Washington Public Power Supply System
Box 1223 Elma, Washington 98541 (206) 482-4428

Docket No. 50-508

September 2, 1983
G03-83-711

Director of Nuclear Reactor Regulation
ATTN: Mr. G. W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: NUCLEAR PROJECT 3
RESPONSES TO NRC SAFETY
EVALUATION QUESTIONS

Reference:
a) Letter, T. M. Novak to R. L. Ferguson, dated April 12, 1983
b) Letter, T. M. Novak to R. L. Ferguson, dated May 3, 1983
c) Letter, T. M. Novak to R. L. Ferguson, dated May 11, 1983
d) Letter, G. W. Knighton to R. L. Ferguson, dated June 1, 1983
e) Letter #G03-83-451, G. D. Bouchey to H. R. Denton, dated June 3, 1983
f) Letter #G03-83-544, G. C. Sorensen to H. R. Denton, dated July 12, 1983
g) Letter #G03-83-561, G. C. Sorenson to G. w. Knighton, dated July 15, 1983

The above referenced letters (a through d) transmitted to the Supply System requests for additional information pertaining to the NRC Safety Evaluation of the WNP-3 Operating License Application. The Supply System responded on July 15, 1983 (Reference g) with responses to 115 of these questions and a schedule for further submittals.

Several of these questions addressed items which were still being evaluated by the Supply System. For those cases where our evaluation was not complete, the Supply System herewith augments it's submittal with further information.

Please note that in responding to certain of these questions, it has been necessary to generate full size drawings. Since as a practical matter it is quite difficult to include a copy of each drawing for each copy of this letter, the NRC Licensing Project Manager will receive three copies of each for distribution.

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RESPONSES TO NRC SAFETY EVALUATION QUESTIONS

As noted in Reference g, due to the recent implementation of a construction delay at WNP-3 by the Supply System [References e) & f)], it will not be possible to respond to 100% of the NRC's requests for information by the requested date. However, a majority of the questions have been responded to and in some cases, all of the questions generated by a particular NRC branch have been responded to and been completed. The Supply System will continue work on a reduced level to respond to the remainder of NRC's requests for additional information related to WNP-3.

This situation has been discussed with the NRC Licensing Project Manager for WNP-3. As indicated in References e) & f), when financing is available, all construction and licensing activities at WNP-3 will be resumed.

If you require additional information or clarification, the Supply System Point of Contact for this matter is Mr. K. W. Cook, Licensing Project Manager (206/482-4423 ex. 5436).

Sincerely,

KW Cook for

G. C. Sorensen, Manager
Nuclear Safety and Regulatory Programs

AJM/sa

Attachments:

cc: D. J. Chin - Ebasco NYO
N. S. Reynolds - D & L
J. A. Adams - NESCO
D. Smithpeter - BPA
A. Vietti - NRC
A. A. Tuzes - CE
Ebasco - Elma
WNP-3 Files - Richland

STRUCTURAL ENGINEERING BRANCH

220.10 - Complete *
220.11 - Complete *
220.12 - Complete *
220.13 - Not Scheduled
220.14 - Complete *
220.15 - Not Scheduled
220.16 - Not Scheduled
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220.35 - Complete *
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220.38 - Complete *

GEOSCIENCES BRANCH

230.1 - Not Scheduled
230.2 - Not Scheduled
230.3 - Not Scheduled
230.4 - Not Scheduled
230.5 - Not Scheduled
230.6 - Not Scheduled

GEOSCIENCES BRANCH

231.1 - Not Scheduled
231.2 - Not Scheduled
231.3 - Not Scheduled
231.4 - Not Scheduled
231.5 - Not Scheduled
231.6 - Not Scheduled
231.7 - Not Scheduled

* - indicates September submittal

HYDROLOGIC AND GEOTECHNICAL ENGINEERING BRANCH

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241.14 - Complete
241.15 - Complete
241.16 - Complete
241.17 - Complete
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QUALITY ASSURANCE BRANCH

260.0 - Not Scheduled

CHEMICAL ENGINEERING BRANCH

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281.16 - Complete *
281.17 - Complete *

EFFLUENT TREATMENT SYSTEMS BRANCH

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321.4 - Complete *
321.5 - Complete
321.6 - Complete *

AUXILIARY SYSTEMS BRANCH

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410.32 - Complete *
410.33 - Complete
410.34 - Not Scheduled
410.35 - Complete *
410.36 - Complete *
410.37 - Complete
410.38 - Complete *
410.39 - Not Scheduled
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410.41 - Complete
410.42 - Not Scheduled
410.43 - Not Scheduled
410.44 - Complete

AUXILIARY SYSTEMS BRANCH CONT.

410.45 - Complete *
410.46 - Complete
410.47 - Complete *
410.48 - Complete
410.49 - Complete
410.50 - Complete *
410.51 - Complete
410.52 - Complete *
410.53 - Not Scheduled

POWER
SYSTEMS
BRANCH

430.3 - Complete*
430.4 - Complete*
430.5 - Complete*
430.6 - Complete*
430.7 - Complete*
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430.9 - Complete*
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430.11 - Not Scheduled
430.12 - Complete*
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POWER
SYSTEMS
BRANCH CONT.

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ACCIDENT
EVALUATION
BRANCH

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450.4 - Complete*
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450.8 - Not Scheduled
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450.11 - Complete*
450.12 - Not Scheduled

ACCIDENT EVALUATION BRANCH

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451.4 - Complete*
451.5 - Complete
451.6 - Not Scheduled
451.7 - Complete

RADIOLOGICAL ASSESSMENT BRANCH

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471.15 - Complete*
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471.23 - Not Scheduled
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471.25 - Not Scheduled

CONTAINMENT SYSTEMS BRANCH

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480.8 - Complete*
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CORE PERFORMANCE BRANCH

490.2 - Not Scheduled

CORE PERFORMANCE BRANCH

492.1 - Complete*
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492.3 - Not Scheduled

LICENSEE QUALIFICATION BRANCH

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630.4 - Complete*
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630.6 - Complete*
630.7 - Complete
630.8 - Complete
630.9 - Complete*
630.10 - Complete*
630.11 - Complete*
630.12 - Complete

PROCEDURES AND TEST REVIEW BRANCH

640.1 - Complete*
640.2 - Complete*
640.3 - Complete*
640.4 - Complete*
640.5 - Complete*
640.6 - Complete*
640.7 - Complete*
640.8 - Complete*
640.9 - Complete*
640.10 - Complete*
640.11 - Complete*
640.12 -
640.13 - Complete*
640.14 - Complete*
640.15 - Complete*

Question No.

220.10 (SRP 3.3.2, II FSAR 3.3.2 & 3.8.4.3)

Tornado load combinations have not been provided as a breakdown of velocity pressure, pressure drop and tornado missiles. Provide the requested load combinations. The staff's position is outlined in NUREG-0800, Section 3.3.2, II, 3, d.

Response

The tornado load combinations used in the WNP-3 design, broken down into velocity pressure, pressure drop and tornado missiles, are as follows:

(i) $W_t = W_w$
(ii) $W_t = W_p$
(iii) $W_t = W_m$
(iv) $W_t = W_w + W_p + W_m$
(v) $W_t = W_w + W_p$
(vi) $W_t = W_w + W_m$

where;

W_t = total tornado load
W_w = tornado wind load
W_p = tornado differential pressure load
W_m = tornado missile load

The load combinations indicated herein are more conservative than the NRC load combinations in that 1.0 W_p is utilized in combinations (iv) and (v) instead of 0.5 W_p specified in NUREG 0800, Section 3.3.2.II.3.d.

Question No.

220.11 (SRP 3.4.2, II FSAR 3.4.1.2.3) Are water-stop materials and caulking compounds properly designed so as to resist deterioration due to potential environmental effects such as time, heat, radiation, and chemicals? Provide details of the materials used, their expected service environment, and their expected resistance to same.

Response

All electrical penetrations in the RAB below grade are provided with 3/8 x 9 inch PVC waterstops to prevent groundwater seepage into the RAB. The waterstops are made of an elastomeric plastic compound, the basic resin being polyvinyl chloride, in accordance with Corps of Engineers Specification CRD-C572-74. The material is resistant to environmental effects such as aging, heat and chemicals. These waterstops are completely embedded within the concrete walls of the RAB and will not be exposed to the environment.

All pipe penetrations in the RAB below grade are sealed with Link-Seal. The basic polymer in the Link-Seal rubber compound is EPDM (Ethylene-Propylene-Diene-Monomer). This synthetic rubber offers a multitude of property advantages, such as outstanding resistance to water, moist environment, chemicals and radiation. Link-Seal's thick section, provides excellent protection against rotting, tearing, aging, punctures and other hazards of direct ground burial.

Link-Seal is primarily used in RAB for flood and earth seal; however, it is also intended for air seal. The following table establishes the suitability of Link-Seal as a sealing material to resist deterioration due to potential environmental effects.

