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RECIP.NAME RECIPIENT AFFILIATION
TEDESCO,R.L. Assistant Director for Licensing

SUBJECT: Forwards marked-up responses to NRC 810710 request for addl info re auxiliary sys.Responses were previously provided to Auxiliary Sys Branch at 810805 working meeting in Phoenix, AZ.Addl respones will be forwarded as listed.

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ARIZONA NUCLEAR POWER PROJECT
Post Office Box 21666 Phoenix, Arizona 85036

August 25, 1981
ANPP-18742 - JMA/KEJ

Mr. R. L. Tedesco
Assistant Director for Licensing
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2 and 3
Docket Nos. STN-50-528/529/530
File: 81-056-026

Reference: Letter, R. L. Tedesco, NRC, to E. E. Van Brunt, Jr., Dated July 10, 1981, Subject: Auxiliary Systems - Request for Additional Information

Dear Mr. Tedesco:

Attached please find a marked-up copy of the responses to the questions in the referenced letter. These responses were previously provided to the ASB at the Working Meeting held on August 5, 1981, in Phoenix, Arizona. Additional information on the following items will be forwarded as shown:

ITEM	DESCRIPTION OF INFO. TO BE SENT	DATE TO BE FORWARDED
410.4	P-T analysis of the CVCS let-down and auxiliary steam lines in the Auxiliary Building	Dec., 1981
410.5	Same as 410.4	Dec., 1981
410.20	Means for assuring a proper operating environment for the ESP Pumps	Future Amendment Package
410.26	Verification that water leaving the Turbine Building due to a circulating water system failure will not affect any safety related building.	Aug. 31, 1981

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If you have any questions, please contact me.

Very truly yours,

E. E. Van Brunt, Jr.
APS Vice President,
Nuclear Project
ANPP Project Director

EEVBJr/KEJ/pc

Attachments

cc: J. Kerrigan (w/a)
O. Parr "
P. Hourihan "
A. C. Gehr "

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, Edwin E. Van Brunt, Jr., represent that I am Vice President Nuclear Projects of Arizona Public Service Company, that the foregoing document has been signed by me on behalf of Arizona Public Service Company with full authority so to do, that I have read such document and know its contents, and that to the best of my knowledge and belief, the statements made therein are true.

Edwin E. Van Brunt
Edwin E. Van Brunt, Jr.

Sworn to before me this 26th day of AUGUST, 1981.

Connie Lou Armstrong
Notary Public

My Commission expires:
June 24, 1983

INCREMENTAL

AUXILIARY SYSTEMS BRANCH
REQUEST FOR ADDITIONAL INFORMATION
PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2 & 3
DOCKET NOS. 50-528/529/530

QUESTION 3A.27 (NRC QUESTION 410.1) (3.5.1.2)

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410.1 (3.5.1.2) Your evaluation of potential missile sources inside containment is not complete. The following concerns should be addressed.

a) Verify that secondary missiles, if any, generated by impact of the primary missiles identified in FSAR Table 3.5-4 inside containment will not cause damage to essential systems required to assure a safe shutdown or result in unacceptable release of radioactivity.

b) Verify that a seismic event will not result in gravity missiles within the containment which could cause damage to essential systems required to assure a safe shutdown or result in unacceptable releases of radioactivity.

Response

INSERT (A)

a) Reviews conducted regarding the effects of primary missiles concluded that there are no credible secondary missiles.

b) As noted in FSAR Section 3.6.1.2, separation reviews were conducted to ensure that non-seismically supported equipment could not impair the function of essential equipment or structures. Thus, safe shutdown systems and radioctivity release barriers will not be damaged.

INSERT A TO QUESTION 3A.27

THE EFFECTS OF SECONDARY MISSILES WERE EVALUATED DURING SEPARATION REVIEWS OF THE PUNGS SCALE MODEL. THE EFFECTS FELL INTO ONE OF THREE CATEGORIES:

(1) NO SECONDARY MISSILE, OR

(2) SECONDARY MISSILE WITH INSUFFICIENT ENERGY TO CAUSE DAMAGE, OR

(3) SECONDARY MISSILE BUT WITHOUT SAFETY IMPACT.

QUESTION 3A.28 (NRC QUESTION 410.2) (3.5.2)

410.2 (3.5.2) In FSAR Figures 3.5-4 thru 3.5-7 you have identified those areas housing equipment, systems and components required for safe reactor shutdown as missile targets. However, you have not considered areas housing radioactive fluid such as the radwaste building as missile targets. Verify that equipment, systems and components containing radioactive fluid are protected against tornado missile damage, or assure that failure of unprotected components will not result in an unacceptable release of radioactivity.

Response

As noted in FSAR Sections 15.7.3.3, 15.7.3.4, and 15.7.3.5, failures of liquid and gaseous radwaste components do not cause unacceptable releases of radioactivity; therefore, missile protection is not required. ALSO SEE AMENDED TABLE 3.5-9.

Table 3.5-9

MISSILE BARRIERS FOR TORNADO AND ACCIDENT MISSILES (Sheet 3 of 4)

Protected Systems and Components	Missile Barrier	Concrete Thickness (in.)			Design Concrete Strength (psi)
		Walls	Roof	Floor	
Diesel generator fuel storage tank	Underground (10 feet below grade with DG fuel oil storage tank valve box located above it)	NA	NA	NA	
Diesel fuel transfer pumps and pump motors	Underground in DG fuel oil storage tank valve box		16 (b)		5000
		16			4000
Main steam line isolation valves	Containment structure wall	44			6000
	Main steam support structure		20		5000
		39			4000
Condensate storage tank	Cylindrical walls	21	None	NA	4000
CONDENSATE TRANSFER PUMPS	UNDERGROUND	NA	NA	NA	
Condensate piping	Underground	NA	NA	NA	
Essential spray pond pumps and pump motors	Pond discharge structure	24	24	24	4000

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QUESTION 3A.29 (NRC QUESTION 410.3) (3.5.2) INCREMENTAL

410.3
(3.5.2)

Describe the protection provided for all essential ventilation system air intakes and exhausts against damage due to multiple tornado generated missiles assuming missiles as identified in the tornado missile spectrum for the plant. Verify that safety related equipment and spent fuel is not affected by tornado missile impact to these openings or that openings in structures created by failures due to a tornado will not affect the function of safety related components or cause damage to spent fuel by allowing missile entry.

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Response

Essential ventilation system openings with a potential for tornado generated missiles to enter and damage safety-related equipment are provided with missile PROTECTION, as shown in Table ~~410.3-1~~ 3A-1. This prevents tornado generated missiles from damaging safety-related equipment or spent fuel.

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TABLE 3A-1 ~~410.3-1.~~

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Missile Protection of Essential Ventilation System Air Intakes and Exhausts

Intake/Exhaust Point	Protective Feature
Fuel Building Exhaust	~~Exposed portion of exhaust duct will not crimp upon missile impact.~~ Steel plate prevents missile passage through penetration.
~~Fuel Building Intake~~	~~1) Intake via infiltration - no penetration.~~
~~Containment Hydrogen Control System~~	~~1) Openings are protected by auxiliary building.~~
Main Steam Support Structure	~~1) No essential intakes or exhausts.~~ STEEL PLATE PREVENTS MISSILE PASSAGE THROUGH PENETRATION
Auxiliary Building	
• Hydrogen recombiner cooling air intake	STEEL PLATE IS BEING PROVIDED AS MISSILE SHIELD
• Hydrogen recombiner cooling air exhaust	STEEL PLATE IS BEING PROVIDED AS MISSILE SHIELD.
~~C) Recirculation area ventilation exhaust~~	~~C.1) Exhaust plenum runs below grade to fuel building.~~
~~D) Recirculation area ventilation intake~~	~~D.1) Intake via infiltration - no penetration.~~
Control Building Intake	Concrete intake plenum DESIGNED AS LABYRINTH
Control Building Exhaust	Steel louvers
~~B) All other~~	~~2) Exhaust via exfiltration~~
Diesel Generator	
• Combustion Air Intake	Offset concrete baffles prevent missile entry.
• Combustion Air Exhaust	Protected by a combination of concrete and guard piping.
• Cooling Air Intake	Offset concrete baffles prevent missile entry.
• Cooling Air Exhaust	Concrete plenum

