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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 24 1978

Docket Nos. STN 5
and STN 5 3

APPLICANT: Arizona Public Service Company

FACILITY: Palo Verde Nuclear Generating Station, Units 4 and 5

SUBJECT: SUMMARY OF MEETING HELD ON OCTOBER 19, 1978 REGARDING THE SAFETY REVIEW OF PALO VERDE, UNITS 4 AND 5

A meeting was held between NRR staff members and representatives of the Arizona Public Service Company and their consultants in Phoenix, Arizona on October 19, 1978 to discuss the safety review of Palo Verde 4 & 5. The public was invited to attend the meeting, but less than five members of the public were present. The meeting agenda and list of attendees are attached as Enclosures 1 and 2.

<u>Summary of Meeting</u>

Enclosure 3 to this summary is a compilation of the questions and applicant responses discussed during the meeting. In addition to the responses documented in the Enclosure, the following points were made:

1. Concerning Containment Systems question number 2, the applicant agreed (a) to confirm that the nodalization study was based on the peak pressure loads and (b) to provide the acceptance criteria for the nodal array used. The staff will inform the applicant if more detailed information is required to complete confirmatory analyses.

2. Concerning Power Systems question numbers 3 and 4, the staff agreed to discuss these matters further at a future meeting.

Questions from the public concerned the adequacy of ECCS and the Palo Verde cooling water supply.

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Conclusions

The staff will evaluate the information provided by the applicant and will determine if more information is required in order to draw the conclusions necessary for a safety evaluation report. For those question responses that provided substantive information, the applicant will incorporate the information into a future PSAR amendment.

Robert L. Stright, Project Manager
Light Water Reactors Branch No. 3
Division of Project Management

Enclosures:
1. Meeting Agenda
2. List of Attendees
3. Questions and Responses

cc w/enclosures:
See next page

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ENCLOSURE 1

NUCLEAR REGULATORY COMMISSION - ARIZONA PUBLIC SERVICE COMPANY

MEETING - OCTOBER 19, 1978 - PHOENIX, ARIZONA

I. Introductory Remarks - Roger Boyd

II. NRC Staff - APS Technical Meeting - Robert Stright

- A. Introduction of Participants
- B. Presentation by APS
- C. Technical Subjects
  1. Containment Systems - Stuart Brown
     - (a) Asymetric Loads in Subcompartments
     - (b) Main Steam Line Break Analysis
  2. Power Systems - Om Chopra
     - (a) Containment Electrical Penetrations
     - (b) Abnormal Grid Voltage Conditions
     - (c) Use of Load Sequencer
     - (d) Switchyard Layout
     - (e) Startup Transformers
  3. Structural Engineering - Sai Chan
     - (a) Soil-Structure Interaction
     - (b) Seismic Instrumentation
     - (c) Clarification of Base Plant Changes
  4. Materials Engineering - Dave Sellers
     - (a) Regulatory Guide 1.99

III. Questions From Public

IV. Closing Remarks - Roger Boyd

ENCLOSURE 2

LIST OF ATTENDEES

NRC

R. Boyd
R. Stright
S. Brown
O. Chopra
S. Chan
C. Sellers
R. Stevens
J. Wermiel
C. Long
G. Georgiev

Arizona Public Service Company

E. E. Van Brunt, Jr.
J. Allen
D. Karner
M. Hodge
J. Berrow
W. Quinn
D. Keith - Bechtel
J. Goldberg - Combustion Engineering

ENCLOSURE 3

[illegible] VERDE NUCLEAR GENERATING STATION

UNITS 4 AND 5

DOCKET NOS. STN 50-592 AND STN 50-593

REQUEST FOR ADDITIONAL INFORMATION

Containment Systems

Question 1

In the qualification review item number E.28, an analysis of the containment response to an assumed steam line break inside the containment, assuming the failure of the broken loop main steam isolation valve to close, was requested. In response (Amendment 17) you stated that this analysis was performed with conservative assumptions and the result was an incremental increase of pressure (2.8 psi). However, for the staff to complete its review in this area (including a confirmatory analysis) we will require the following additional information:

1. A list of the assumptions used in your analysis with a discussion of their conservativeness.

2. The mass and energy release rates to this analysis.

3. The results of your analysis in the form of temperature and pressure profiles as a function of time.

Response:

ASSUMPTIONS:

a. The steam inventory between the MSIV, the turbine stop valves and the reheater drain tank check valve will vent 14.6M Btu's through the failed MSIV to the containment.

b. The additional energy of (a) is conservatively added to the containment at the time of peak pressure as calculated in the main steam line break analysis presented in the PVNGS 1, 2 and 3 PSAR without any loss to passive or active heat sinks.