ENVIRONMENTAL PARAMETERS	REACTOR AUXILIARY BUILDING BELOW GRADE		
LOCATION	INSIDE	OUTSIDE	
REFERENCE	FSAR FIGS. 3.11-1 & 3.11-2	ER TABLE 2.5-10	LINK-SEAL
Temperature °F	60 to 120	Ambient Groundwater (40 to 68)	-14 to +212
Humidity %	20 to 40	Ambient	100
Radiation (40 years dose) RADS	8.8×10^2 to 5.0×10^6	Background	5.0×10^8
pH	---	6.8 to 7.5	4.0 to 11.0

Question No.

220.12 (SRP 3.5.3, II FSAR 3.5.3.1.2) Provide details of your design and or analysis of gratings and their supports to resist missile impacts. Also, discuss what assumptions were used in the application of empirical missile penetration formulas to gratings. Provide sketches of the gratings and their supports and fastenings.

Response In response to the question, attached are extracts from the tornado missile protection grating design calculations and copies of production drawing G-3240-3467 showing details of grating and supports.

The empirical missile penetration formulas available are derived from missile impact data on steel plates. The main differences between a missile striking a steel plate or a grating are,

- Openings in grating reduce the missile contact area.

- In equal contact areas, the compressive strength of grating is less than that of a plate due to Poisson's effect.

In order to account for the above effects, the following reduction factors were applied to the empirical missile penetration formula:

1 - correction factor for contact area

$$\alpha 1 = \frac{\text{cross sectional area of missile}}{\text{minimum area of grating bars contacted}}$$

$\alpha 1$ values for various missiles are given in Subsection 3.5.3.1.2

2 - correction factor for ultimate strength

$\alpha 2 = (1-\nu^2) = 0.91$ where ν = Poisson's ratio

The thicknesses required to prevent penetration are less than those required for structural effects. Penetrations calculated using the indicated formulas are less than 25% of grating thickness. For a detailed discussion of the above, see Subsection 3.5.3.1.2.

Response (Cont'd)

220.14

PROGRAM	DESCRIPTION	METHOD OF VALIDATION
NASTRAN	(1) Seismic dynamic analysis (2) Static analysis	Criterion (i)
DYNAMIC 2037 (Also called FIXMAT 2037	Seismic dynamic analysis	Previously validated on the Waterford-3 FSAR (Docket No. 50-382) using Criterion (ii). See attached pages.
STARDYNE	(1) Seismic dynamic analysis (torsional) (2) Static analysis	Criterion (i)
ANSYS	Static analysic (non-linear)	Criterion (i)
SHAKE	See ref: Schnabel, P B, Lysmer, J and Seed, H B, "SHAKE: A Computer Program for Earthquake Response Analysis of Horizontally Layered Sites." Report No. EERC, 72-12 Earthquake Engineering Research Center, University of California, Berkeley, California - December 1972	Criterion (i)

Comparison of DYNAMIC 2037 and STARDYNE

DYNAMIC 2037 is an EBASCO in-house computer program which operates on BURROUGHS-7700 and solves seismic dynamic problems by time history modal-response method. Since this program is not a recognized program in public domain, a comparison of it with STARDYNE (version 4/1/72) is made here to demonstrate its validity and applicability.

A typical reactor building is used in this comparison and the dynamic structural model of this building is shown in Fig. 1. The seismic time history used is Elcentro NS 1940 normalize to 0.18g.

Natural frequencies for first ten modes, maximum displacements, forces, shears and moments at selected mass points or numbers output from both DYNAMIC 2037 and STARDYNE are tabulated in TABLE I, II, III, IV and V respectively. These almost identical results validate DYNAMIC 2037 for type of problem stated here.

Q 220.14

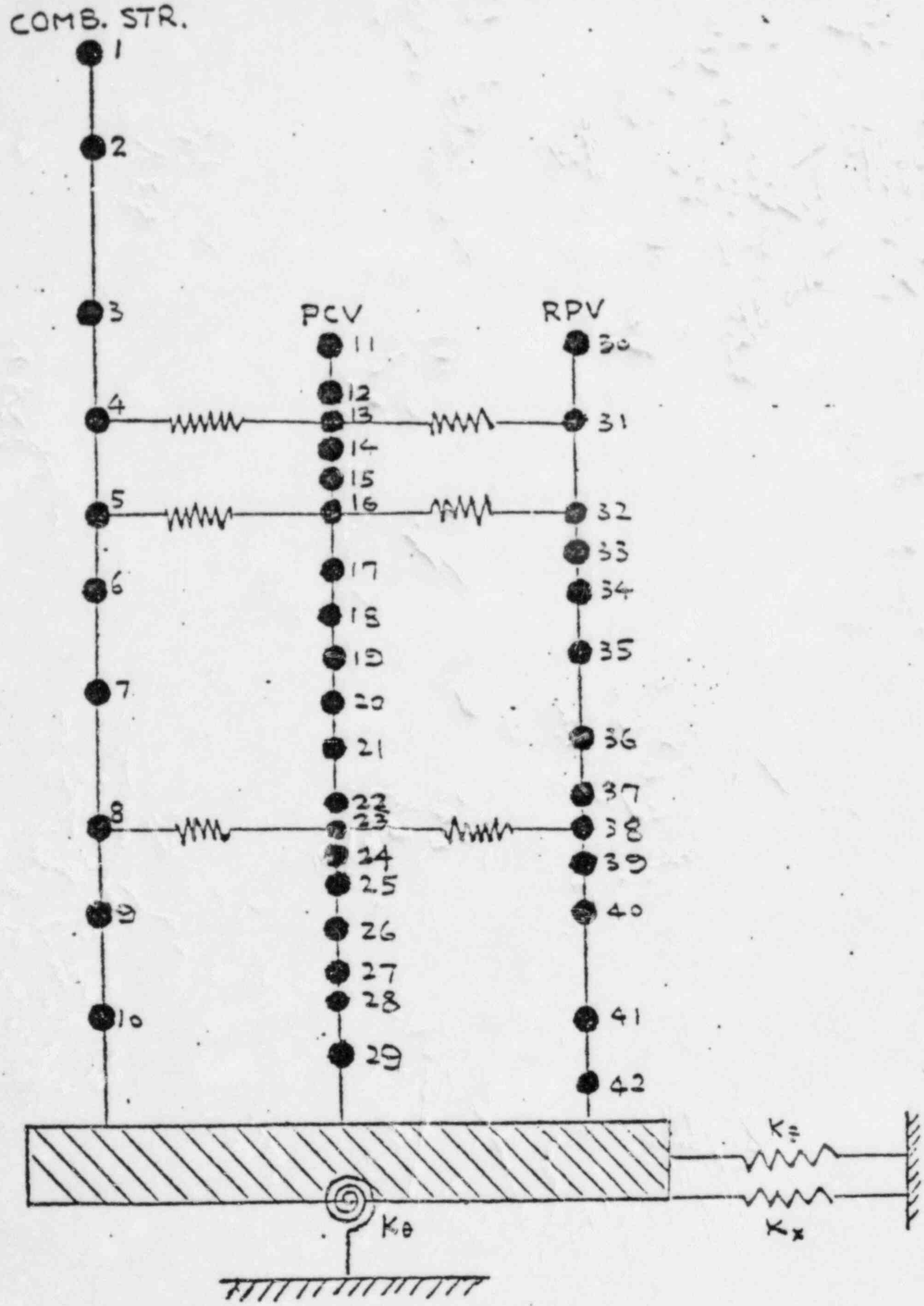

FIG. 1 STRUCTURAL MODEL

Q 220.14

MODE NUMBER	NATURAL FREQUENCY	
	DYNAMIC 2037 cps	STARDYNE (version 4/1/72) cps
1	2.44	2.43
2	5.02	5.01
3	8.39	8.36
4	8.91	8.91
5	11.3	11.2
6	13.1	13.1
7	15.5	15.4
8	17.8	17.7
9	18.4	18.3
10	22.1	22.0

TABLE I

COMPARISON OF NATURAL FREQUENCY

Q220.14

MASS POINT	DYNAMIC 2037		STARDYNE (Version 4/1/72)	
	TIME secs	MAX. DISP. meters	TIME secs	MAX. DISP. meters
1	2.48	0.0565	2.48	0.0567
10	2.69	0.0179	2.69	0.0179
11	2.48	0.0419	2.48	0.0420
29	2.69	0.0172	2.69	0.0172
30	2.48	0.0436	2.48	0.0437
42	2.69	0.0156	2.69	0.0155

TABLE II

COMPARISON OF MAX. DISPLACEMENT

Q220.14

MASS POINT	DYNAMIC 2037		STARDYNE (Version 4/1/72)	
	TIME secs	MAX.FORCE tons	TIME secs	MAX. FORCE tons
1	2.48	3,180	2.48	3,150
10	2.68	14,200	2.69	14,100
11	2.48	20	2.48	20
29	2.68	2,050	2.69	2,040
30	2.49	124	2.49	123
42	2.68	332	2.69	329

TABLE III

COMPARISON OF MAXIMUM FORCE

Q220.14

MEMBER NUMBER	DYNAMIC 2037		STARDYNE (Version 4/1/72)	
	TIME secs	MAX. SHEAR tons	TIME secs	MAX. SHEAR tons
1	2.48	3,170	2.48	3,150
10	2.68	85,600	2.69	85,600
11	2.48	20	2.48	20
29	2.68	3,670	2.69	3,690
30	2.49	124	2.48	123
42	2.66	2,840	2.69	2,810

TABLE IV

COMPARISON OF MAX. SHEAR

Q220.14

MEMBER NUMBER	DYNAMIC 2037		STARDYNE (Version 4/1/72)	
	TIME secs	MAX. MOMENT ton-meters	TIME secs	MAX. MOMENT ton-meters
1	2.48	30,315	2.48	29,900
10	2.48	2,890,000	2.48	2,890,000
11	2.48	54	2.48	54
29	2.48	62,000	2.48	62,300
30	2.49	525	2.48	520
42	2.67	39,600	2.69	38,600

TABLE V

COMPARISON OF MAX. MOMENT

Q220.14

Question No.

