA	13 kW	.85	.91	13 kW	N.A.	13	13	13	13
D/G Lube Oil Warm-Up Heater[h] M-DGA(B)-M02	12 kW	-	-	-	12	N.A.	-	-	-	-
D/G Jkt Wtr Warm-Up Heater[h] M-DGA(B)-M01	18 kW	-	-	-	18	N.A.	-	-	-	-

Table 8.3-3

AUTOMATIC LOADING OF CLASS IE BUSES
(Sheet 2 of 4)

Equipment	Rated HP	BHP	Motor Efficiency	Motor Power Factor	Load (kW)	Motor % LRC	Forced Shutdown (Note b) Train A (kW)	Forced Shutdown (Note b) Train B (kW)	LOCA (Note c) Train A (kW)	LOCA (Note c) Train B (kW)
Step 1 (Cont.)										
D/G Jkt Htr Circ. Pump(h) M-DGA(B)-P01	5	-	0.81	0.83	4.6	650	-	-	-	-
D/G Lube Oil Circ. Pump(h) M-DGA(B)-P04	20	-	.85	.91	17.5	600	-	-	-	-
Control Rm. Vent A Rad. Monitor J-SQA-RU29	2 kVA	-	0.8	0.7	1.4	731	1.4	-	1.4	-
Control Rm. Vent B Rad. Monitor J-SQB-RU30	2 kVA	-	0.8	0.7	1.4	731	-	1.4	-	1.4
Ctmt. Bldg. Atmos. Rad. Monitor J-SQB-RU01	2 kVA	-	0.8	0.7	1.4	731	-	1.4	-	1.4
Fuel Bldg. Vent. Exh. Rad. Monitor J-SQB-RU32	2 kVA	-	0.8	0.7	1.4	731	-	1.4	-	1.4
Ctmt. Bldg. Purge Exh. Rad. Monitor J-SQB-RU34	2 kVA	-	0.8	0.7	1.4	731	-	1.4	-	1.4
TOTAL STEP 1 LOAD							280.8	279.6	927	933.8
Step 2 Time to Start 5 Sec (Note a)										
Diesel Generator Ess. Exh. Fans M-HDA(B)-J01	100	80	0.9(e)	0.9(e)	58.9		58.9	58.9	58.9	58.9
LP Safety Injection Pump M-SIA(B)-P01	500	470	.931	.905	400	498	-	-	400	400
Ctmt. Normal Cooling Unit M-HCN-A01A, C (B,D)	150	150	.933	.901	104	604	208	208	-	-
Fuel Bldg. & Aux. Bldg. Ess. AFU Including Heater (one 40 HP motor and one 28 kW Htr.) M-HFA(B)-E01; M-HFA(B)-J01	40 28 kW	29 -	0.9* -	0.9( ) -	24 28	 N.A.	- -	- -	24 28	24 28
CEDM Normal Air Cooling Unit (2 motors of 250 HP) M-HCN-A02A, C (B,D)	250	190	.941	.895	150.6	633	301.2	301.2	-	-
Battery Chargers (Incld. Class IE Instrument Panels) E-PKA-H11, PKC-H13 (PKB-H12, PKD-H14)	70 kVA 92 kVA	- -	0.9 0.9	0.75 0.75	53 69	N.A. N.A.	53 69	53 69	53 69	53 69
Control Room Ess. AHU M-HJA(B)-F04	125	100	0.9(e)	0.9(e)	69.6		69.6	69.6	69.6	69.6
TOTAL STEP 2 LOAD							759.7	759.7	702.5	702.5
TOTAL LOAD AT 5 SEC							1040.5	1039.3	1629.5	1636.3
Step 3 Time to Start 10 Sec (Note a)										
Auxiliary Feedwater Pump M-AFB-P01	1250	1125	.948	.928	885	608	-	885	-	885
TOTAL STEP 3 LOAD							0	885	0	885
TOTAL LOAD AT 10 SEC							1040.5	1924.3	1629.5	2520.8

Table 8.3-3

AUTOMATIC LOADING OF CLASS IE BUSES

(Sheet 3 of 4)