RELEASE RATES:

The conservative mass and energy release rates, presented in Table 6.2.1-24 of CESSAR, were used in the design basis MSL break and the evaluation of the MSIV failure.

P-T PROFILES:

Due to the conservative method used to evaluate the failure of the MSIV, pressure-temperature profiles as a function of time are not available. This information will be available at the FSAR submittal.

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REQUEST FOR ADDITIONAL INFORMATION

Containment Systems

Question 2

In the qualification review for Palo Verde Units 1, 2 and 3, the question of asymmetric loading on components and supports located within containment subcompartments was addressed (item E-29). Although some of the required information has been provided, the Staff requires additional information to resolve this issue for Palo Verde 4 and 5.

1. Provide a schematic drawing showing the compartment nodalization for the model used to calculate the maximum differential pressure loads for the component supports evaluation. Provide a tabulation of the nodal net-free volumes and interconnecting flow path areas. For each flow path, provide an L/A (ft^{-1}) ratio, where L is the average distance the fluid flows in that flow path and A is the effective cross sectional area. Provide and justify values of vent loss coefficients and/or friction factors used to calculate flow between nodal volumes. When a loss coefficient consists of more than one component, identify each component, its value and the flow area at which the loss coefficient applies.

2. Describe the nodalization sensitivity study performed to determine the minimum number of volume nodes required to conservatively predict the maximum differential pressure loads acting on the component supports. The nodalization sensitivity study should include consideration of spatial pressure variation circumferentially, axially, and radially within the compartment.

3. Graphically show the pressure (psia) and differential pressure (psi) responses as functions of time for each node. Discuss the basis for establishing the differential pressure on components.

4. Provide the peak and transient loading on the major components used to establish the adequacy of the supports' design. This should include the load forcing functions (e.g., $f_x(t)$, $f_z(t)$) and transient moments (e.g., $M_x(t)$, $M_y(t)$, $M_z(t)$) as resolved about a specific, identified coordinate system. Provide the projected area used to calculate these loads and identify the location of the area projections on plan and section drawings in the selected coordinate system. This information should be presented in such a manner that confirmatory evaluations of the loads and moments can be made.

Response:

1. The compartment nodalization used to determine the pressure loads on components located in the reactor cavity and the steam generator compartment are shown in Figures 6.2-14 and 6.2-14A of the PSAR. The nodal net-free volumes, the interconnection flow path areas, flow path loss coefficients and the L/A ratio for the above models are tabulated in Tables 6.2-14 through 6.2-14F of the PSAR. The methods used to calculate the flow path loss coefficients is given in Section 6.2.1.3.4.2F of the PSAR.

2. The nodalization sensitivity study of a geometrically similar plant arrangement was used to establish the minimum number of nodes to predict the differential pressure loads acting on components and their supports. The study considered three dimensional pressure variations within the compartments. The study showed that differential pressure loads acting on compartment components increased with finer nodalization at an ever decreasing rate. Thus a point of diminishing return is reached, after which increases in the number of model nodes produces changes in the component loads that are small when compared to that load.

3. Nodal pressures for the reactor cavity and steam generator compartment are shown in Figures 6.2-18 and 6.2-20 of the PVNGS 1, 2 & 3 PSAR , respectively. A differential pressure load can be evaluated from these figures. Differential pressure plots have not been provided due to the very large number of combinations required to represent the loads on all the walls and components that are analyzed.

4. This question implies that component support design is based solely on pressure differentials acting on the exterior of the component following a postulated break. To the contrary, the component may be subject to differential pressures acting on the component internals, jet thrust and impingement load in addition to SSE loads. Bechtel provides Combustion Engineering external pressure transients, which are combined in their analysis to determine the resultant transient loads acting on the component. The information provided in Section 6.2.1 of the PVNGS 1, 2 & 3 PSAR is in the form used in the design process (e.g., pressures, affected areas).