220.17 (SRP 3.7.2, II, 6, b FSAR 3.7.2.6)	In the analysis of the common mat for seismic excitation in 3 directions, neither the rationale for nor the design procedure itself were understood from the description given. Provide further details and justification for the method of combining earthquake inputs in the design of the common mat. How was the horizontal amplification factor of 1.2 arrived at? What does the statement that the mat responses are combined "linearly" mean?

Response

As discussed in FSAR Subsection 3.7.2.6, the SRSS method of combining the seismic responses (moments, shears, etc.) from three components of earthquake motion is not applicable to the mat design and an alternative design approach is needed.

The alternative method used in the WNP-3 mat design was based on the recommendation contained in Subsection 5.5.5.4 of the ASCE design manual titled "Structural Analysis and Design of Nuclear Plant Facilities" issued for trial use in 1976, (pages 5-81 through 5-83 of the manual are attached). This method is based on the rationale that the effects of three-component seismic motion can be taken into account by considering earthquake motion only in two directions (one vertical and one horizontal). However, the horizontal earthquake loads are to be amplified to such an extent that reasonably conservative results can be obtained when the effects of the amplified horizontal earthquake loads are combined with those of the full vertical loads by linear algebraic summation. The term "linear" is used in contrast to the SRSS combination which is non-linear.

To amplify the horizontal earthquake loads, a factor of 1.2 was used as suggested for the rectangular foundation in the attached Subsection 5.5.5.4 of the ASCE manual.

5.5.5.3 Floor Response Spectrum

Due to the generally unsymmetrical behavior of nuclear power plant structures, the movements of structure are normally three directional in nature even when subjected to only one component of earthquake motion. For example, a particular location on a particular floor might have both E-W and N-S motions in addition to the vertical motion when the building is subjected to one horizontal earthquake excitation only. To properly estimate floor spectrum values to include the three directional effects of both earthquake and structural behavior, the following method is recommended:

$$S_x = \sqrt{S_{x1}^2 + S_{x2}^2 + S_{x3}^2} \tag{5.24}$$

Where S_x is the most probable spectrum value, at any frequency point in the x direction.

S_{xk} (k = 1,2,3) is the spectrum value at the same frequency point in the x direction due to earthquake component in the kth direction.

If the time history method as described in Section 5.5.5.2 (b) - (2) is used, the floor response spectrum may be generated directly from the time history responses at the floor level since it already includes both the three directional behavior of the earthquake motions and the unsymmetrical characteristics of the structures.

5.5.5.4 Miscellaneous Design Considerations

In some special cases, the SRSS method as described in the previous sections becomes difficult to apply due to the nonlinear characteristics of the structural problem for which the principle of super-position does not

Q220.17

hold. One example is the determination of soil compressive stress distributions underneath the foundation mat when the foundation is subjected to the seismic loads. Since soils are not capable of resisting any tensile loads, reasonable soil compressive stresses due to the seismic loads could not be determined without the presence of other loads such as the dead load, live load, buoyancy force, etc. The soil stresses due to seismic loads alone could not be separated from the stresses due to other loads and therefore cannot be combined by the SRSS method for the three directional earthquake effects, unless a method such as outlined in Section 5.5.5.5 is used. In this case, direct solution may be found using the time history method as described in Section 5.5.5.2 (b) 2. However, it requires great amount of calculating effort and may not be suitable for practical engineering applications. As an alternative, the following method is suggested:

	Earthquake Loads			Other Loads
Case	H_x	H_z	V_y	
1	$\pm(A)Ex$	0	$\pm Ey$	All other loads
2	0	$\pm(A)Ez$	$\pm Ey$	All other loads

Where (A) is a factor selected to properly amplify the horizontal earthquake loads which are used in conjunction with the vertical seismic loads and other applied loads for the determination of, for example, soil stresses underneath the foundation mat. Calculations shall be made in two horizontal directions separately and the design shall envelope all analysis results. This method is based on the assumption that the three directional earthquake effects on structures may be handled sufficiently well by considering earth-

Q220.17

quake loads only in two directions (one vertical and one horizontal), however, the horizontal earthquake loads shall be amplified to such an extent that reasonably conservative results could be assured. It shall be noted here that the amplified horizontal earthquake loads are combined linearly with the full vertical earthquake loads and the SRSS method is not applied.

At the present time, not enough work has been done to provide a clear guidance on how to select the factor (A), however (A) is believed to be greater than unity and less than $\sqrt{2}$ and a value in between may be decided for (A) depending on the complexities of the problem, the shape of structure, level of earthquake load contribution vs. contributions of all other loads, etc. For determination of soil stresses or detailed bending and shear stresses in the foundation mat of a rectangular structure under seismic loads, a factor (A) of 1.2 is believed adequate enough. Similarly, a factor of 1.0 may be used for circular foundation for the same purpose. It must be emphasized that when the factor (A) of 1.2 is recommended for the rectangular foundation, it is based on the observation that the maximum soil compressive stress occurring generally at one corner of the mat could be considerably higher under the simultaneous action of both horizontal earthquake loads than the condition for which only one horizontal earthquake action is considered. This factor of 1.2 shall not be interpreted as an increase of the basic prescribed seismic design criteria namely levels of OBE and SSE, etc. For circular foundations, a factor of 1.0 may be adequate since the maximum soil compressive stress under a circular foundation is essentially the same either under the action of one horizontal earthquake load or two horizontal earthquake loads simultaneously.

Q220.17

2572W-11

Question No.

220.19 (SRP 3.7.3, II, 5 FSAR 3.7.4 II, 5 as it refers to Subsection 7.6.1.1.7)	Provide details of a seismic instrumentation inservice surveillance program. The staff's position is outlined in the SRP, NUREG 0800, Section 3.7.4, II, 5.

Response

The details of the in-service surveillance program will be found in Chapter 16 as stated in Subsection 7.6.1.1.7 on page 7.6-7 in Amendment No. 2.

Question No.

220.20 (SRP 3.7.2, II, 1) (FSAR 3.7.2.1)

What is the significance of the adjective "modal" in the description of the time-history method? Does the modal time-history method differ from the time-history method? Describe the differences and provide justification.

RESPONSE

There are several methods available to solve dynamic problems in time steps known as time-history methods. The modal time history method that was used in the seismic analysis refers to one that utilizes the normal mode theory with discrete time step solution as described in FSAR Subsection 3.7.2.1.3.

Other known time-history methods are: (1) the direct integration method that utilizes a numerical integration scheme such as Newmark's β - method, Wilsons θ - method, Houbolt method, Central Difference method, Runge-Kutta method, etc; and (b) the complex frequency response method that transforms time histories into a frequency form and obtains solutions in the frequency domain. The frequency responses are then transformed back into time history responses.

The modal time history method was selected since it has the advantage of being capable of omitting those modes that are insignificant to the response of the system and thereby reducing the computational effort.

Question No.

220.21 (SRP 3.7.3, II, 2, b FSAR 3.7.3.2)	Rather than referring to CESSAR-F it is requested that the number of earthquake cycles considered in the NSSS and BOP analyses be specifically stated in this section of the FSAR. Provide justification if not in compliance with staff positions outlined in the SRP.

Response

The procedure used to account for the number of earthquake cycles during one seismic event includes consideration of the number of significant motion peaks expected to occur during one seismic event. The number of significant motion peaks would be expected to be equivalent in severity to no more than 40 full load cycles about a mean value of zero and with an amplitude equal to the maximum response produced during the entire event. Based upon this consideration and the assumption that seismic events equivalent to five operating basis earthquakes occurs during the life of the plant, seismic Category I systems, components and equipment are designed for a total of 200 full load OBE cycles. In addition, one safe shutdown earthquake is assumed.

The procedure used to account for the fatigue effect of cyclic motion associated with the OBE recognizes that the actual motion experienced during a seismic event consists of a single maximum or peak motion, and some number of cycles of lesser magnitude. The total or cumulative fatigue effect of all cycles of different magnitude results in an equivalent, cumulative usage factor. The equivalent cumulative usage factor can also be specified in terms of a finite number of cycles of the maximum or peak motion. Based on this consideration, seismic Category I systems, components and equipment are designed for a total of 200 full load cycles about a mean value of zero and with an amplitude equal to the maximum response produced during the entire five OBE events.

FSAR Subsection 3.7.3.2 will be amended to include the above information.