Equipment	Rated HP	BHP	Motor Efficiency	Motor Power Factor	Load (kW)	Motor % LRC	Forced Shutdown (Note b)		LOCA (Note c)	
							Train A (kW)	Train B (kW)	Train A (kW)	Train B (kW)
Step 4										
Time to Start 15 Sec (Note a)										
Ctmt. Spray Pump M-SIA(B)-P03	800	700	.938	.928	557	537	-	-	557	557
TOTAL STEP 4 LOAD							0	0	557	557
TOTAL LOAD AT 15 SEC							1040.5	1924.3	2186.5	3078.3
Step 5										
Time to Start 20 Sec (Note a)										
Essential Cooling Water Pump M-EWA(B)-P01	800	725	0.942	0.892	574	547	574	574	574	574
TOTAL STEP 5 LOAD							574	574	574	574
TOTAL LOAD AT 20 SEC							1614.5	2498.3	2760.5	3652.3
Step 6										
Time to Start 25 Sec (Note a)										
Essential Spray Pond Pump M-SPA(B)-P01	600	588	0.925	0.85	474	600	474	474	474	474
TOTAL STEP 6 LOAD							474	474	474	474
TOTAL LOAD AT 25 SEC							2088.5	2972.3	3234.5	4126.3
Step 7										
Time to Start 30 Sec (Note a)										
Essential Chilled Water Pump M-ECA(B)-P01 (Note d)	20	13.3	.848	.829	11.7	519	11.7	11.7	11.7	11.7
Essential Water Chiller M-ECA(B)-E01	344 kW	270 kW	0.94	0.906	270	540	270	270	270	270
TOTAL STEP 7 LOAD							281.7	281.7	281.7	281.7
TOTAL LOAD AT 30 SEC							2370.2	3254.0	3516.2	4408
Step 8										
Time to Start 55 Sec (Note a)										
Normal Chilled Water Pump M-WCN-P01A	50	45	0.915	0.855	40	600	40	-	-	-
Normal Water Chiller M-WCN-E01A	968 kW	799 kW	0.949	0.92	799	580	799	-	-	-
TOTAL STEP 8 LOAD							839	-	-	-
TOTAL LOAD AT 55 SEC (TOTAL SEQUENCED LOAD)							3209.2	3254.0	3516.2	4408
Manual Control										
LP Safety Injection Pump[g] M-SIA(B)-P01	500	470	.931	.905	400	498	400	400	-	-
Hydrogen Recombiner N-HPA(B)-D01	50 kW	-	-	-	50	N.A.	-	-	50	50
Pressurizer Heater M-RCE-A07,8,9 (10,11,12)	183 kW	150 kW	-	-	150	N.A.	150	150	-	-
Fuel Pool Cooling Pump[e] M-PCA(B)-P01	100	70	.915	.884	58.7	625	-	-	-	-

Table 8.3-3

AUTOMATIC LOADING OF CLASS IE BUSES
(Sheet 4 of 4)

Equipment	Rated HP	BHP	Motor Efficiency	Motor Power Factor	Load (kW)	Motor % LRC	Forced Shutdown (Note b)		LOCA (Note c)	
							Train A (kW)	Train B (kW)	Train A (kW)	Train B (kW)
Manual Control (Cont.)										
Essential Lighting E-QBN-D91 (D90)	160 kW(e)	-	-	0.8(e)	160	N.A.	160	160	160	160
120V Non-Cl. IE Instr. Pnl. E-NNN-V17(18)	25 kVA	-	0.85	0.91	25	N.A.	25	25	25	25
Charging Pump(f) M-CHA(B)-P01, M-CHE-P01	100	80	0.93	.867	64.2	632	-	-	-	-
TOTAL MANUAL LOAD							735	735	235	235
1 TOTAL LOAD							3944.2	3989.0	3751.2	4643
DIESEL GENERATOR RATING							5500	5500	5500	5500
1 MARGIN							1555.8	1511	1748.8	857.0 15.6%

a. Starting time is counted from the generator breaker closure instant. This starting time excludes the 10 seconds maximum allowable time for the diesel generator to come up to speed and voltage after the start signal.

b. Unscheduled shutdown of the station unit in conjunction with loss of normal onsite and offsite power.

c. Loss of coolant accident.

d. If essential chiller is operating prior to load shed and simultaneous ESFAS, the time to start will be delayed an additional 2-3/4 minutes due to chiller internal controls.

e. Assumed or unconfirmed data.

f. Will be started manually at operator's discretion. Need not be added to total load.

g. Starts automatically in Step 2 in case of LOCA.

h. These loads are not on when D/G is running.