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REQUEST FOR ADDITIONAL INFORMATION

Power Systems

Question 1

Your response to qualification review item E11 regarding your design of containment electrical penetration protection is inadequate in its present form. We require that the following requirements of IEEE-279 be satisfied with regard to the protection of the electrical penetrations:

a. The system shall, with precision and reliability automatically disconnect power to the penetration conductors when currents through the conductors exceed the established protection limits.

b. All primary and backup breaker overload and short circuit protection systems shall be qualified for the service environment including seismic. However, the seismic qualification for non-Class IE circuit breaker protection systems should as a minimum assure that the protection systems remain operable during an operating basis earthquake. In addition, the non-Class IE circuit breaker and protection system shall be of high quality.

c. The circuit breaker protection system trip set points and

breaker coordination between primary and backup protection shall have the capability for test and calibration. Provisions for test under simulated fault conditions should be provided. For designs where protection is provided by a combination of a breaker and a fuse or two fuses in series, provisions shall be provided for testing fuses.

d. No single failure shall cause excessive current in the penetration conductors which will degrade the penetration seals.

e. Where external control power is used for tripping breakers, signals for tripping primary and backup breakers shall be independent, physically separated and powered from separate sources.

Provide modified response that includes our above requirements.

Response:

a. The power to the penetrations is automatically disconnected by means of molded case circuit breakers and air circuit breakers when a fault occurs. The Class IE breakers have been manufactured to meet the service environment requirements as outlined in IEEE 323-1974 and IEEE 344-1975. The non-Class IE breakers have been manufactured to meet a high degree of reliability and are being qualified to a static seismic loading of .13g in the horizontal

direction and .09g in the vertical direction.

b. The primary and backup breakers are coordinated such that the operating time of the backup breaker for a three phase fault is taken as the minimum fault withstand time for the penetration seal design. These values are specified in the electrical penetration assemblies specification. The non-Class IE breakers are designed to seismic conditions as described in the response to 1.a. above.

c. The circuit breakers have capability for testing and calibration. A fault condition on air circuit breakers is simulated by inducing current to the circuit breaker trip coil. It is not necessary to test molded case circuit breakers under simulated fault conditions as they are passive devices. The PVNGS design does not have combination of fuse and circuit breaker or two fuses for circuits being fed through electrical penetrations.

d. The penetration assemblies are designed to preclude the failure of penetration seals due to a single failure of the primary breaker. Any such single failure will be protected against as indicated in the response to 1.b. above.

e. Where external control power is used for tripping breakers (RCP motors), separate non-Class IE battery sources are used to provide tripping signals for primary and backup breakers.

It should be noted that the PVNGS 1, 2 and 3 design was reviewed against Regulatory Guide 1.63 Revision 0 and approved for construction. The PVNGS Qualification Review Letter required a response to Regulatory Guide 1.63, Revision 1. As the changes made by Revision 1 of Regulatory Guide 1.63 did not involve the electrical protection of penetration assemblies, the PVNGS design in this area has not been modified. The responses given to question 1.a. through 1.e. describe the existing design for PVNGS 1, 2 and 3 and will not be modified for PVNGS 4 and 5.

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REQUEST FOR ADDITIONAL INFORMATION

Power Systems

Question 2

It is not clear from the information provided in response to qualification review item E-32 position 1, if a second level of under voltage protection is provided (in addition to the existing under voltage protection) that will automatically perform the function of switching from offsite power (the preferred source) to the onsite power sources in case of sustained degraded voltage conditions at the offsite power source. This second level of protection is a requirement. Therefore, provide a modified response to this item and include the setpoints and time delays associated with the first and second levels of undervoltage protection.

Response:

A second level of voltage protection with time delay would be required for use with an undervoltage protection scheme that utilized instantaneous relays with time delays. The primary undervoltage protection for such a scheme would be typically set to operate at about 70% of nominal voltage with appropriate time delays. Such a scheme would not detect a degraded grid condition between 70% and 100% of the nominal voltage. Monitoring this range of voltage would require the use of a second level of voltage protection.

The undervoltage protection scheme provided for the PVNGS is adequate to detect loss of offsite power at 4160 volt ESF busses and to protect the onsite power system from any adverse effects that could result from a sustained degraded voltage condition on the offsite power system. The PVNGS design for the undervoltage protection utilizes induction disc relays with inverse voltage-time relationship measured from approximately 90% nominal bus voltage down to zero voltage. This system inherently provides a second level of undervoltage protection. Since the Class IE motors for PVNGS are specified to start and accelerate their loads at 75% rated voltage and to operate continuously at 90% of rated voltage, any bus voltage that falls below 75% voltage for short time periods and below 90% for long time periods will be considered a degraded condition. Such degraded conditions will be monitored by induction disc relays and will generate a loss of voltage signal. Section 8.3.1.1.2.11 B of the PVNGS 1, 2 & 3 PSAR summarizes the setpoint and design criteria for these relays.