For rigid equipment modeled as one or more degree of freedom system, the equivalent static load factor is the response acceleration on the floor response spectra at the fundamental period of the equipment. For rigid valves, the equivalent static load factors are 3.0 g horizontal and vertical for safe shutdown earthquake (SSE) and 1.5 g horizontal and vertical for operating basis earthquake (OBE).

e) Time History Analysis Method

Time history method is not used other then the NSSS Systems.

f) Cable tray and HVAC ducts are analyzed by the equivalent static load method. The span length between supports are determined based on design criteria which involves the use of appropriate charts and tabulation, so that the first mode frequency is at least 33 Hz.

3.7.3.2 Determination of Number of Earthquake Cycles

CESSAR-F Subsection 3.7.3.2 is applicable to NSSS and BOP subsystems.

INSERT 1

3.7.3.3 Procedure Used For Modeling

The mathematical model used in all seismic Category I piping subsystems include sufficient mass points and corresponding degrees of freedom to provide a three dimensional representation of the dynamic characteristics of the subsystem. The distribution of mass and the selected location of mass points account for torsional effects of valves and other eccentric masses.

As indicated in Subsection 3.7.3.1.1.a, the maximum spacing of the mass points does not exceed one half the distance for which the frequency of a simply supported beam would be 20 Hz. Each mass points, except for points indicated as restrained in a given direction, have three linear degrees of freedom. Therefore, the degrees of freedom exceeds twice the number of modes with frequencies less than 33 Hz. In addition, all dynamic modes below 33 Hz are included in the analysis.

The criterion used for sufficiency of numbers of modes considered in the analysis is that the inclusion of additional modes does not result in more than a 10 percent increase in response. For WNP-3/5, frequencies of 33 Hz and above are in the rigid zone and there is not more than 10 percent increase in response due to inclusion of modes above 33 Hz.

Piping may be decoupled if the ratio of the moment of inertia of the larger pipe and the smaller pipe is greater than 100.

Rigid valves are modeled as outlined in Subsection 3.7.3.11.

Non-rigid valves (less than 33 Hz) are modeled with the piping. The model of the valve is supplied by the valve manufacturer.

All non-rigid equipment is modeled with the piping subsystem with sufficient detail to reflect the dynamic response of all significant modes. All modes with natural frequencies in the range of 33 Hz and below are considered significant.

Q220.21
SCN 560

INSERT 1

The procedure used to account for the number of earthquake cycles during one seismic event includes consideration of the number of significant motion peaks expected to occur during one seismic event. The number of significant motion peaks would be expected to be equivalent in severity to no more than 40 full load cycles about a mean value of zero and with an amplitude equal to the maximum response produced during the entire event. Based upon this consideration and the assumption that seismic events equivalent to five operating basis earthquakes occurs during the life of the plant, seismic Category I systems, components and equipment are designed for a total of 200 full load OBE cycles. In addition, one safe shutdown earthquake is assumed.

The procedure used to account for the fatigue effect of cyclic motion associated with the OBE recognizes that the actual motion experienced during a seismic event consists of a single maximum or peak motion, and some number of cycles of lesser magnitude. The total or cumulative fatigue effect of all cycles of different magnitude results in an equivalent, cumulative usage factor. The equivalent cumulative usage factor can also be specified in terms of a finite number of cycles of the maximum or peak motion. Based on this consideration, seismic Category I systems, components and equipment are designed for a total of 200 full load cycles about a mean value of zero and with an amplitude equal to the maximum response produced during the entire five OBE events.

Q 220.21
SEN 560

Question No.

220.23 (SRP 3.7.3, II, 2, a FSAR 3.7.3.1.1, a, 3.7.2.5, and Table 1.8-1)	With the exception of the issue noted in question 220.22, discuss in detail and justify all differences between the response spectra as described in the referenced section of the FSAR and the staff's position as described in Regulatory Guide 1.122.

Response

With the exception of the issue of peak broadening discussed in response to NRC Question 220.22, the development of floor response spectra for WNP-3 conforms in all respects to the regulatory position as given in Regulatory Guide 1.122.

Question No.

220.24 (SRP 3.7.3, II, 2, e and 3.7.2, II, 13 FSAR 3.7.3.15)	The description of the analysis procedure for the damping indicates compliance with Subsection 3.7.2.15 of CESSAR-F which outlines damping relations only for NSSS and not in great detail. Discuss compliance with the staff's position as outlined in the above referenced sections of NUREG-0800 (SRP).

Response

The damping factors used in seismic analysis of Category I structures, systems and equipment for NSSS and BOP are selected from the table below. The damping factors given in the table are in agreement with those recommended in Regulatory Guide 1.61.

DAMPING VALUES USED IN ANALYSIS OF CATEGORY I STRUCTURES, SYSTEMS AND COMPONENTS

	Maximum Allowable Damping Percent Of Critical Viscous Damping	
Item	Operation Basis Earthquake	Safe Shutdown Earthquake
Equipment and large diameter piping system, pipe diameter greater than 12 inches.	2	3
Small diameter piping systems, diameter less than or equal to 12 inches.	1	2
Welded steel structures.	2	4
Bolted steel structures.	4	7

FSAR Subsection 3.7.3.15 will be amended to include the above information.

The underground duct banks containing Class 1E electrical cables are seismically analyzed.

3.7.3.13 Interaction of Other Piping with Seismic Category I Piping

In general all non-seismic Category I piping systems are designed to be isolated from any seismic Category I piping system.

Where seismic Category I piping systems are in close proximity to non-seismic systems, the excessive movement of the non-seismic Category I system due to seismic induced effects is restrained so that no failure of the seismic Category I system occurs.

Where seismic Category I piping is directly connected to nonseismic piping, the seismic effects of the nonseismic piping is prevented from being transferred to the seismic Category I piping by use of anchors or combinations or restraints. If this is not practiced, the interaction effects of the unrestrainted portion of the nonseismic piping is included in the analysis of the seismic Category I piping.

When piping is routed between a seismic Category I and a non-seismic Category I building structure (i.e., Feedwater, Main Steam and S.G. Blowdown Systems), the anchor or restraint is designed to seismic Category I so that the seismic portion of the system is not affected by the non-seismic portion of the system during an earthquake event.

See CESSAR-F Subsection 3.7.3 for NSSS Seismic Subsystem Analysis.

3.7.3.14 Seismic Analysis for Reactor Internals

See CESSAR-F Subsection 3.7.3.14.

3.7.3.15 Analysis Procedure for Damping

See CESSAR-F Subsection 3.7.2.15.

Values of critical damping used in the seismic analysis for seismic Category I subsystems are in accordance with Regulatory Guide 1.61 for various types of structural members, for the OBE and SSE accelerations. Table 3.7.3-2 provides the damping values used in the ~~•~~ seismic analysis ~~for~~ of Category I structures, systems and components.

Q 220.24

TABLE 3.7.3-2

DAMPING VALUES USED IN ANALYSIS OF CATEGORY I STRUCTURES, SYSTEMS AND COMPONENTS

Item	Maximum Allowable Damping Percent Of Critical Viscous Damping: Operation Basis Earthquake	Safe Shutdown Earthquake
Equipment and large diameter piping system, pipe diameter greater than 12 inches.	2	3
Small diameter piping systems, diameter less than or equal to 12 inches.	1	2
Welded steel structures.	2	4
Botled steel structures.	4	7

Q220.24

Question No.

220.27 (SRP 3.8.2, II, 4, d FSAR 3.8.2 (see Table 1.8-3))

Provide an analysis of containment ultimate capacity. The analysis should provide the information listed in the staff's position as outlined in the referenced section of NUREG-0800 (SRP).

Response

An analysis of the containment ultimate capacity was not performed since the steel containment vessel is designed, constructed and tested in conformance with the requirements of Section III of the ASME Code for Class MC Components. Design loads and load combinations used are described in FSAR Subsection 3.8.2.3 and satisfy the containment design basis which can accommodate, with sufficient margin, the Design Basis Accident (DBA).

The design internal pressure used is 44.0 psig. A discussion on the selection of the internal design pressure of the containment is provided in FSAR Subsection 6.2.1.

Upon completion of the Containment Vessel a pressure test at (50.6 psig) 115 percent of the design pressure (44.0 psig) is performed in accordance with the ASME Code.

Question No.

220.28 (SRP Section 3.8.2, II, 4, b FSAR 3.8.2.4 and Table 1.8-3)

In Table 1.8-3 of the FSAR it is noted that the dynamic nature of the loads applied in the static analysis of buckling was said to have been accounted for. Provide a complete description of the analysis used which indicates how the dynamic nature of the loads was accounted for. Provide results of your analysis. (It is noted that there is no Subsection 3.8.2.4.3 in the FSAR).

Response

The procedures used in the static analysis of the containment vessel are described in FSAR Subsection 3.8.2.4. Compressive stresses obtained from the analysis are shown to be within the buckling allowables given in the structural acceptance criteria in FSAR Subsection 3.8.2.5. Loads which have a dynamic nature consist of seismic, pipe rupture and jet impingement. To account for the dynamic nature, these loads have been applied as follows:

Seismic Loads: The seismic response of the containment vessel resulting from the Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) represented by percent "g" variation along the height was obtained from the dynamic analysis. The seismic accelerations thus obtained were multiplied by the permanent weights of the shell to determine seismic forces.