QUESTION 3A.30 (NRC QUESTION 410.4) (3.6.1)

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410.4 (3.6.1) Your analysis of the consequences of high and moderate energy pipe breaks outside containment is not complete. Provide the following additional information:

a) Verify that the high and moderate energy pipe break analysis outside containment is in accordance with the guidance of Branch Technical Position (BTP) ASB 3-1.

b. Reference is made in FSAR Section 3.6.1.3 to specific safety related system failure modes and effects analyses. However, these tables do not identify the capability of individual systems to mitigate the consequences of pipe breaks assuming a single failure as identified in the criteria of BTP ASB 3-1. Include such a discussion in FSAR Section 3.6.1.3.

c. Provide layout drawings of safety related areas outside containment showing the routing of high and moderate energy piping systems and their relative position to safety related equipment and components. These drawings should identify postulated break and crack locations in high and moderate energy lines. Further, provide a table which identifies the means of protection (i.e., pipe whip restraint, jet impingement barrier, separation, floor drainage, etc.) for safety related equipment from the effects of the postulated high and moderate energy pipe breaks.

d. Expand the discussion in FSAR Section 3.6.1 to identify the design bases for the protection of individual safety related equipment which has been identified in part c) above. For example, the FSAR should describe the design bases for internal flood protection

410.4
(3.6.1)
Cont'd

(expected leakage rate), jet impingement protection (force assumed from the blowdown), worst expected environment (temperature, pressure and humidity), etc. which result from the bounding pipe breaks in the area of the auxiliary feedwater pumps.

Response

A) Extent of compliance with BTP ASB 3-1 (follows format of BTP ASB 3-1)

1. In compliance.

2a. In compliance.

2b(1). In compliance.

2b(2). In compliance.

2c(1). The design of PVNGS fluid system piping in the penetration area either:

(1) Meets the stress limits of BTP MEB 3-1 Sec. B.1.b or B.2.b, or,

(2) Is not essential to shutdown the reactor or mitigate the consequences of the postulated piping failure (at the terminal end) without offsite power.

2c(2). Not applicable to PVNGS

2c(3). Terminal ends of the piping are considered to originate at the penetration sleeve inside and outside containment.

2c(4). In compliance.

2d(1). In compliance.

2d(2). In compliance.

2d(3). Not applicable to PVNGS.

410.4 Cont'd

2d(4). In compliance.

3a. In compliance.

3b(1). In compliance.

3b(2). In compliance.

3b(3). In compliance with the clarification that the criteria have been extended to include high energy (e.g., CVCS charging system) as well as moderate energy systems.

3b(4). In compliance.

3c. In compliance.

3d. PVNGS will comply.

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B) The equipment or systems required to mitigate the effects of various types of breaks are listed in Section 3.6.1.2. The equipment layout and/or design features are such that high or moderate energy breaks will not adversely affect either train of any system required for shutdown or mitigate the consequences of the break. Therefore, the single failure analyses (refer to Section 6.2.1.3) do not require addition of direct high energy or moderate energy effects since these effects are precluded by design.

C) PVNGS utilized a three-dimensional scale model for design and layout of equipment. Orthographic layout drawings showing pipe routings in relationship to safety-related areas are not available. Break locations and protective devices are shown on the model. For areas outside the containment, flooding calculations utilizing the worst case flow from high or moderate energy piping systems provided the basis for sizing the floor drains. Compartmentation as shown in FSAR Fig. 1.2-4 through 1.2-8 was utilized

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410.4 (Cont'd)

to minimize the potential for common safety features to be affected by a single failure. A table identifying means of protection of safety related systems from effects of high and moderate energy pipe breaks is provided as Table ~~12~~ 3A-2 ALSO SEE AMENDED SECTION 3.6.1.2.

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D) The design bases for the protection of individual safety related equipment follows the guidance of BTP ASB 3-1. One of the following methods is utilized (listed in decreasing order of preference):

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- o Separation of fluid piping systems from eseential systems and components, or
- o Enclosure of essential components such that they can withstand effects of postulated piping failure, or
- o Addition of pipe whip restraints and/or jet impingement barriers.

Internal flooding due to moderate energy pipe cracks was considered (on a room-by-room basis) to result from a postulated break of the worst case fluid piping within a room, discharging for one-half hour at normal operating temperature and pressure. Only passive means for allowing water to leave the room (i.e., drains, doorways) were considered to mitigate the break effects during that time interval. The maximum flood levels were then calculated. Safety-related equipment was located so as to be unaffected.

410.4 (Cont'd)

Jet impingement due to high energy line break (HELB) was postulated using the Moody expansion model. Where impingement on safety-related equipment was found, operability was assured by damage assessment analysis (eg. stress analysis of impinged piping systems) or addition of jet impingement restraints/ barriers.

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Environmental concerns due to postulated high and moderate energy breaks were addressed in FSAR Appendix 3E. [P-T analyses of the CVCS letdown and auxiliary steam lines in the auxiliary building may indicate some locally higher temperatures and pressures. Resolution is deferred until completion of these analyses.]

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TABLE 3A-2

Methods of Protection of Safety Related Systems from High and Moderate Energy Line Breaks

SYSTEM	SEPARATION(a)	FLOOR DRAINS & CURBS	JET IMPINGEMENT (JI) BARRIERS/REST.(b)	PIPE WHIP RESTRAINTS(b)	OTHER
Reactor Coolant (incl. PZR spray and surge lines) [RCS]	E	N/A	Yes (SG, SDC)	Yes (SG, SDC)	Plastic analysis on surge line for J I effects.
Steam Generating (incl. main steam & main feed) [SG]	L,E	Yes (in MSSS)	Yes (RCS)	Yes (RCS)	No Break Zone in MSSS (augmented In-Service Inspection)
Safety Injection [SI]	L,E,R	Yes (in Aux. Bldg.)	No	Yes (SDC, RCS)	Plastic Analysis on SI lines for J I effects.
Shutdown Cooling [SDC]	L,E,R	Yes (in Aux. Bldg.)	No	Yes (RCS)	Plastic analysis on SDC lines for J I. effects.
Containment Spray [CS]	E,R	Yes (in Aux. Bldg.)	Yes (SG)	Yes (SG)	
Auxiliary Feed [AF]	L,E,R	Yes (in MSSS)	N/A	N/A	
CVCS (charging) [CH]	R(c)	Yes (in Aux. Bldg.)	No	Yes (CVCS Letdown)	
Nuclear Sampling (incl. Post-Accident Sampling System) [SS]	L,E,R	Yes (in Aux. Bldg.)	No	No	
Radiation Monitors (PAPA's only)	L(d)	Yes (in Aux. Bldg.)	No	No	
Hydrogen Control	L(d)	Yes (in Aux. Bldg.)	No	No	

TABLE 3A-1

Methods of Protection of Safety Related Systems from High and Moderate Energy Line Breaks

SYSTEM	SEPARATION[(a)]	FLOOR DRAINS & CURBS	JET IMPINGEMENT BARRIERS/REST.[(b)]	PIPE WHIP RESTRAINTS[(b)]	OTHER
Ess. Cooling Water [EW]	L,R	Yes (in Aux. Bldg.)	N/A	N/A	
Ess. Chill Water [EC]	L,R	Yes (in Aux. Bldg.)	N/A	N/A	
Ess. Spray Pond [ES]	L,R	Yes (in Aux. Bldg.)	N/A	N/A	
Control Bldg. HVAC	L,E,R	Yes	N/A	N/A	
Fuel Bldg. HVAC	L,E,R	Yes	N/A	N/A	
Diesel Gen. Bldg. HVAC	L,E,R	Yes	N/A	N/A	
Diesel Gen.	L,E,R	Yes	N/A	N/A	
Diesel F.O. and Transfer	L,E,R	Yes	N/A	N/A	
Class IE Electrical Power	L[(e)]	Yes (in Aux. Bldg.)	Yes (SG, CH, SI, SDC)	N/A	
ESFAS (incl. Post-Accident Monitoring)	L [(f)]	Yes (in Aux. Bldg.)	Yes (SG, CH, SI, SDC)	N/A	
Reactor Protective	L,E	N/A	N/A	N/A	
Ex-Core Monitors	L	N/A	N/A	N/A	
Main Control Board	L,E,R	Yes	N/A	N/A	