Reliability of the undervoltage detection is assured by the use of four relays, with 2 out of 4 coincidence logic, on each of the 4160 volt Class IE busses.

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REQUEST FOR ADDITIONAL INFORMATION

Power Systems

Question 3

Your response to position 2 of item E32 is unacceptable because 1) your design does not prevent load shedding of the emergency buses once the onsite sources are supplying power to all sequenced loads on the emergency busses and, 2) your design does not include the capability of the load shedding feature to be automatically reinstated if the onsite source supply breakers are tripped. Provide a modified response to this item that meets our requirements or provide full justification for your proposed design on some other defined bases.

Response:

1) Prevention of the load shedding feature for the Class IE 4.16kv buses would be required if an undervoltage protection system design were based on the utilization of undervoltage relays with instantaneous characteristics. The undervoltage relays utilized for PVNGS as described in Section 8.3.1.1.2.11.B of the PVNGS PSAR have inverse voltage-time characteristics. On a two-out-of-four coincidence logic a single pulse load shed signal is generated for degraded bus voltage condition or for a loss of offsite power.

The undervoltage relays are adjusted to initiate a load shed when conditions are present such that there is insufficient bus voltage available to accelerate a motor (less than 75% of rated voltage for short period of time) or a sustained undervoltage condition exists (less than 90% of rated voltage for long duration). The diesel generators are designed to be consistent with the recommendations of Regulatory Guide 1.9. The undervoltage relays are not expected to generate an undervoltage signal during normal bus sequencing due to the time delay inherent in their inverse voltage-time operation.

2) Section 8.3.1.1.3.6 of the Unit 1, 2 & 3 PSAR states: "After load shed, tripping of the Class IE 4.16 kV bus offsite supply breaker and subsequent closing of diesel generator breaker to the Class IE 4.16kV bus, the undervoltage relays monitor the standby (onsite) power supply for an undervoltage occurrence. Should an undervoltage occur, the Class IE 4.16kV loads are shed and the loading sequence restarted."
This indicates that there is no need for reinstatement of the load shed feature since it is never disconnected from the Class IE 4.16kV busses. If the onsite source supply breakers are tripped, the undervoltage relays detect the subsequent bus undervoltage and initiate a load shed.

The load shed feature is retained in the PVNGS design when the onsite (standby) source is supplying power to the Class IE 4.16kV bus for the following reasons:

A. If a load shed is not generated during a degraded voltage condition, then a condition could exist where there is insufficient voltage on the bus for either accelerating Class IE motors or for the continuous operation of Class IE motors. If the load shedding feature was prevented, the affected motors and subsequent motors sequenced onto the bus would remain at approximately a locked rotor current condition, eventually tripping their associated circuit breakers. Allowing the load shed feature to clear the bus will enable the diesel generator to recover and be reloaded through the load sequencer. Without this feature tripping of the motor circuit breakers on locked rotor current conditions would lock-out the circuit breakers so they would have to be manually reclosed. This would result in their not being readily available when needed and could result in damage to the motors.

B. A load shed will not be generated if a short circuit occurs on motor feeders since the resultant voltage dip will not be detected by the load shed undervoltage relays by the time the fault is cleared by the motor circuit breaker and the voltage returns to normal on the bus. For complete description of electrical circuit protection refer to PVNGS PSAR Section 8.3.1.1.2.11.

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REQUEST FOR ADDITIONAL INFORMATION

Power Systems

Question 4

Section 8.3.1.1.2.8 of the PSAR states that, "If preferred power is available to the Class IE bus following an engineered safety feature actuation signal, the required Class IE loads will be started through a sequencer." Provide your basis and justification for sequencing safety loads when preferred (offsite) power is available during the accident.

Provide a comparison on a bus by bus basis for all emergency buses of the voltage and motor starting transients associated with sequenced versus instantaneous loading for the condition of grid voltage at the low end of its normal range and maximum plant auxiliary load. In addition, address the loss of one startup transformer and the capability to fast transfer to the other startup transformer during this transient.

Provide a description of what would be required to remove this non-standard design feature from your design and the associated safety implications, if any.