Pipe Break and Jet Impingement Loads: Pipe break and jet impingement loads used in the analysis are equivalent static loads. The dynamic nature of the loads are accounted for as described in Subsection 3.6.2 of the FSAR.

Question No.

220.29 (SRP 3.8.3, II, 1 FSAR 3.8.3.1)

Provide additional detailed sketches or production drawings for the following:

1. Reactor base support including concrete reinforcement of primary shield wall.

2. Reinforcement of containment internal concrete fill.

3. Reinforcement of secondary shield walls.

4. Attachment of primary and secondary shield walls to fill concrete.

5. Attachment of internal concrete to containment vessel.

Response

Copies of the following listed production drawings are attached hereto in response to the above request:

WPPSS 3240 G2520-SH 1	Reactor Bldg Internal Conc - Containment Vessel Suppt, M & R SH 1
WPPSS 3240 G2520-SH 2	Reactor Bldg Internal Conc - Containment Vessel Suppt, M & R SH 2
WPPSS 3240 G2520-SH 3	Reactor Bldg Internal Conc - Containment Vessel Suppt, M & R SH 3
WPPSS 3240 G2520-SH 4	Reactor Bldg Internal Conc - Containment Vessel Suppt, M & R SH 4
WPPSS 3240 G2521	Reactor Bldg Internal Conc - Internal Base Concrete - M SH 1
WPPSS 3240 G2522	Reactor Bldg Internal Conc - Internal Base Concrete - M SH 2
WPPSS 3240 G2523	Reactor Bldg Internal Conc - Internal Base Concrete - M SH 3
WPPSS 3240 G2524	Reactor Bldg Internal Conc - Internal Base Concrete - R SH 1
WPPSS 3240 G2525	Reactor Bldg Internal Conc - Internal Base Concrete - R SH 2
WPPSS 3240 G2526	Reactor Bldg Internal Conc - Internal Base Concrete - R SH 3
WPPSS 3240 G2527	Reactor Bldg Internal Conc - Internal Base Concrete - R SH 4
WPPSS 3240 G2528	Reactor Bldg Internal Conc - Internal Base Concrete - R SH 5
WPPSS 3240 G2538	Reactor Bldg Internal Conc - Secondary Shield - R - SH 1
WPPSS 3240 G2539	Reactor Bldg Internal Conc - Secondary Shield - R - SH 2
WPPSS 3240 G2540	Reactor Bldg Internal Conc - Secondary Shield - R - SH 3

Response to Question 220.29 (Cont'd)

WPPSS 3240 G2541	Reactor Bldg Internal Conc - Secondary Shield - R - SH 4
WPPSS 3240 G2542	Reactor Bldg Internal Conc - Secondary Shield - R - SH 5
WPPSS 3240 G2550	Reactor Bldg Internal Conc - Reactor Primary Shield - M - SH 1
WPPSS 3240 G2551	Reactor Bldg Internal Conc - Reactor Primary Shield - M - SH 2
WPPSS 3240 G2552	Reactor Bldg Internal Conc - Reactor Primary Shield - M - SH 3
WPPSS 3240 G2553	Reactor Bldg Internal Conc - Reactor Primary Shield - R - SH 1
WPPSS 3240 G2554	Reactor Bldg Internal Conc - Reactor Primary Shield - R - SH 2
WPPSS 3240 G2555	Reactor Bldg Internal Conc - Reactor Primary Shield - R - SH 3
WPPSS 3240 G2556	Reactor Bldg Internal Conc - Reactor Primary Shield - R - SH 4
WPPSS 3240 G2595-S2	Reactor Bldg Internal Conc - Penetration Det - R - SH 2

Question No.

220.31 (SRP 3.8.3, II, 3, b FSAR 3.8.3.3 and Table 1.8-3)	With regard to load combinations for concrete internal structures, the following remark was found in table 1.8-3 for the referenced SRP Section: "(2) By combining these load combinations with the allowable limits presented in the Structural Acceptance Criteria (paragraph II.5 of this SRP) expressions defining structural acceptance criteria for every load combination can be generated. They are different from those presented in the FSAR. However, FSAR conditions are found to be conservative and SRP criteria here are amply satisfied." The significance of this statement is not clear. Please expand the explanation and provide pertinent examples.

Response

The following is an explanation of the above referenced note to FSAR Table 1.8-3:

By combining the service load conditions shown on Page 1.8-142 of FSAR Table 1.8-3 for SRP acceptance criterion II.3.b(1)(b) (equations 1-4 below):

1) $1.4D + 1.7L$
2) $1.4D + 1.7L + 1.9E$
3) $(0.75)x(1.4D + 1.7L + 1.7To + 1.7Ro)$
4) $(0.75)x(1.4D + 1.7L + 1.9E + 1.7To + 1.7Ro)$

with the structural acceptance criteria specified on Page 1.8-152 of Table 1.8-3 which states that:

1) for SRP acceptance criterion b(i)(b) equations 1 and 2, the allowable limit for U is equal to U.

2) for SRP acceptance criterion b(i)(b) equations 3 and 4, the allowable limit for U is equal to U.

The following equations can be written:

1) $U = 1.4D + 1.7L$
2) $U = 1.4D + 1.7L + 1.9E$
3) $U = (0.75)x(1.4D + 1.7L + 1.7To + 1.7Ro)$
4) $U = (0.75)x(1.4D + 1.7L + 1.9E + 1.7To + 1.7Ro)$

Response

220.31 (Cont'd)

The intent of the remark was in reference to the fact that the service load conditions (shown above) indicated in Table 1.8-3, SRP 3.8.3 are different from those shown in FSAR Subsection 3.8.3.3.2.1. A comparison of the two however, indicates the service load combinations and acceptance criteria used in the design of WNP-3 are more conservative than those shown above from Table 1.8-3, SRP 3.8.3. As an example, compare equation (3) above with equation (1) from FSAR Subsection 3.8.3.3.2.1.

Equation (3) above may be rewritten:

$$U = 1.05D + 1.275L + 1.275To + 1.275Ro.$$

Equation (1) from the FSAR is:

$$U = 1.4D + 1.7L + 1.3To = 1.3Ro.$$

From a comparison of the above equations, it can be seen that the WNP-3 design is more conservative than required by SRP 3.8.3.

Question No.

220.32 (SRP 3.8.4, II, 1 and 3.8.5, II, 1 FSAR 3.8.4.1 and 3.8.5.1)	Provide additional detailed sketches or production drawings for the following:

1. Shield building reinforcement and attachment to the common mat including all shear reinforcement.

2. Auxiliary building main wall reinforcement and attachment to the common mat.

3. Interfaces between the shield building and auxiliary building walls and floors showing actual clearances.

4. Reinforcement of common mat.

5. Reinforcement and wall connections of tank enclosure mat foundation.

6. Reinforcement of dry cooling tower mat foundation and attachment to walls.

(NOTE: The sketches provided up to and including revision 2 of the FSAR are not considered sufficient to satisfy this request.)

Response

Copies of the following production drawings are provided in response to your request:

Drawing No.	Rev	Title
WPPSS-3240-G-2505	4	Shield Building Cylinder Wall-Reinf-Sh. 1
WPPSS-3240-G-2506	4	Shield Building Cylinder Wall-Reinf-Sh. 2
WPPSS-3240-G-2509-S1	3	Shield Building Base Ring Det-Reinf-Sh. 1
WPPSS-3240-G-2509-S2	1	Shield Building Base Ring Det-Reinf-Sh. 2
WPPSS-3240-G-2511	1	Shield Building Dome Reinforcing-Sh. 1
WPPSS-3240-G-2512	3	Shield Building Dome Reinforcing-Sh. 2
WPPSS-3240-G-2513	3	Shield Building Dome Reinforcing-Sh. 3
WPPSS-3240-G-2334	3	RAB Substr Exterior Walls-North Elev.-R
WPPSS-3240-G-2369	3	RAB Superstr Exterior Walls-North Elev.-R
WPPSS-3240-G-2320	3	RAB Substr Common Mat-Dowel Plan-Sh. 1
WPPSS-3240-G-2314	4	RAB Substr Common Mat-Plan-R-Sh. 1
WPPSS-3240-G-3106	6	Architectural Roof Plan
WPPSS-3240-G-3121-S1	5	Architectural Details & Sections-Sh. 3
WPPSS-3240-G-2243	3	Cond & Refuel Tanks Fdn Reinf-Sh. 1
WPPSS-3240-G-2244	2	Cond & Refuel Tanks Fdn Reinf-Sh. 2
WPPSS-3240-G-2245	2	Cond & Refuel Tanks Fdn Reinf-Sh. 3
WPPSS-3240-G-2246	2	Cond & Refuel Tanks Fdn Reinf-Sh. 4
WPPSS-3240-G-2247	2	Cond & Refuel Tanks Fdn Mics Det-M & R

Response to Question 220.32 (Cont'd)

Drawing No.	Rev	Title
WPPSS-3240-G-2262	0	Dry Cooling Tower Foundation Mat-Reinf Sh. 1
WPPSS-3240-G-2263	0	Dry Cooling Tower Foundation Mat-Reinf Sh. 2
WPPSS-3240-G-2264	0	Dry Cooling Tower Foundation Mat-Reinf Sh. 3

Question No.