TABLE # 3A-2

Methods of Protection of Safety Related Systems from High and Moderate Energy Line Breaks

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SYSTEM	SEPARATION[a]	FLOOR DRAINS & CURBS	JET IMPINGEMENT BARRIERS/REST.[b]	PIPE WHIP RESTRAINTS[b]	OTHER
Containment Isolation					
o Penetration Assemblies	L	N/A	N/A	N/A	
o Isolation Valves	L	N/A	N/A	N/A	No Break Zone in MSSS (SG)
o Equipment Hatch	L	N/A	N/A	N/A	
o Emergency Personnel Hatch	L	N/A	N/A	N/A	
o Personnel Lock	L	N/A	N/A	Yes (SI)	
o Liner Plate	L[g]	N/A	Yes (SG)	Yes (SG)	No Break Zone in MSSS (SG)
o [illegible]t Connections	L	N/A	N/A	N/A	
o Piping between Penetration Assy's and Isolation Valves	L	N/A	N/A	N/A	

TABLE ~~1c~~ 3A-2

Methods of Protection of Safety Related Systems
from High and Moderate Energy Line Breaks

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Notes:

(a) Separation from high or moderate energy break effects accomplished by the following methods in decreasing order of preference:

- o Layout (=L)
- o Enclosure (=E)
- o Redundancy (=R)

(b) Protection provided from break effects originating in system listed in parentheses.

(c) CVCS (charging) required for forced shutdown only (MS Line Break and LOCA are mitigated by SI)

(d) Separated from LOCA induced jet impingement or pipe whip effects; not required for any other HELB scenario.

(e) Separation review for electrical conduits and tray is in progress. Jet impingement sources are postulated, but not confirmed.

(f) Separation review of sensing lines is in progress. Jet impingement sources are postulated, but not confirmed.

(g) Separated from LOCA induced jet impingement or pipe whip effects; protected from MSLB whip and impingement effects by restraints or barriers; not required for any other HELB scenario.

3. The ability to place the plant in a safe shutdown condition must be maintained.

INSERT (A) A three-dimensional model was utilized in the layout and design to protect the essential systems, structures, and components. Figures 3.6-2 through 3.6-32 depict the resulting pipe routing. 6

The potential effects of flooding as a consequence of a pipe break or critical crack were analyzed on a case-by-case basis to ensure that the operability of safety-related equipment would not be impaired.

An analysis of the potential effects of missiles is discussed in section 3.5.

The potential environmental effects of steam on essential systems are discussed in section 3.11. In general, because of the protective measures of redundancy and separation between systems and trains, the consequential effect of the transport of steam will not be sufficient to impair the ability of the essential system to shut down the plant and/or mitigate the consequences of the given accident of interest.

There are no high-energy lines in the vicinity of the control room. As such, there are no effects upon the habitability of the control room by pipe break either from pipe whip, jet impingement, or transport of steam. Further discussion on control room habitability systems is provided in section 6.4.

3.6.1.3 Safety Evaluation

By means of design features such as separation, barriers, and pipe whip and jet impingement restraints, all of which are discussed below, the effects of pipe break will not damage essential systems to an extent that would impair their design function nor affect necessary component operability.

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INSERT (A) TO PAGE 3.6-25

PVNGS utilized a three-dimensional scale model for design and layout of equipment. A systematic approach of multidiscipline analyses of safety-related and associated systems was initiated to verify compliance with design criteria, interface requirements, and safety design bases. On-going reviews of the model identified potential hazards and highlighted susceptibility of essential equipment from common mode failure, as well as provided an independent method of verification of the availability of essential equipment required to mitigate the consequences of postulated accident scenarios. The resolution of comments raised during these reviews resulted in changes to equipment layout, ~~development~~ design of pipe whip and jet impingement restraints, upgrading some non-seismic supports to seismic, and the addition of curbs, drains and other flood mitigation measures.

QUESTION 3A.31 (NRC QUESTION 410.5) (3.6.1)

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410.5 (3.6.1)

It is our position that the common compartment which houses the main steam lines and feedwater lines and the isolation valves for these lines (the main steam support structure) be designed to consider the environmental effects (pressure, temperature, humidity) and potential flooding consequences from an assumed crack of one square foot. The essential equipment located within the main steam support structure, including the atmospheric dump valves, main steam isolation valves and feedwater isolation valves and their operators, and the essential auxiliary feedwater pumps and associated equipment should be capable of operating in the environment resulting from the above crack. Further, if this assumed crack could cause the structural failure of this compartment, then the failure should not jeopardize the safe shutdown of the plant.

We, therefore, request that you submit a subcompartment pressure analysis to confirm that the design of the main steam support structure conforms to our position as outlined above. The evaulation should include a verification that the methods used to calculate the pressure buildup in the main steam support structure for the postulated breaks are the same as those used for subcompartments inside the containment. Also, the allowance for structural design margins (pressure) should be the same. If different methods are used, justify that your method provides adequate design margins and identify the margins that are available. When you submit the results of your evaluation, identify the computer codes used, and the assumptions used for mass and energy release rates. The peak pressures and temperatures resulting from the postulated break of a high energy pipe located in the main steam support structure is dependent on the mass and energy flows during the time of the break. Therefore, for each

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410.5 (3.6.1) Cont'd

pipe break or crack analyzed, provide the total blowdown time and the mechanism used to terminate or limit the time of blowdown flow so that the environmental effects will not affect safe shutdown of the facility.

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Also provide a similar analysis for other compartments outside containment in the vicinity of safety related structures, systems and components which house high energy lines such as CVCS charging, letdown and steam generator blowdown.

Response

A pressure-temperature analysis of the main steam support structure (MSSS) was performed as discussed in amended Section 3.6.2.1.2.2. The purpose of establishing design parameters (i.e., pressure, temperature) of the enclosing structure, a double-area break of the main steam line was conservatively assumed [instead of the single area opening required in BTP ASB 3-1 Section B.2.c.(2)]. The results of the analysis indicate a peak temperature of 288^{o}F and a peak pressure of 19.5 psig. A temperature of 300^{o}F (for 15 minutes) and a pressure of 21 psig, were conservatively selected for equipment qualification and structural design. The blowdown terminates at 3 minutes due to the boiling dry of the affected steam generator.

The pressure-temperature effects resulting from cracks in the main feedwater, steam generator blowdown, and steam generator downcomer feed lines are bounded by the results from the main steam line break analysis.

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410.5 (3.6.1) Cont'd

Analyses of breaks in the CVCS letdown and auxiliary steam lines is in the preliminary stages. However, significant separation exists (both vertically and laterally) between safety-related equipment and the routing of these lines.

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QUESTION 5A.14 (NRC QUESTION 410.6) (5.2.5)

410.6 (5.2.5) Provide the following additional information concerning leakage from the reactor coolant pressure boundary:

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a) Provide further detail of how the reactor drain tank (RDT) can be used to detect leakage of primary coolant to the shutdown cooling system as identified in FSAR Section 5.2.5.1.5.

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b) Describe the means of detection of leakage of primary coolant from the CVCS, reactor coolant pump seals and other radioactive fluid sources to normally non-radioactive systems such as the nuclear cooling water system.

c) Verify that the containment radioactive gas and air particulate monitor has a sensitivity for detecting a one gpm RCPB leak in one hour in accordance with the guidelines of Regulatory Guide 1.45.

Response

a) Isolation valves SI-UV651 and SI-UV652 isolate the reactor coolant system from the shutdown cooling system. Should these valves leak, pressure relief valves SI-PSV469 and SI-PSV169 would relieve into the Reactor Drain Tank. This continuous inflow would cause filling of the RDT, which can be monitored in the control room by a level indicator CH-LI-268. Further, high RDT water level is annunciated in the control room by an alarm.

b) Normally non-radioactive systems that may receive leakage from radioactive systems are monitored for radioactivity. These systems include nuclear cooling water, essential cooling water,

410.6
(5.2.5)
Cont'd

steam generator blowdown, and auxiliary steam. Monitor details are provided in FSAR Section 11.5.

c) The containment radioactive gas and air particulate monitor has sensitivities in accordance with Regulatory Guide 1.45. These are 1×10^{-6} μci/CC and 1×10^{-9} μci/CC, respectively. These sensitivities allow detection of a one gpm RCPB leak within one hour, assuming reactor coolant concentrations consistent with ANSI N-237-1976.