<u>Response</u>:

Justification of sequencing the LOCA loads with offsite power available is that the simultaneous starting of these loads will depress the voltage at motor terminals below 75% on 480 volt loadcenters and MCC's. This is below the minimum to start and accelerate the motors. This conclusion is based on the attached calculations of voltage drop on starting all safety loads simultaneously.

We have investigated the use of this sequencing feature with fifteen other applicants, representing forty PWR's which are either under construction or have begun commercial operation within the last several years. Of these, twelve applicants, representing twenty-five units, sequence with offsite power available, either through the use of a sequencer or with individual time delay relays, while three applicants, representing fifteen units, do not sequence. This demonstrates that this should not be considered a non-standard design feature, but rather a standard alternative way of starting emergency loads with offsite power available.

The PVNGS design does not provide for automatic fast transfer from one start-up transformer source to another. This transfer is performed manually. Should one start-up transformer source be lost the ESF loads of the redundant train will be available to mitigate the consequences of an accident. This is in accordance with GDC 17. Per R.G. 1.93, operation is allowed for 72 hours in this LCO before proceeding to cold shutdown.

The PVNGS ESF transformers are sized to simultaneously handle the loads of both ESF trains. It is, therefore, sized twice as large as required for steady state operation. In addition, the transformer impedance has been specified as 5% to minimize the voltage drop effects.

The sequencer for PVNGS utilizes solid state logic with self-test features to enhance the reliability of sequencer operation.

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UNITS 4 AND 5

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REQUEST FOR ADDITIONAL INFORMATION

Power Systems

Question 5

Provide physical layout drawings of the circuits that connect the Units 1, 2 & 3 switchyard to the Units 4 and 5 switchyard and the onsite distribution system to the preferred power supply. In addition, provide assurance that physical separation of overhead bus extension lines that connect the Units 4 and 5 switchyard to the Units 1, 2 and 3 switchyard is sufficient so as to minimize the likelihood of simultaneous failure of both lines.

Response:

The overhead bus extension lines that connect the Units 4 and 5 switchyard to the Units 1, 2 and 3 switchyard will maintain the same 570 foot centerline to centerline spacing as the switchyard busses to which they connect. They will pull straight off the busses and will not exceed the phase spacing and tower height of the plant to switchyard 500kv line segments, which are 46 feet and 127 feet, respectively.

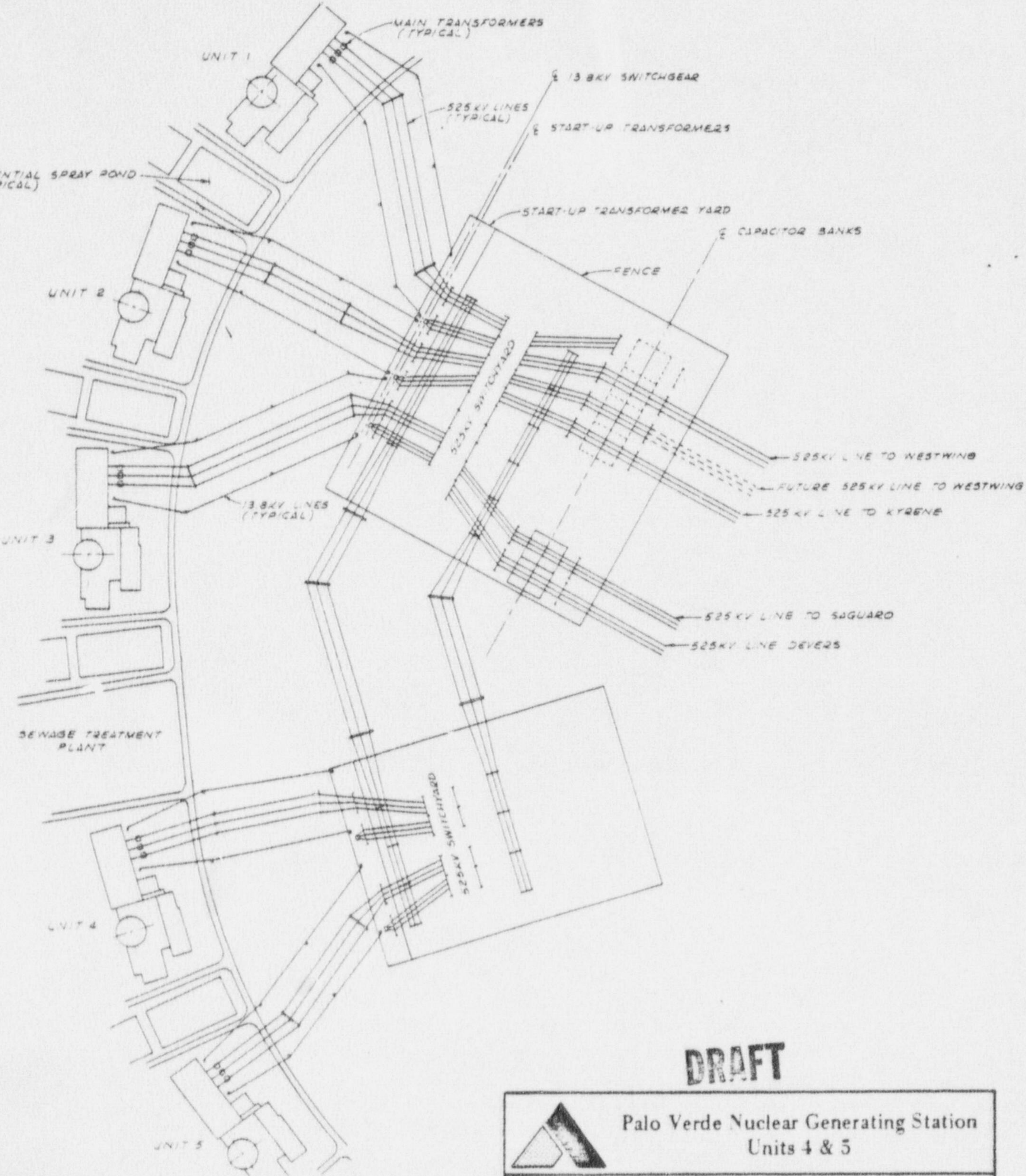
If one line were to physically fail, with a tower falling directly toward the other line, there would still be 351 feet of clearance (minimum) between the top of the tower and the nearest phase of