220.33 (SRP 3.8.4, II, 1 FSAR 3.8.4.1.4)	The last sentence in FSAR Subsection 3.8.4.1.4 refers to "masonry drawings of the Tank Enclosure Structure." Please confirm that the reference to "masonry" does not involve any reference to masonry block walls in this structure.

Response

The reference to "masonry" in FSAR Subsection 3.8.4.1.4 does not involve block walls. There are no block walls associated with the Tank Enclosure Structure.

Question No.

220.34 (SRP 3.8.4, II, 6 FSAR 3.8.4.6) Describe in detail, materials, design procedures, installation procedures, and quality assurance requirements for all types of concrete anchors, both cast-in-place and drilled-in, which are used in seismic Category-I structures and/or to support safety related equipment.

Concrete anchors used in seismic Category I structures and/or to support safety related equipment consist of a) Anchor bolts, b) Anchor studs and c) Expansion bolts.

Response Quality Assurance requirements which are common to all types of concrete anchors are as follows:

Concrete anchors used in seismic Category I structures and/or to support safety related equipment are classified as Supply System Quality Class I. They are procured and installed in accordance with the overall Quality Assurance program described in Chapter 17 of the FSAR.

Materials, design procedures and installation procedures used for a) Anchor bolts, b) Anchor Studs and c) Expansion bolts are described individually as follows:

A - Anchor Bolts

1. Materials

The following materials are used for concrete anchors and are included in those specified for Structural Steel in Subsection 3.8.3.6.3 of the FSAR:

a) Anchor bolts used for structures inside the containment, other Category I structures and for anchoring safety related equipment conform to the following specifications:

i - ASTM A36 with ASTM A563 Grade A nuts unless otherwise noted.

ii - ASME SA 193 Grade B7 with SA 194 nuts.

iii - SAE Grade 5.

b) Anchor bolts and materials used for attachment structures for NSSS component supports and related equipment including RCS pipe stops and rupture restraints are specified in Subsection 3.8.3.6.3(b) of the FSAR. Specific material applications are shown in Table 3.8.3-11.

Question No. 220.34

Response (Cont'd)

A - Anchor Bolts (Cont'd)

2. Design Procedures

Anchor bolts are designed to transmit tension loads from the structure and/or equipment to concrete. Shear loads, if present, are transmitted by shear keys provided for this purpose. The tensile capacity of the bolt is in accordance with the design procedures of the AISC Specification. Tensile loads transmitted to concrete are determined by the bond developed between the concrete and the bolt in accordance with ACI 318-71. Bolts equipped with anchor plates transmit the tensile load by bearing between the plate and concrete.

3. Installation Procedures

Anchor bolts are installed in accordance with tolerances and criteria specified on the drawings. Bolts found to be outside the installation tolerances are identified as nonconforming.

B - Anchor Studs

1. Materials

Materials use for concrete anchor studs conform to low carbon steel ASTM A108 of a grade suitable for end welding to steel plates with automatically timed welding equipment.

2. Design Procedures

Anchor studs used to anchor embedded plates to concrete are designed for both shear and tension loads. Design data contained in "Embedment Properties of Headed Studs" published by TRW Nelson Division are utilized.

3. Installation Procedures

Welding details, qualifications and procedures for stud welding used in the installation of anchor studs are in accordance with AWS D1-1.

C - Expansion Anchors

1. Materials

Expansion bolt anchors (Hilti Bolts) are externally threaded expansion bolt anchors with split ring conforming to Federal Specification FF-S-325 Group II, Type 4, Class I and the purchase specification for "Drilled-in Expansion Type Anchors" prepared by Ebasco Services Inc.

Question No. 220.34

Response (Cont'd)

C - Expansion Anchors (Con't)

2. Design Procedures

Embedded drilled-in anchors are statically designed in shear and tension such that the lesser of the allowable loads established by the following methods are not exceeded.

a) Allowable percentages of SA325 type bolting material yield stress (max temperature = 100°F), as established by the applicable ASME Boiler and Pressure Vessel Code Sections, applied to the following areas:

For tension - across the minimum bolt diameter at the tapered section of the wedge mandrel

For Shear - across the root area of the nominal thread diameter

b) The average ultimate static loads in 4000 psi concrete and 5000 psi concrete, divided by the following factors of safety:

For Tension - 4
For Shear - 4

3. Installation Procedures

Expansion anchors (Hilti Bolts) are installed in strict accordance with the recommended installation instructions of the manufacturer and by qualified personnel with appropriate training in installation techniques.

Question No.

220.35 (SRP 3.8.3, II 3.8.4, II 3.8.5, II FSAR 3.8.3, 3.8.4, 3.8.5)	The applicant has used ACI 318-71 as the basis for design of Category I concrete structures. Currently, the staff's position as referenced in NUREG 0800 (SRP) is that ACI 349 as implemented by Regulatory Guide 1.142 is to be used as the basis for design of Category I concrete structures other than containment. The applicant should identify and justify all differences between his design procedure for concrete structures and those found in ACI 349/Guide 1.142.
Response	The NRC accepted ACI 318-71 for the design of seismic Category I concrete structures in WNP-3/5 Safety Evaluation Report (NUREG-0023) February 1976. Design of Category I concrete structures for the project started prior to the issuance of ACI 349-76 code. Provisions of ACI 318-71 and NRC technical positions taken during PSAR evaluation have been used for the design of Category I concrete structures.

Question No.	
220.36 (SRP 3.7.4, 3.8.3, 3.8.4 FSAR 3.7.4, 3.8.3, 3.8.4 and Table 1.8-3)	The following note appears in several places in FSAR Table 1.8-3 regarding various acceptance criteria of the referenced FSAR sections: "Where differences exist between the WNP-3 design criteria and the acceptance criteria identified in this SRP, the bases for concluding that the WNP-3 design criteria are in compliance with the Commission's regulations will be provided by January 1983." Provide the information.
Response	FSAR Table 1.8-3 and the associated text, where applicable, have been revised to reflect the extent of compliance with the commission's regulations in Amendments 2 and 3.

Question No.

220.38 (SRP 3.8.4, II FSAR 3.8.4.1.2, a)

Provide a sketch or drawing showing the reinforcement of the spent fuel pool floor slab, including shear reinforcement. Show connection details of the floor slab to the walls. Provide results of key calculations relating allowable to actual shear and bending stress in the floor slab of the spent fuel pool.

Response

The following are attached in response to above request.

1) Drawing G-2448 "Fuel Handling Building Substructure Floor Slab - EL. 383.00 ft. - R. The drawing shows the reinforcing details of the Spent Fuel Pool Slap including shear reinforcement and connection details to the walls.

2) The following is a summary of calculation results for the Fuel Handling Building Spent Fuel Pool Slab at El. 383.00'.

SHEAR		FLEXURE (Including In Plane Shear	
Actual	Allowable	Required	Provided
115.0 psi	141.0 psi	As' = 5.0 in^2 TOP EW	2 - #11@7'2" T & B, EW
		As' = 4.8 in^2 BOT EW	As provided = 5.0 in^2

REF: Design Book NF 303
Fuel Handling Building

Question No.

241.18 (SRP 2.5.4)

You state, in the FSAR, Subsection 2.5.4.10.4, that you used a dynamic soil-structure-interaction analysis for dynamic lateral pressure calculations. Describe the method used. Provide assumed rock parameters, groundwater table assumptions, and describe the seismic input motion used for this analysis. Present your lateral pressure calculation results that you have already obtained and compare them with the results of calculations using a more commonly accepted procedure, e.g., the Seed and Whitman approach. (Seed, H. B. and R. V. Whitman, 1970, "Design of Earth Retaining Structures for Dynamic Loads," Proceedings of the State of the Art papers presented at 1970 Specialty Conference on Lateral Stresses in the Ground and Design of Earth Retaining Structures, American Society of Civil Engineers, June 22-24, 1970, pp 103-147). Substantiate the input data used in both these analyses, and verify that your dynamic finite element lateral pressure results are sufficiently conservative, and loads due to adjacent buildings have been properly taken into account.

Response

The finite element method was used in evaluating the effects of rock-structure interaction on the Category I structure including the dynamic lateral pressures. Specific details of this finite element analysis are discussed in FSAR Subsection 3.7.2.4.

The rock shear modulus used in the finite element anaysis is 400 KSI for the SSE and 417 KSI for the OBE which correspond to an average shear strain of 1×10^{-4} in./in. and 6×10^{-5} in./in. respectively. The average damping ratio is 2.5 percent for SSE and 2.2 percent for OBE. These values were obtained from the rock column studies described in Appendix 3.7A.

The ground water level assumptions only affect the rock unit weight in the finite element analysis. A constant saturated unit weight of 128 lb/ft^3 was used in the analysis. The seismic input motion used in the analysis is described in FSAR Section 3.7.1.