QUESTION 9A.41 (NRC QUESTION 410.7) (9.3.1)

410.7 (9.3.1)

Concerning the compressed air system, provide the following additional information:

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a) Describe the means provided to verify that proper instrument air quality will be maintained over the plant life to assure the safety function of the system (i.e., air operated valves will fail in their safe position on loss of instrument air supply). Include the air quality limits which should not be exceeded in order to assure the above safety function.

b) Verify that a single failure of any air operated valve to assume its fail safe position will not prevent the function of a safety-related system or compromise the ability to safely shut down.

Response

a. IN THE PVNGS DESIGN THE INSTRUMENT AIR SYSTEM IS NOT A SAFETY RELATED SYSTEM. HOWEVER, ~~a.~~ ~~Local~~ local annunciation is provided for the following changes in instrument air quality:

(1) High differential pressure across the prefilter

(2) High differential pressure across the dryer

(3) High differential pressure across the afterfilter

(4) Excessive moisture in the processed air

(5) Failure of dryer transfer valves to function

410.7
Cont'd

(6) Loss of control power

Items 2, 4, 5, and 6 have a common trouble alarm in the control room. Items 1 and 3 have separate control room annunciation.

This instrumentation is adequate to ensure that instrument air is maintained at or below minus 40°F dewpoint at 105 psig. The afterfilter removes 97% of particulate matter in excess of 25 microns. These specifications meet air supply requirements for safety related valves. All valves fail in their safe position upon loss of instrument air.

b. As there are two independent, 100% capacity trains of safety related equipment available to perform ESF functions, a single failure in either train will not prevent the function of the other train.

QUESTION 9A.42 (NRC QUESTION 410.8) (9.3.3)

410.8 (9.3.3) You state in FSAR Section 9.3.3.2.1.1.2 that maximum abnormal leakage each ESF sump is estimated to be 50 gal/min. What is the basis for this assumption? It is our position that you verify that adequate protection has been provided for safety related equipment assuming a total pipe rupture for all non-seismic piping system (such as the fire protection system and nuclear cooling water system) and components (such as tanks) located in safety related areas. This protection can not assume credit for non-seismic Category I sump pumps. Your response should include the time required for operator action if necessary to provide protection of essential equipment once indication from the Class IE level switches is given.

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Response

The abnormal leakage of 50 gal/min conservatively bounds the total leakage from all ESF components, such as pumps, valves, etc. The auxiliary building rooms, including the ESF pump rooms on elevation 40, were analyzed for flooding due to rupture of the largest non-safety related piping for a duration of 30 minutes. Flooding was also analyzed based on operation of fire protection systems, such as hoses and sprinklers, for 15 minutes without operator action or without operAtion of the sump pumps. The Auxiliary Building is sized to accept 400,000 gallons of Non-ESF leakage before any leakage would affect ESF components. FOR FLOODING CONSIDERATIONS, ALL NON-SEISMIC PIPING WAS ASSUMED TO HAVE FAILED. THE WATER VOLUME RELEASED WILL NOT EXCEED THE DESIGN 400,000 GALLON CAPACITY.

QUESTION 9A.43 (NRC QUESTION 410.9) (9.3.3)

410.9 (9.3.3) FSAR Figure 9.3-5 shows locked closed manual valves on the drain lines from both essential auxiliary feedwater system (AFS) pump rooms in the main steam support structure. Describe the purpose of the valves and the means provided to prevent loss of function of the essential AFS pumps as a result of internal flooding.

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Response

Figure 9.3-5 will be revised to show valves V073 AND V079 locked open with check valves V203 AND V204 upstream. ~~Valve V078 remains locked closed, with check valve V204 upstream.~~

~~Valve V079 is locked open to allow drainage of steam condensate from the steam turbine Train A auxiliary feedwater pump. Check valve V203 precludes backflow and flooding.~~

QUESTION 9A.44 (NRC QUESTION 410.10) (7.4)

410.10 (9.4) Verify that the CESSAR interfaces for environmental conditions for equipment within the CE scope of supply have been satisfied by the Palo Verde HVAC system designs.

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Response

The CESSAR interfaces have been met by the HVAC System.

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QUESTION 9A.45 (NRC QUESTION 410.11) (9.4) INCREMENTAL

410.11 (9.4)

FSAR Table 9.4-1 identifies the weather conditions within the site area which serve as the design basis for HVAC system sizing based on ASHRAE data to 1972. Verify that weather conditions since 1972 have not resulted in the need to modify HVAC system designs in order to meet the environmental qualification limits for plant areas containing safety related equipment.

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Response

The design basis for HVAC systems used to meet environmental qualification envelope parameters is that the limits be met under outside air conditions of 113°F dry bulb, 76°F wet bulb. Comparison of actual site and Phoenix data since 1972 as shown in FSAR Tables 2.3-8 and 2.3-9 with data obtained prior to 1972 (refer to FSAR Table 2.3-11), indicates that weather conditions have not become more severe.

QUESTION 9A.46 (NRC QUESTION 410.12) (9.4)

410.12 (9.4) Describe the measures provided for detecting and correcting dust accumulation on safety-related equipment in order to assure their availability on demand.

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Response

PVNGS has developed a housekeeping program on equipment throughout the plant. Safety related equipment is included in this program. The program provides for the periodic inspection and cleaning of equipment and will be a part of the preventative maintenance program.

QUESTION 9A.47 (NRC QUESTION 410.13) (9.4)

410.13 (9.4) Describe the affect on the safety function of the essential HVAC systems in the event of a single failure in a fire damper in the ventilation system ducts. It is our position that such a failure not compromise the safety function of the HVAC system.

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Response

A single fire damper failure (actuation) in one ESF ventilation train will render that train inoperable. As another redundant 100% capacity ESF ventilation train is provided, there will be no adverse effect upon the safety function of essential ventilation.

FSAR FIGURES 9.4-1 (SHEET 2 OF 2) AND 9.4-9, WILL BE REVISED TO SHOW REMOVAL OF THE ESSENTIAL FUEL BUILDING EXHAUST FIRE DAMPER.

QUESTION 7A.48 (NRC QUESTION 410.14) (9.4.1)

410.14 (9.4.1) FSAR Section 9.4.1 indicates that emergency ventilation is not provided for the upper and lower cable spreading room. Verify that safe operating conditions for essential equipment are maintained in these rooms during all accident modes (including long term plant cooldown). If this can not be demonstrated, provide a safety grade means of indication of the conditions in these rooms with sufficient time for operator action to provide the necessary temporary cooling, or provide a safety-related emergency cooling system for these rooms.

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Response

Even without ventilation, temperatures in the upper and lower cable spreading rooms will be less than 105°F. Essential equipment in these areas is qualified to this limit.

QUESTION 7A.47 (NRC QUESTION 410.15) (9.4.1)

410.15 (9.4.1)

In the event of indication of radioactive contamination of the normal control room intake, the normal ventilation system is shut off and isolated as the essential control room system is started. However, the control building normal air handling unit or essential ESF switchgear room air handling unit (if operating) would continue to function and circulate potentially contaminated air to other areas of the control building. Describe the measures provided to prevent contamination of vital areas of the control building and still assure a proper environment for operation of essential equipment.

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Response

The vital area in the control building is the control room (elevation 140′). As noted in the question, this is the only area subject to ESF grade charcoal/HEPA filtration. Contamination of this area is prevented by pressurization (using filtered makeup air) to 1/4 inch water gauge.

Dose rates due to noble gases in other areas of the control building will be approximately the same as in the control room, ignoring local shielding effects. Accordingly, access by operators into other areas of the control building will not be unduly restricted by airborne dose provided respiratory and facial protection is used. (WHOLE BODY EXPOSURE TO OPERATORS DUE TO IODINE IS 1.3 REM OVER 30 DAYS)

Equipment qualification design bases considered the radiation dose from airborne activity in the building, as well as direct dose from the outside cloud and adjacent buildings.

Accordingly, a proper environment for operation of essential equipment has been provided.

QUESTION 9A.50 (NRC QUESTION 410.16) (9.4.1)

INCREMENTAL

410.16 (9.4.1) Expand Table 9.4-4, "Single Failure Analysis for the Essential ESF Switchgear, ESF Equipment and Battery Rooms" to include the consequences of failure of any system component. This analysis should verify that a single failure in any safety related damper or total failure of all non-safety related dampers and ducts in the ESF switchgear, ESF equipment and battery rooms HVAC system will not prevent at least one train of the essential ESF switchgear room HVAC system from performing its safety function.