the second line.

In addition, due to their location, immediately adjacent to the switchyards on the plant site, these lines are subject only to the sam occurences which could be postulated for the switchyards, the risks of which have already been judged to be acceptable by the NRC on Units 1, 2 and 3.

This, therefore, provides assurance that the physical separation of these bus extension lines is sufficient to minimize the likelihood of their simultaneous failure.

Revised PVNGS-425 PSAR Figure 8.2-5, attached, depicts the layout of the offsite to onsite power system connections.



DRAFT

Palo Verde Nuclear Generating Station
Units 4 & 5

525 KV SWITCHYARDS AND TRANSMISSION LINES

Figure 8.2-5

PALO VERDE NUCLEAR GENERATING STATION

UNITS 4 AND 5

DOCKET NOS. STN 50-592 AND STN 50-593

REQUEST FOR ADDITIONAL INFORMATION

Power Systems

Question 6

Your response to qualification review item A4b regarding capacity of the startup tranformers is not clear. We require that each startup transformer that is shared between the two units must have sufficient capacity to supply all accident loads in one unit and normal shutdown loads in the other unit plus margin. Provide a discussion of your design criteria of sizing the startup transformers and demonstrate how your design meets our position.

Response:

The PVNGS start-up loads are estimated to be approximately 91 MVA and the accident loads per unit (2 redundant trains) to be approximately 11 MVA. The total of start-up load and accident loads is approximately 102 MVA. With the start-up transformer size of 140 MVA there will be more than 38 MVA of margin.

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REQUEST FOR ADDITIONAL INFORMATION

Structural Engineering

Question 1

Clarify whether or not both the lumped parameter and the finite element methods are to be used for the dynamic responses of all Category 1 structures. Explain how these two methods are to be used in the design. If both are used, is a comparison of dynamic responses available?

Response:

Refer to PVNGS 4 and 5 PSAR Section 3.7.1.6 and PVNGS 1, 2 and 3 PSAR Section 3.7.1.6 for a discussion of the calculational methods. Refer to PVNGS SER Section 3.7.2 for NRC acceptance of these methods. Response spectra are calculated using both the lumped parameter and finite element methods for all Seismic Category I buildings. In each case a higher response spectrum is calculated using the lumped parameter method. Structures are designed using the lumped parameter method.

Under the replication policy the design of PVNGS 4 and 5 safety related structures will be identical to that of PVNGS 1, 2 and 3. As no reference was made to this matter in either the Palo

Verde Qualification Review Letter, dated December 12, 1977 or the "final listing of the issues originally addressed in Category E of the qualification review letter," dated October 12, 1978, the design of safety related structures for PVNGS 1, 2 and 3 is considered acceptable for replication by PVNGS 4 and 5.