Question 241.18

Response (Cont'd)

The dynamic lateral pressure value used for design of the Category I structure exterior walls that was based on rock-structure interaction analysis is 10.27 Kips/ft^2. As requested, the Seed and Whitman approach was followed in calculating an alternate value. The input to this aproach consists of a conventional static lateral pressure distribution plus a dynamic lateral pressure increment based on the Mononabe-Okabe approach. Also included in the Seed and Whitman calculation is a hydrostatic lateral pressure based on a ground water table at elevation 355 ft. and a lateral pressure increase due to the surcharge effect of the adjacent structures (turbine pedestal mat).

The design value for the dynamic lateral pressure calculated according to the Seed and Whitman approach is 4.7 Kips/ft.^{2}. This value is less than one-half of the value obtained by the rock-structure interaction approach (10.27 Kips/ft^2) that was actually used in the design. Therefore, the rock-structure interaction analysis that was used for dynamic lateral pressure determination was conservative.

Question No.

241.19 (2.5.4) The staff finds that your description of the tuff beds given in various subsections of the FSAR Setion 2.5.4, is inconsistent. In Subsection 2.5.4.2.1, you state that tuff beds could affect the Category I structures whereas in Subsection 2.5.4.1.4 you imply that tuff beds 1 and 2 are not present near the plant site below the foundation elevation (326 feet) and tuff beds 3 and 4 are located very deep below the foundations and may not affect the plant foundation. Revise these sections to make them consistent. Also give the thickness of the tuff beds in individual borings that are in the proximity of Category I structures, discuss their characteristics and describe the significance of the pressure of these layers in your static and dynamic analysis assumptions.

Response In response to the question, FSAR Subsection 2.5.4.2.1 will be amended to provide consistency with Subsection 2.5.4.1.4.

The following are the borings in the proximity of Category I structures which exhibit tuff bed 1:

Boring #	Tuff Bed Thickness	Boring #	Tuff Bed Thickness
A-3	3'	B-21	9'
A-23	10'	B-22	9'
		B-23	11'
B-1	10'	B-24	9'
B-2	7'	B-25	10'
B-3	8'	B-26	10'
B-4	10'	B-32	11'
B-13	8'	B-34	9'
B-14	8'	B-35	9'
B-15	10'	B-36	9'
B-16	9'		
B-17	8'	D-1	9'
B-18	10'	D-5	7'
B-19	8'	D-6	1'
B-20	7'		

In all of the above borings, except B-1, B-4, B-13, B-14, B-15, B-32 and D-5, the indicated tuff bed has been removed during excavation.

The tuff below plant grade is coarse to fine grained and of low to moderate hardness, much the same as the weathered and fresh sandstone. On the basis of strength testing, the engineering properties of the tuff do not differ significantly from those of the weathered and fresh sandstone. The tuff beds are not zones

Question 241.19

Response (Cont'd)

of structural weakness and there is no evidence of bedding planes between the tuff layers and the sandstone. Therefore, based on the preceeding, the static and dynamic design values for the tuff were selected as identical to those of the weathered and fresh sandstone.

formation: residual soil, weathered sandstone, fresh sandstone, and tuff. Residual soil and weathered sandstone are differentiated on the basis of standard penetration resistance value N = 100 bl/ft and coreability. Weathered sandstone and fresh sandstone are differentiated on the basis of color change. Tuff beds are differentiated on the basis of color, hardness, and mineralogy.

The plant grade is established at EL. 390 through a cut and fill operation that removed residual soil at the plant location. The Category I structures are founded on sandstone. Therefore, subsurface materials that ~~could affect~~ exist below the Category I structures are fresh sandstone, weathered sandstone, and tuff beds. The static and dynamic properties of these materials were determined by field measurements and laboratory tests and are discussed below and summarized in Tables 2.5-15 through 2.5-17.

2.5.4.2.2 Properties of Fresh Sandstone

The fresh sandstone underneath the foundation of the Category I structure is of low to moderate hardness, fresh, gray, medium to fine grained; see App. 2.5A for classification criteria. The mineralogy of the fresh sandstone is described in Appendix 2.5I.

2.5.4.2.2.1 Static Properties

Static properties determined include index properties, compressive strength, and deformation properties.

2.5.4.2.2.1.1 Index Properties

Index properties determined on rock specimens include saturation water content, saturated and dry unit weight, specific gravity, core recovery, and rock quality designation (RQD). Saturation water content, dry and saturated unit weight, and specific gravity were determined in general accordance with ASTM Standards. Details of test procedures and results are presented in Appendix 2.5B.

Core recovery is defined as the length of core recovered divided by the length of the core run, expressed as a percentage. Core recovery values were computed for all cores of the A-series, B-series, D-series, L-series and CT-series borings; and results are presented in Appendix 2.5A.

Rock quality designation (RQD) is defined as the total length of sound core pieces, four in. long and over, divided by the length of the core run, expressed as a percentage. In case of cores broken by mechanical fractures during drilling or handling (i.e., the fracture surfaces are fresh, irregular breaks rather than natural joint surfaces), the fresh, broken pieces were fitted together and were counted as one piece provided they formed the requisite length of four in. RQD values were computed for all cores of the

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Question No.

241.21 (SRP 2.5.4) Provide the values of soil properties used in the seismic analysis of the buried pipes. Explain your procedure for calculating dynamic axial and bending stresses and provide the seismic input used for this analysis. Verify that you have adequately accounted for the effect of changes in soil properties in your analysis, along with the proper use of intensification factors at bends.

Response

For the analysis of the portion of buried piping which is fully-restrained by the soil, the "pipe moves with the ground" assumption is used. The maximum axial, bending and shear stresses due to compressional wave and shear wave are calculated separately using the stress formulas presented by Newmark (Reference 1) and Yen (Reference 2). The seismic input used in the analysis consists of the velocities of wave propagation in the soil, maximum acceleration and velocity of free field earthquake motion.

Since the maximum stresses due to various seismic waves do not occur simultaneously, the maximum combined seismic stress is calculated by the SRSS method using the principal stress formula.

The procedure used in the design of the buried piping systems is based on the assumption as committed in the FSAR that buried piping systems are embedded in the class A1 compact soil of sufficient density so that liquefaction shall not take place and backfill will not lose its integrity. The soil properties used in the analysis of buried piping were obtained by laboratory testing as described in Subsection 2.5.4.5.3, 2.5.4.11 and Table 2.5-27 of the FSAR.

The design procedure takes into account the soil friction and slippage effect, soil subgrade reaction, seismic soil strain, elbow flexibility and soil resistance to ovalization. The pipe/soil relative movement, bending moment and pipe stresses including the intensification factor for the buried elbow/bend are calculated accordingly.

Reference

1. N. M. Newmark, "Earthquake Response Analysis of Reactor Structures," Nuclear Engineering and Design, Vol. 20, pp. 303-322 (1972).

2. G. C. K. Yeh, "Seismic Analysis of Buried Metal or Concrete Pipes," April 1974.

Question No.

241.22 (SRP 2.5.4) Your summary of the results of field compaction testing does not provide sufficient detail for an adequate review. Present the results of field density and moisture content tests performed in conjunction with quality control of all backfill placement under and adjacent to safety related structures. Present the results, in a format that will allow ready verification of compliance with compaction specifications, for each Category I structure separately (i.e., present separate data for each seismic Category I structure, electrical duct banks, manholes, and pipelines, as appropriate).

Response Quality Class I structural fill will be required under and adjacent to the following safety related structures, pipelines and duct banks.

- Reactor Auxiliary Building access ramp
- Auxiliary Feedwater pipelines (Designation AF)
- Chemical and Volume Control pipelines (Designation CH)
- Component Cooling pipelines (Designation CC)
- Diesel Generator Fuel Oil Storage and Transfer System (Designation EG)
- Class IE Duct Lines from Reactor Auxiliary Building to Dry Cooling Tower and Refueling Water Storage Tank Area

The results of all field density and moisture content tests performed in conjunction with backfill placement under and adjacent to safety related structures will be provided as construction progresses.

At present, the only Category I backfills that have been placed, are soil-cement used to backfill the ramps adjacent to Unit 3 and Class A1 structural fill along the Auxiliary Feedwater pipelines. The results of the field density and moisture content tests for these activities are attached.

WPPSS Specification 3240-466, "Soil-Cement and Structural Backfill," requires the soil-cement to be placed at a moisture content of 10.4% $\pm$ 2% compacted to 95% of the maximum density obtained from Standard Proctor Tests ASTM D558-57.

As can be seen from the soil-cement results (Attachment 1), 92 of the 96 moisture content tests met the moisture content criteria and 95 of the 96 compaction tests met the density

Question No. 241.22

Response (Cont'd)

criteria. The one failing test was compacted to 94.7%. The mean percent compaction is 104.1%. These results are well within the acceptable percentage range for tests meeting the acceptance criteria. Note that the test numbers for this area indicates 97 but there is no test for number 68; so that there are only 96 tests as noted above.