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Response

The response is provided in Amended Table ~~410.16-1.~~ 9.4-4

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Table 9.4-4

ESSENTIAL HVAC SYSTEM SINGLE FAILURE ANALYSIS ESF SWITCHGEAR, ESF EQUIPMENT AND BATTERY ROOMS

Component	Failure Mode/ Cause	Effects on System	Method of Detection	Inherent Compensating Provision
Outside air damper	Fails closed makeup air side/ corrosion	Loss of makeup air to rooms	Position indicating lights in control room	Each of the two redundant ESF equipment and battery rooms is conditioned by separate air conditioning systems
Air handling unit	Fails to operate/ mechanical or electrical failure	Loss of cooling to one ESF train	Low fan differential pressure alarm in control room	Each of the two redundant ESF equipment and battery rooms is conditioned by separate air conditioning systems
Battery room exhaust fan	Fails to operate/ mechanical or electrical failure	Hydrogen level rises in battery room	Low fan differential pressure alarm in control room	Each of the two redundant ESF equipment and battery rooms is conditioned by separate air conditioning systems
ESF switchgear and battery room supply damper	Fails to operate/ mechanical or electrical failure	Loss of cooling to one ESF train or battery room	Position indicating lights in control room	Each of the two redundant ESF equipment and battery rooms is conditioned by separate air conditioning systems
Non-ESF dampers and ducts	Fails to operate/ mechanical or electrical failure	None	Operator patrol	Two independent ESF HVAC systems provided

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QUESTION 9A.51 (NRC QUESTION 410.17) (9.4.1)

INCREMENTAL

410.17 (9.4.1) Describe the measures for assuring a proper operating environment for essential control room and ESF switchgear room air handling units when the normal control building HVAC system is not available in emergency conditions.

Response

Even without ventilation, temperatures in the ESF air handling units rooms will be less than 96°F. Essential equipment in these areas qualified to this limit.

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QUESTION 9A.52 (NRC QUESTION 410.18) (9.4.1)

410.18
(9.4.1)

Verify that the control room HVAC air intake chlorine and radiation monitors are seismic Category I.

INCREMENTAL

Response

Control room HVAC air intake chlorine and radiation monitors are Seismic Category I.

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QUESTION [illegible] (NRC QUESTION [illegible]) (9.4.1)

410.19
9.4.1

The essential fuel building and auxiliary building exhaust units serve only those auxiliary building equipment areas located below elevation 100′-0". The charging pumps, letdown heat exchangers and other CVCS equipment which contain radioactive fluid are located above the 100′-0" elevation. Describe the means provided for detecting potential radioactivity in these rooms under emergency conditions when the normal HVAC system is not available, and isolating them prior to release of unacceptable airborne contamination to the environment.

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Response

There are three methods available to detect potential airborne radioactivity in the upper levels (above elevation 100′-0") of the auxiliary building when normal HVAC is not operable:

- o Noble Gas Monitor 13-J-SQN-RU-9 (see FSAR Section 11.5)
- o Movable Airborne Monitor (particulate, iodine, and noble gas monitoring using self contained pump)
- o Fixed and Portable Area Radiation Monitors.

There is, however, little likelihood that airborne contamination due to leakage from the CVCS could be released at unacceptable levels. The use of the CVCS~~, if highly contaminated,~~ under post accident conditions is not required. Before it could be used, non-1E power or manual actions would have to be available. As two normal HVAC filtration units are provided, on different non-1E buses, it is reasonable to expect that at least one train of filtration could be placed in operation prior to use of the CVCS. Under this alignment, the auxiliary building upper level (13-J-SQN-RU-10), auxiliary building ventilation exhaust inlet

410.19 (9.4.2) Cont'd

(13-J-SQN-RU-8), and plant vent (13-J-SQN-RU-143 and 13-J-SQN-RU-144) radiation monitors can also be used to monitor exhaust concentrations.

INCREMENTAL

Without the HVAC system in operation, there would be no driving force for release and therefore exfiltration rates would be low. If use of the CVCS is required without the availability of HVAC filtration, radiation monitoring will be required to ensure and confirm that unacceptable releases do not occur.

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QUESTION 9A.54 (NRC QUESTION 410.20) (9.4.2)

410.20
(9.4.2)

Describe the means provided for assuring the proper operating environment under normal and emergency conditions for the essential spray pond pumps in order to assure the availability of the ultimate heat sink.

INCREMENTAL

Response

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The design ~~has been~~ WILL BE revised to include ~~an exhaust fan~~ ADEQUATE VENTILATION for each pump room.

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QUESTION 9A.55 (NRC QUESTION 410.21) (9.4.2 AND 9.4.5)

410.21 (9.4.2) (9.4.5) Describe the interaction in the essential fuel building and auxiliary building exhaust air handling units operation when they are being utilized for emergency operation for processing fuel building air and auxiliary building air before release to the environment. Specifically:

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(a) Does continued operation of the normal fuel handling building ventilation system in the event of a safety injection actuation result in potential contamination of the fuel building environment when the essential exhaust unit is processing contaminated auxiliary building air?

(b) Does contaminated fuel building air enter the auxiliary building through the interconnecting tunnel in the event of a fuel handling accident?

Response

(a) No. The systems are separated up to the exhaust plenum.

(b) No. Dampers HFA-M06 and HFB-M06 close on fuel building essential ventilation actuation signal (FBEVAS).

QUESTION 9A.56 (NRC QUESTION 410.22) (9.4.3)

~~410.22~~ (9.4.3) Describe the means provided for isolating the radwaste building ventilation system following a design basis event (such as a SSE) in order to prevent the release of potentially radioactive airborne contaminants through building openings.

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Response

The radwaste building ventilation system will be automatically tripped following loss of offsite power. It can be manually tripped after any other design basis event. As noted in FSAR Section 15.7.3.5, dose consequences from the instantaneous unfiltered release of the contents of one waste gas decay tank will be less than 1% of 10 CFR 100 limits. Accordingly, isolation of Radwaste Building ventilation is not required.

QUESTION 9A.[illegible] (NRC QUESTION [illegible]0.23) (9.4.5)

INCREMENTAL

410.23 (9.4.6) Describe the means provided for assuring the proper operating environment for the spent fuel pool cooling pumps and thereby assure the safety of the spent fuel pool, when the normal fuel building HVAC system is isolated in a fuel handling accident, or not available due to a loss of offsite power.

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Response

Infiltration of air to replace that being exhausted by the essential system will provide adequate cooling. The essential system is available during a fuel handling accident or a loss of offsite power.

QUESTION 9A.58 (NRC QUESTION 410.24) (9.4.6)

INCREMENTAL

410.24 (9.4.6)

Verify that loss of the normal main steam and feedwater penetration HVAC supply and exhaust system in the main steam support structure in an emergency situation will not result in an environment detrimental to essential equipment in the MSSS.

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Response

MSSS does not require forced ventilation to maintain the equipment qualification profile noted in FSAR Section 3E.

QUESTION 10A. (NRC QUESTION 410.25) (10.3)

410.25
410.31

In order to prevent blowdown of more than one steam generator, verify that the main steam isolation valves are designed to stop full main steam flow at the maximum design differential pressure in both directions in the event of a main steam line break in one steam line upstream of an MSIV and corresponding single failure (to close) in an MSIV to the other steam generator.

INCREMENTAL

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Response

The valve is capable ~~to close~~ OF CLOSING WITHIN 5 SECONDS against full main steam flow AND FULL DIFFERENTIAL PRESSURE (1800 PSIG) in either direction.

QUESTION 10A. (NRC QUESTION 4[illegible].26) (10.4.5)

410.26 (10.4.5) The evaluation of potential flooding of essential plant areas as a result of a circulating water system failure indicates that the water level would eventually reach plant grade at which point the water leaves the turbine building. Verify that this water can not enter safety related structures through openings at grade or describe the protection provided for safety related equipment from such an occurrence.

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Response

The analysis is given in FSAR Section 10.4.5.2. Water leaving the turbine building will not enter safety related structures.