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REQUEST FOR ADDITIONAL INFORMATION

Structural Engineering

Question 2

Clarify whether or not one complete set of seismic instrumentation is to be installed for Palo Verde Units 4 and 5. Explain how the peak strain gages provide the required information as opposed to the accelerograph recommended by Regulatory Guide 1.18.

Response:

Only one set of seismic instrumentation will be installed for all the five units since the same seismic response is expected at all the units based on the seismic analysis used in the seismic design of the plant. This is in conformance with ANSI Standard N18.5, Section 4.4.

Peak strain gages are not being implemented in the PVNGS seismic instrumentation design. The requirements of Regulatory Guide 1.12 are being met by using strong motion accelerometers.

Section 3.7.4 of the PVNGS 1, 2 and 3 PSAR, as referenced by the PVNGS 4 and 5 PSAR, will be revised in a future amendment to clarify the use of strong motion accelerometers in lieu of peak strain gages.

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REQUEST FOR ADDITIONAL INFORMATION

Structural Engineering

Question 3

Section 3.8.1.2.2: Indicate the reason for deleting ASME code date. State what year ASME code the relevant components have been designed and constructed.

Response:

The ASME code date was deleted from the PVNGS 1, 2 and 3 PSAR Section 3.8.1.2.2 because ASME Section III Division I is not applicable to containment design except for the access hatch and locks. The ASME Section III Division I code date for the access hatch and locks is the 1974 edition, Winter 1974 Addenda.

PALO VERDE NUCLEAR GENERATING STATION

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Structural Engineering

Question 4

Section 3.8.1.6.1, 3.8.3.6.1 and 3.8.4.5: The concrete strength age requirement was deleted. The age corresponding to the value of f'c should be specified. Furthermore, clarify whether fly ash is used and the amount used.

Response:

The concrete strength age requirement varies with the mix design. The following table indicates the age at which the required strengths are developed. Fly ash is not used. Calcined natural pozzolon is utilized in mixes containing approximately 15% replacement of portland cement with pozzolan, by weight.

f'c		Age
[illegible]0 psi	without pozzolan	28 days
4000 "	with "	91 days
5000 "	without "	28 days
5000 "	with "	91 days
6000 "	with "	91 days

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Structural Engineering

Question 5

Section 3.8.1.6.6.1: This section indicates that the minimum curing period will be 7 days or the time necessary to attain 70% of the specified design strength, whichever is less. Indicate how the 70% of f'c is verified.

Response:

The 70% of f'c is verified by strength tests on test cylinders. Strength tests are accomplished in accordance with ASTM C39, Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens.

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Structural Engineering

Question 6

Section 3.8.3.6.1: Clarify what is meant by the statement "The containment internal concrete structure has a design compressive strength of 5000 psi or greater, as determined by design analysis.

Response:

The results of the design analysis determined the concrete design strengths required for containment internal concrete structure. The actual strength attained is verified by strength tests on test cylinders.

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Structural Engineering

Question 7

Section 3.8.1.6.1, Item 2a, Page 3.8-63A: Indicate the method of transporting the concrete and the time elapsed between the discharge of the batch plant stationary mixer and the placement of the concrete into the forms. Clarify why correlation tests need not be performed between the mixing point and the placement point.

Response:

Concrete is transported from the batch plant to the placement area by truck mixer where it is discharged to a belt conveyor or concrete pump. The elapsed time between the discharge of the batch plant stationary mixer and the placement of the concrete into the forms is a maximum of 45 minutes. Correlation tests are performed as indicated in items 2d and 2c of PVNGS 1, 2 & 3 PSAR Section 3.8.1.6.6.1.H (Page 3.8-68B).

PALO VERDE NUCLEAR GENERATING STATION

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Materials Engineering

Question 1

Your response to Regulatory Guide 1.99 in Appendix 3J stated that: "This guide is not applicable to the balance of plant design. We will review the response to this guide when it is addressed in CESSAR, however you should be aware that heat-up and cool-down curves and technical specifications applicable to Palo Verde must utilize the recommendation of Regulatory Guide 1.99.

Response:

Palo Verde will use the heat-up and cool-down curves and technical specifications resolved between the NRC staff and APS in the FSAR.