QUESTION 10A.24 (NRC QUESTION 410.27) (10.4.7)

410.27 (10.4.7) It is our position that you commit to perform a steam generator/ feedwater water hammer test in accordance with the guidance for preheat type steam generators as identified in NUREG/CR-1606, "An Evaluation of Condensation-Induced Water Hammer in Preheat Steam Generators." The following procedure should be followed:

"Run the plant at approximatey 15% of full power by using feedwater through the downcomer nozzle at the lowest feedwater temperature that the plant Standard Operating Procedure (SOP) allows. Switch the feedwater at that temperature from the downcomer nozzle to the economizer nozzle by following the SOP. Observe and record the transient that follows."

Response

PVNGS agrees to perform a steam generated feedwater water hammer test in accordance with NUREG/CR-1606. PVNGS will perform the test according to a Standard Operating Procedure (SOP). PVNGS will run the plant at approximately 15% of full power by using feedwater through the downcomer nozzle. The feedwater will then be switched from the downcomer nozzle to the economizer nozzle and the following transient will be observed and recorded.

QUESTION 3A.32 (NRC CLARIFICATION 410-1)

INCREMENTAL (3.5.11 AND 3.5.1.2)

~~Clarification concerning~~ internally ~~generated missiles (Section 3.5.11 and 3.5.1.2)~~

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~~1.~~ Section 3.5.1.1.1 states that only normally operating rotating components were considered as missile sources outside containment. But, Table 3.5-1 includes some normally not operating components (i.e., HPSI pumps, LPSI pumps, containment spray pumps). Explain this apparent discrepancy.

Response

The response is given in Amended Table 3.5-1. LPSI pumps are considered part of normally operating equipment (due to its use in shutdown cooling) per the definitions of BTP ASB 3-1.

Table 3.5-1

INTERNALLY GENERATED ROTATING COMPONENT FAILURE

MISSILES OUTSIDE CONTAINMENT (Sheet 1 of 2)

Missile Identification	Source of Missile	Location	Missile Characteristics: Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)	Calculated Maximum Steel Perforation Depth (in.)	Casing Thickness (in.)	Casing Perforation	Missile Residual Velocity After Casing Perforation (ft/s)	Calculated Thickness of Surrounding Material to Prevent: Concrete Spalling (in.)	Steel Perforation (in.)	Remarks
Impeller	Cooling water holdup tank pumps	Auxiliary building El. 40'	93.6	2.8	9.84	0.065	0.5	No	---	--	--	--
Impeller	Chemical drain pumps	Auxiliary building El. 40'	77.8	2.5	6.8	0.045	0.5	No	---	--	--	--
Impeller	Reactor Drain pumps	Auxiliary building El. 40'	79.	4.8	24.	0.055	0.375	No	---	--	--	--
Impeller	Containment spray pumps	Auxiliary building El. 40'	112.	8.	193.3	0.21	0.75	No	---	--	--	--
Impeller	HPSI pumps	Auxiliary building El. 40'	185.	7.3	131.	0.35	2.	No	---	--	--	--
Impeller	LPSI pumps	Auxiliary building El. 40'	112.	8.	193.3	0.21	0.75	No	---	--	--	--
Impeller	Auxiliary steam boiler feedwater pumps	Yard Area El. 100'	77.	4.8	24.	0.053	0.5	No	---	--	--	--
Impeller	Boric acid makeup pumps	Auxiliary building El. 70'	125.2	6.	60.4	0.15	0.43	No	---	--	--	--
Impeller	Reactor makeup water pumps	Auxiliary building El. 70'	125.2	6.	60.4	0.15	0.43	No	---	--	--	--
Impeller	ECWS pumps	Auxiliary building El. 70'	97.5	5.3	115.5	0.186	1.25	No	---	--	--	--
Impeller	Crud pump	Auxiliary building El. 100'	69.8	2.4	5.5	0.035	0.5	No	---	--	--	--
Impeller	Normal chilled water pump	Auxiliary building roof	68.	6.3	74.	0.072	0.56	No	---	--	--	--
Impeller	NCWS pump	Yard area El. 100'	70.1	3.7	26.	0.064	0.5	No	---	--	--	--
Fan blade	HPSI pump room essential ACU fans	Auxiliary building El. 51'-6"	36.1	0.22	0.17	0.016	0.028	No	---	--	--	--

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Table 3.5-1

INTERNALLY GENERATED ROTATING COMPONENT FAILURE MISSILES OUTSIDE CONTAINMENT (Sheet 2 of 2)

Missile Identification	Source of Missile	Location	Missile Characteristics: Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)	Calculated Maximum Steel Perforation Depth (in.)	Casing Thickness (in.)	Casing Perforation	Missile Residual Velocity After Casing Perforation (ft/s)	Calculated Thickness of Surrounding Material to Prevent: Concrete Spalling (in.)	Steel Perforation (in.)	Remarks
Fan blade	Auxiliary feed-water pump room essential ACU fans	MSSS El. 100	36.1	0.22	0.17	0.016	0.028	No	---	--	--	--
Fan blade	LPSI pump room essential ACU fans	Auxiliary building El. 51'-6"	37.6	0.23	0.14	0.014	0.028	No	---	--	--	--
Fan blade	Electrical pene-tration room essential ACU fans	Auxiliary building El. 120	74.2	0.47	0.26	0.026	0.028	No	---	--	--	--
Fan blade	CS pump room essential ACU fans	Auxiliary building El. 51'-6"	90.9	0.52	0.38	0.038	0.028 (inner casing)	Yes	55.8	0.42	0.02	Outer casing is 0.0359 in. thick - no penetration
Fan blade	ECW pump room essential ACU fans	Auxiliary building El. 70'	90.9	0.52	0.38	0.038	0.028 (inner casing)	Yes	55.8	0.42	0.02	Outer casing is 0.0359 in. thick - no penetration
Fan blade	Control building ESF SWGR room essential AHU fans	Control building El. 74	59.7	0.2	0.17	0.033	0.028 (inner casing)	Yes	28.4	0.43	0.013	Outer casing is 0.0359 in. thick - no penetration
Fan blade	Diesel generator building control room essential AHU fans	Diesel generator building El. 113'-5"	104.5	0.72	1.03	0.065	0.031 (inner casing)	Yes	85.4	1.1	0.05	
							0.0478 (outer casing)	Yes	18.7	0.0	0.0065	Surrounding steel is thicker than 0.0065 in. - no penetration
Fan blade	Containment refueling purge normal AHU fan	Auxiliary building roof	293.2	1.4	1.93	0.2	0.5625	No	---	--	--	--
Fan blade	Containment pre-access normal AHU fan	Auxiliary building roof	60.	0.6	0.97	0.035	0.0478	No	---	--	--	--
Fan blade	Auxiliary build-ing normal AHU fan	Auxiliary building roof	163.9	1.34	2.9	0.127	0.0598	Yes	134.5	0.92	0.096	Missile cannot hit other equipment
Fan blade	Access control area normal AHU fan	Auxiliary building roof	137.	1.66	3.6	0.093	0.0598	Yes	95.9	0.5	0.058	Missile cannot hit other equipment

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QUESTION 3A.33 (NRC CLARIFICATION 410-2) (3.5)

~~2.~~ Tables 3.5-2 and 3.5-4 identify missile sources from pressurized equipment outside and inside containment respectively. For some missiles you indicate the steel target thickness and for others you do not (an N/A appears in the column). But, in all cases, a maximum steel perforation depth is indicted. For those missiles with no steel target mentioned, what is the protection for safety related equipment from these missiles?

Response

The response is given in Amended Tables 3.5-2 and 3.5-4.

QUESTION 3A.34 (NRC CLARIFICATION 410-3)

INCREMENTAL (3.5.1.1.2)

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3. Section 3.5.1.1.2 states that missiles were postulated from systems with a design pressure greater than 275 psig. But, Table 3.5-2 includes missile source from THE ECW (essential cooling water system) which operates at a much lower pressure. Explain this apparent discrepancy.

Response

The response is given in Amended Table 3.5-2.

Table 3.5-2
INTERNALLY GENERATED PRESSURIZED COMPONENT FAILURE
MISSILES OUTSIDE CONTAINMENT (Sheet 1 of 4)

Missile Identification	Source of Missile	Location	Missile Characteristics: Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)	Steel Target Thickness (in.) (CONCRETE)	Residual Velocity (ft/s)	Calculated Maximum Steel Perforation Depth[a] (in.) (CONCRETE)	Remarks
Relief valve	Auxiliary condensate receiver	Auxiliary building El. 51'-6"	0.91	1.0	5.0	0.218	---	0.002	No perforation
Water gauge cocks and glass	Auxiliary condensate receiver	Auxiliary building El. 51'-6"	6.52	1.5	8.5	0.125	---	0.002	No perforation
Nitrogen blader fitting	Charging pump discharge accumulators	Auxiliary building El. 100'-0"	287.0	1.05	0.83	0.048	260.1	0.154	HVAC suction duct is perforated; has no effect on safety of operation
Nitrogen blader fitting	Charging pump suction stabilizers	Auxiliary building El. 100'-0"	60.5	1.05	0.83	0.048	---	0.013	No perforation
Instrument noz. with valve (N9)	ECW heat exchangers (2)	Auxiliary building El. 100'-0"	39.8	3.0	18.0	N/A	---	0.029	No perforation
Instrument noz. with valve (N10)	ECW heat exchangers (2)	Auxiliary building El. 100'-0"	38.2	2.5	12.0	0.18	---	0.025	No perforation
Instrument noz. with valve (N11)	ECW heat exchangers (2)	Auxiliary building El. 100'-0"	37.5	2.5	12.0	N/A	---	0.024	No perforation
Instrument noz. with valve (N12)	ECW heat exchangers (2)	Auxiliary building El. 100'0"	40.7	3.0	18.0	N/A	---	0.03	No perforation

a. For concrete, calculated maximum perforation depth is less than 2 inches.

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Table 3.5-2

INTERNALLY GENERATED PRESSURIZED COMPONENT FAILURE

MISSILES OUTSIDE CONTAINMENT (Sheet 2 of 4)

Missile Identification	Source of Missile	Location	Missile Characteristics Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)	(CONCRETE) Steel Target Thickness (in.)	Residual Velocity (ft/s)	Calculated Maximum (CONCRETE) Steel Perforation Depth[(a)] (in.)	Remarks
Shell vent	ECW heat exchanger	Auxiliary building El. 100'-0"	86.1	1.5	0.5	N/A	---	0.015	No perforation
1" S.W. coup.	ECW heat exchanger	Auxiliary building El. 100'-0"	16.5	1.75	9.0	N/A	---	0.010	No perforation
1" Lev. ind. noz. with valve	Equipment drain tank	Auxiliary building El. 40'-0"	21.1	1.33	6.0	N/A	---	0.015	No perforation
Temp. probe	Equipment drain tank	Auxiliary building El. 40'-0"	63.4	1.33	1.0	N/A	---	0.032	No perforation
Vent noz. with valve	ECW surge tank	Auxiliary building El. 120'-0"	5.01	1.75	8.0	N/A	---	0.002	No perforation
Lev. ind. noz. with valve	ECW surge tank	Auxiliary building El. 120'-0"	5.50	3.0	25.0	N/A	---	0.002	No perforation
Press. ind. noz. with valve (G1)	Letdown heat exchanger	Auxiliary building El. 100'-0"	24.8	1.75	10.0	0.218	---	0.018	No perforation
Press. ind. noz. with valve (G2)	Letdown heat exchanger	Auxiliary building El. 100'-0"	23.9	1.75	10.0	~~N/A~~ (18)	---	~~0.017~~ (<2)	No perforation
Temp. ind. nozzle (H1)	Letdown heat exchanger	Auxiliary building El. 100'-0"	79.9	1.75	1.0	~~N/A~~ (18)	---	~~0.010~~ (<2)	No perforation
Temp. ind. nozzle	Letdown heat exchanger	Auxiliary building El. 100'-0"	244.8	1.75	1.0	~~N/A~~ (18)	---	~~0.010~~ (<2)	No perforation

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Table 3.5-2

INTERNALLY GENERATED PRESSURIZED COMPONENT FAILURE MISSILES OUTSIDE CONTAINMENT (Sheet 3 of 4)

Missile Identification	Source of Missile	Location	Missile Characteristics: Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)	(CONCRETE) Steel Target Thickness (in.)	Residual Velocity (ft/s)	Calculated Maximum Steel (CONCRETE) Perforation Depth(a) (in.)	Remarks
0.50" Lev. ind. noz. with valve	Radwaste crud tank	Auxiliary building El. 100'-0"	10.12	0.84	6.33	~~N/A~~ (24)	---	~~0.008~~ (<2)	No perforation
Press. conn. with valve	Seal injection heat exchanger	Auxiliary building El. 100'-0"	20.6	0.75	6.0	N/A	---	0.003	No perforation
Shell side drain	Seal injection heat exchanger	Auxiliary building El. 100'-0"	16.5	0.75	0.23	N/A	---	0.003	No perforation
Tube side drain	Seal injection heat exchanger	Auxiliary building El. 100'-0"	27.5	0.75	0.61	~~N/A~~ (24)	---	~~0.007~~ (<2)	No perforation
Instrument noz. with valve (1) TUBE SIDE	Shutdown cooling heat exchanger	Auxiliary building El. 70'-0"	26.1	1.75	9.0	~~N/A~~ (24)	---	~~0.019~~ (<2)	No perforation
Instrument noz. with valve (2) TUBE SIDE	Shutdown cooling heat exchanger	Auxiliary building El. 70'-0"	26.7	1.75	9.0	~~N/A~~ (24)	---	~~0.019~~ (<2)	No perforation
Instrument noz. with valve (3)	Shutdown cooling heat exchanger	Auxiliary building El. 70'-0"	26.8	1.75	9.0	N/A	---	0.018	No perforation
Instrument noz. with valve (4)	Shutdown cooling heat exchanger	Auxiliary building El. 70'-0"	23.8	1.75	9.0	N/A	---	0.016	No perforation
1" Lev. ind. noz. with valve (6 & 7)	Spray chemical storage tank	Auxiliary building El. 120'-0"	31.6	1.75	18.45	N/A	---	0.037	No perforation
1" Lev. ind. noz. with valve (8 & 9)	Spray chemical storage tank	Auxiliary building El. 120'-0"	33.7	1.75	18.45	N/A	---	0.040	No perforation

Table 3.5-2

INTERNALLY GENERATED PRESSURIZED COMPONENT FAILURE MISSILES OUTSIDE CONTAINMENT (Sheet 4 of 4)

Missile Identification	Source of Missile	Location	Missile Characteristics			Steel Target Thickness (in.)	Residual Velocity (ft/s)	Calculated Maximum Steel Perforation Depth[(a)] (in.)	Remarks
			Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)				
Upper lev. ind. noz. with valve	Volume control tank	Auxiliary building El. 120'-0"	20.5	1.33	6.0	N/A	---	0.013	No perforation
Lower lev. ind. noz. with valve	Volume control tank	Auxiliary building El. 120'-0"	20.5	1.33	6.0	N/A	---	0.013	No perforation
Temperature probe	Volume control tank	Auxiliary building El. 120'-0"	90.5	1.75	0.7	N/A	---	0.016	No perforation

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QUESTION 3A.35 (NRC CLARIFICATION 4/10-4) (3.5.1.2)

Palo Verde FSAR Section 3.5.1.2 does not indicate that protection against missile sources inside containment identified in Section 3.5.1.2 of CESSAR is provided as indicated as an interface in CESSAR. Is this being met at Palo Verde? It is our position that Palo Verde comply with the CESSAR interface and provide the necessary missile protection.

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Response

The response is given in Amended Section 3.5.1.2 and Table 3.5-4.

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3.5.1.2 Internally Generated Missiles (Inside Containment)

There are two general sources of postulated missiles inside the containment:

- Rotating component failure
- Pressurized component failure

A tabulation of safety-related structures, systems, and components outside the containment, their locations, seismic categories, quality group classifications, and the applicable FSAR sections, which include system piping and instrumentation drawings describing safety design features, is given in table 3.2-1. General arrangement and section detail drawings are located in section 1.2.

Also refer to CESSAR Section 3.5.1.2 for components within C-E scope. 6

3.5.1.2.1 Rotating Component Failure Missiles

A tabulation of missiles generated by postulated failures of rotating components, their sources and characteristics, and provided missile protection, is given in table 3.5-3.

Missile selection was based on the following conditions:

A. Rotating components that are operated during normal operating plant conditions are capable of becoming missiles

B. The energy in a rotating part associated with 120% overspeed is assumed to be sufficient for component failures

C. Determination of whether the energy of the missile is sufficient to perforate the protective housing

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3.5.1.2.2 Pressurized Component Failure Missiles

A. Reactor Coolant System Pressure Boundary (RCPB)

The selection of potential missiles is based on the application of single-failure criteria to the normal retention features of plant equipment for which there is a source of energy capable of creating a missile in the event of the postulated removal of the normal retention features. Where redundancy is provided by the normal retention features, such that sufficient retention capability remains to prevent creation of a missile in the event of a postulated failure of a single retention feature, no potential missile is postulated. Table 3.5-4 presents the potential missiles postulated to originate from RCPB equipment, ~~and~~ summarizes their characteristics, AND LISTS PROVIDED ~~The provided~~ missile protection ~~is presented in table 3.5-4.~~ (INCLUDING MISSILES FROM EQUIPMENT WITHIN THE C-E SCOPE OF SUPPLY). | 6

B. Non-RCPB Systems

A tabulation of missiles generated from failures of pressurized components, their sources and characteristics, and provided missile protection, is given in table 3.5-4. The bases for selection are identical to those described in section 3.5.1.1.2.

3.5.1.3 Turbine Missiles

3.5.1.3.1 Turbine Placement and Orientation

The placement and orientation of the turbine generators is shown in figure 3.5-1.

3.5.1.3.2 Missile Identification and Characteristics

Analysis has indicated that high-pressure turbine missiles and generator missiles would be retained by their respective

Table 3.5-4

INTERNALLY GENERATED PRESSURIZED COMPONENT FAILURE

MISSILES INSIDE CONTAINMENT (Sheet 1 of ~~2~~ 3)

Missile Identification	Source of Missile	Location	Missile Characteristics: Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)	(Concrete) Steel Target Thickness (in.)	Residual Velocity (ft/s)	Calculated Maximum (Concrete) Steel Perforation Depth (a) (in.)	Remarks
1" temp. ind. nozzle	Pressurizer	Containment building El. 110'-0"	179.2	1.25	2.78	~~N/A~~ 2.0	---	0.148	No perforation
0.75" instrument nozzle (2 each)	Pressurizer	Containment building El. ~~110'-0"~~ 145'	187.5	1.08	1.72	~~N/A~~ (24)	---	~~0.136~~ (<2)	No perforation
0.75" Instrument nozzle (2 each)	Pressurizer	Containment building El. ~~110'-0"~~ 145'	197.7	1.05	1.96	~~0.23~~ (24)	---	~~0.159~~ (<2)	No perforation
0.75" instrument nozzle (2 each)	Pressurizer	Containment building El. 110'-0"	197.0	1.05	1.96	~~0.23~~ (24)	---	~~0.158~~ (<2)	No perforation
1" lev. ind. noz. with valve	Reactor drain tank	Containment building El. 85'-0"	5.29	1.33	6.0	N/A	---	0.002	No perforation
Temperature probe	Reactor drain tank	Containment building El. 85'-0"	13.0	1.33	1.0	N/A	---	0.002	No perforation
Vent noz. with valves	Regenerative heat exchanger	Containment building El. 119'-9-11/16"	38.9	1.05	15.0	~~N/A~~ (24)	---	~~0.10~~ (<2)	No perforation
0.75" primary instrument noz. (4 each)	Steam generator	Containment building El. 101'-4"	200.6	1.05	1.47	~~0.750~~ (48)	---	~~0.134~~ (<2)	No perforation
0.75' lev. ind. noz. (L1, L2, L3, L4)	Steam generator	Containment building El. ~~101'-4"~~ 120'	153.4	1.05	1.23	~~N/A~~ (48)	---	~~0.003~~ (<2)	No perforation

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a. FOR CONCRETE, CALCULATED MAXIMUM PERFORATION DEPTH IS LESS THAN 2 INCHES

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SAFETY VALVE FLANGE BOLT	PRESSURIZER	CONTAINMENT BUILDING EL. 153'	16.2	1.25	3.7	(24)	---	(<2)	NO PERFORATION
MANWAY STUD AND NUT	PRESSURIZER	CONTAINMENT BUILDING EL. 149'	32.8	1.25	4.25	(24)	---	(<2)	NO PERFORATION

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Table 3.5-4

INTERNALLY GENERATED PRESSURIZED COMPONENT FAILURE

MISSILES INSIDE CONTAINMENT (Sheet 2 of ~~2~~ 3)

Missile Identification	Source of Missile	Location	Missile Characteristics Velocity (ft/s)	Eq. Dia. (in.)	Weight (lbs)	~~Steel~~ (CONCRETE) Target Thickness (in.)	Residual Velocity (ft/s)	Calculated Maximum ~~Steel~~ (CONCRETE) Perforation Depth (2) (in.)	Remarks
0.75" lev. ind. noz. (L5, (L6, L7, L8)	Steam generator	Containment building El. ~~101'-4"~~ 140'	152.6	1.05	1.23	~~N/A~~ (48)	---	~~0.082~~ (<2)	No perforation
0.75" lev. ind. noz. (L9, L10, L11, L12)	Steam generator	Containment building El. ~~101'-4"~~ 153'	177.3	1.05	1.23	~~N/A~~ (48)	---	~~0.10~~ (<2)	No perforation
0.75" Press. test noz. ~~(P1)~~ (2 each)	Steam generator	Containment building El. ~~101'-4"~~ 163'	178.7	1.05	1.23	~~N/A~~ 0.25	---	0.10	No perforation
~~0.75" press. test noz. (P2)~~	~~Steam generator~~	~~Containment building El. 101'-4"~~	~~179.4~~	~~1.05~~	~~1.23~~	~~N/A~~ (48)	~~---~~	~~0.10~~ (<2)	~~No perforation~~
CLOSURE HEAD NUT	REACTOR VESSEL	CONTAINMENT BUILDING, EL. 114'	33.1	10.125	100	(30)	---	(<2)	NO PERFORATION
CLOSURE HEAD NUT AND STUD	REACTOR VESSEL	CONTAINMENT BUILDING, EL. 114'	24.2	6.75	577	(30)	---	(<2)	NO PERFORATION
CONTROL ROD DRIVE ASSEMBLY	REACTOR VESSEL	CONTAINMENT BUILDING EL. 120'	58.1	10.0	1100	(30)	---	(<2)	NO PERFORATION
TEMPERATURE NOZZLE W/ RTD ASSEMBLY	REACTOR COOLANT PUMP	CONTAINMENT BUILDING EL. 107'	93.9	2.75	8	(48)	---	(<2)	NO PERFORATION
SURGE AND SPRAY PIPING THERMAL WELLS WITH RTD ASSEMBLY	REACTOR COOLANT PIPING	CONTAINMENT BUILDING EL. 123'	69.0	2.75	3.75	(24)	---	(<2)	NO PERFORATION

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				Eq. DIA. (IN)	WEIGHT (LBS)				
PRIMARY MANWAY STUD AND NUT	STEAM GENERATOR	CONTAINMENT BUILDING EL 104'	32.8	1.5	4.25	(48)	---	(<2)	NO PERFORATION
SECONDARY HANDHOLD STUD AND NUT	STEAM GENERATOR	CONTAINMENT BUILDING EL. 110'-5"	19.8	0.75	1.15	(48)	---	(< 2)	NO PERFORATION
SECONDARY MANWAY STUD	STEAM GENERATOR	CONTAINMENT BUILDING EL. 153'-10"	11.6	1.25	3.36	(48)	---	(<2)	NO PERFORATION

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TABLE 3.5-4

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				Eq DIA (IN)	WEIGHT (LBS)				
REACTOR ~~MAIN~~ COOLANT PUMP THERMAL WELL WITH RTD ASSEMBLY	REACTOR COOLANT PIPING	CONTAINMENT BUILDING EL. 104'	93.9	2.75	8	(48)	. . . .	(22)	NO PERFORATION
SHUTDOWN COOLING VALVE STEM	REACTOR COOLANT PIPING	CONTAINMENT BUILDING EL. 88'	50.3	2.5	85	0.75	. . .	0.35	NO PERFORATION

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