A review of the results of the in-place density tests for Class A1 structural fill (Attachment 2) along the Auxiliary Feedwater pipelines shows that the backfill meets or exceeds the 95% compaction criteria obtained from the Modified Proctor Test ASTM D1557-78. Areas tested that initially did not meet tne density requirement, were recompacted and retested until the acceptance criteria was achieved. The retest areas are designated as tests R1, R2, etc (e.g., Test Number 8514R1). The final mean percent compaction is 96.3% for this area. Note that there are no test numbers 8543, 8544 or 8548.

Attachment I

Q 241.22

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SHEET 1 OF 7

OFS NO. ______ DEPT. NO. ______

RESULTS OF FIELD COMPACTION TESTING

DATE TESTED	TEST NUMBER	LOCATION	ELEVATION	MOISTURE CONTENT (%)	COMPACTION (%)	MATERIAL AND ACCEPTANCE CRITERIA
	SSSC #	RAB #3 Access Ramp, SW Corner				Soil-Cement: Moisture Content 10.4% ± 2%
6-2-80	1		+341.00	9.6	101.7	
	2		+341.00	9.5	95.9	Compaction 95%
	3		+341.50	9.7	99.7	
6-3-80	4		+342.00	9.3	106.2	
	5		+342.00	9.5	105.6	
	6		+342.00	10.5	106.9	
	7		+342.50	10.8	106.4	
	8		+342.50	9.8	103.9	
	9		+342.50	10.4	104.2	
	10		+341.75	10.8	101.9	
	11		+342.30	10.3	104.7	
	12		+343.00	10.9	101.5	
	13		+343.00	10.5	105.4	
	14		+343.00	10.7	103.2	
	15		+343.00	10.5	113.2	
	16		+343.50	10.3	104.9	
	17		+343.50	10.0	104.5	
	18		+344.50	10.5	102.0	
6-4-80	19		+345.00	10.0	105.8	
	20		+345.50	9.6	106.7	

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DATE TESTED	TEST NUMBER	LOCATION	ELEVATION	MOISTURE CONTENT (%)	COMPACTION (%)	MATERIAL AND ACCEPTANCE CRITERIA
6-4-80 (cont.)	21	RAB #3 ACCESS RAMP, SW CORNER	+346.00	9.6	103.3	SOIL-CEMENT
	22		+346.00	10.2	104.4	
	23		+346.80	9.5	104.5	MOISTURE CONTENT 10.4% ± 2%
	24		+347.50	10.8	108.0	
	25		+347.50	9.8	109.0	
	26		+347.50	9.6	105.3	
	27		+348.20	9.9	106.7	COMPACTION 95 %
	28		+348.20	10.0	106.2	
	29		+348.20	10.2	104.8	
	30		+349.30	10.2	105.0	
	31		+350.00	9.3	103.8	
	32		+350.00	10.0	98.2	
	33		+351.00	10.2	103.0	
	34		+351.00	10.1	105.0	
	35		+352.00	9.6	110.6	
6-5-80	36		+352.00	10.2	107.7	
	37		+353.00	9.8	109.3	
	38		+353.00	10.0	100.8	
	39		+354.00	9.6	107.3	
	40		+355.00	11.4	101.3	
	41		+356.00	11.5	101.4	
	42		+357.00	11.5	96.7	
	43		+356.00	12.5	99.1	
	44		+357.00	12.4	101.1	
	45		+357.50	12.6	104.6	
	46		+357.50	10.6	101.7	

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DATE TESTED	TEST NUMBER SSSC #	LOCATION	ELEVATION	MOISTURE CONTENT (%)	COMPACTION (%)	MATERIAL AND ACCEPTANCE CRITERIA
6-5-80 (cont.)	47	RAB #3 ACCESS	+ 358.50	7.9	100.5	SOIL-CEMENT
	48	RAMP, SW CORNER	+ 358.50	8.6	100.2	
	49		+ 358.50	10.3	106.4	MOISTURE
	50		+ 359.00	10.5	107.3	CONTENT
	51		+ 360.00	11.3	102.0	10.4% ± 2%
	52		+ 360.00	10.0	99.0	
	53		+ 361.00	10.7	106.8	COMPACTION
	54		+ 361.00	11.7	101.3	95%
6-6-80	55		+ 362.00	10.9	102.4	
	56		+ 362.00	12.0	107.4	
	57		+ 363.00	11.4	98.2	
	58		+ 364.00	11.3	99.1	
	59		+ 364.00	11.5	105.9	
	60		+ 364.50	10.1	103.1	
	61		+ 365.00	10.3	107.1	
	62		+ 365.50	10.2	101.2	
	63		+ 366.50	10.7	105.3	
	64		+ 366.50	11.0	105.2	
	65		+ 367.50	11.3	102.8	
	66		+ 367.50	9.9	105.3	
	67		+ 368.50	10.3	102.6	
	69		+ 368.00	10.2	102.4	
	70		+ 369.00	10.0	100.4	
	71		+ 369.00	10.5	103.4	
	72		+ 369.50	9.0	105.1	
6-12-80	73		+ 371.00	10.5	102.8	

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DATE TESTED	TEST NUMBER	LOCATION	ELEVATION	MOISTURE CONTENT (%)	COMPACTION (%)	MATERIAL AND ACCEPTANCE CRITERIA
6-12-80 (cont.)	SSSC # 74	RAB #3 Access Ramp, SW Corner	+371.00 ±	9.9	103.3	Soil-Cement
	75		+371.80	9.6	100.8	
	76		+374.50	6.5	102.3	Moisture Content 10.4% ± 2%
	77		+374.00	8.9	104.6	
	78		+374.80	9.0	107.0	
	79		+375.00	10.8	112.1	
6-13-80	80		+374.50	10.0	103.3	Compaction 95%
	81		+376.00	11.1	106.2	
	82		+375.50	10.0	101.9	
	83		+376.80	10.3	109.5	
	84		+378.00	10.0	107.0	
	85		+377.80	8.8	105.5	
	86		+378.90	9.3	105.8	
	87		+380.00	9.5	103.3	
	88		+380.00	9.4	107.5	
	89		+381.00	9.3	107.3	
	90		+381.00	10.1	109.4	
6-16-80	91		+382.00	9.3	105.4	
	92		+382.00	11.0	107.9	
	93		+383.00	10.3	102.8	
	94		+383.25	10.7	101.0	
	95		+384.00	10.0	105.4	
	96		+385.00	10.0	105.4	
	97		+386.00	10.9	94.7	

Attachment 2

BY A. Schechter DATE 5/24/83

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DATE TESTED	TEST NUMBER	LOCATION	ELEVATION	MOISTURE CONTENT (%)	COMPACTION (%)	MATERIAL AND ACCEPTANCE CRITERIA
	SSFDR #	SE CORNER RAB-3 AUXILIARY FEEDWATER PIPES.				CLASS A1 FILL
6-25-82	754		+385.00	7.9	96.5	95% MINIMUM COMPACTION
3-24-83	8501		+383.00	9.2	97.7	
	8502		+383.50	9.8	96.4	
	8503		+384.00	9.7	95.8	
	8504		+384.50	9.3	97.0	
	8505		+385.00	9.7	95.9	
	8506		+385.50	9.3	96.9	
	8507		+386.00	9.5	96.6	
	8508		+386.50	9.1	96.6	
	8509		+387.00	9.3	96.5	
	8510		+387.50	9.3	95.3	
4-4-83	8511		+388.00	8.3	95.0	
	8512		+388.50	8.0	96.5	
	8513		+389.00	9.2	95.9	
	8514		+383.67	11.2	93.5	-
	8514 R1		+383.67	11.1	93.7	-
	8515		+389.50	9.6	94.0	-
	8514 R2		+383.67	12.1	92.5	-
	8515 R1		+389.50	10.7	93.8	-
4-5-83	8514 R3		+383.67	10.8	94.8	-
	8515 R2		+389.50	9.2	95.6	-
	8514 R4		+383.67	10.8	94.1	-
	8514 R5		[illegible]	[illegible]	[illegible]	

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DATE TESTED	TEST NUMBER	LOCATION	ELEVATION	MOISTURE CONTENT (%)	COMPACTION (%)	MATERIAL AND ACCEPTANCE CRITERIA
	JSFDC #	SE CORNER RAB-3 AUXILIARY FEEDWATER PIPES				CLASS A1 FILL
4-5-83	8516		+384.17	8.6	95.9	
	8517		+384.67	8.2	98.5	95%
	8518		+385.17	9.4	96.5	MINIMUM
	8519		+385.67	8.8	97.8	COMPACTION
	8520		+386.17	8.4	98.0	
	8521		+379.50	9.1	94.7	-
	8522		+386.50	8.3	96.0	
	8521 R1		+379.50	10.4	95.0	
	8523		+380.00	11.5	94.5	-
	8523 R1		+380.00	10.7	94.9	-
	8523 R2		+380.00	8.5	96.3	
	8524		+380.50	9.3	94.5	-
	8524 R1		+380.50	9.9	95.0	
	8525		+381.00	7.2	95.3	
	8526		+381.50	8.8	95.6	
	8527		+382.00	9.3	96.1	
	8528		+382.50	8.4	95.3	
	8529		+383.00	7.5	95.3	
	8530		+383.50	8.5	94.3	-
	8530 R1		+383.50	8.0	95.8	
	8531		+384.00	8.6	95.3	
	8532		+384.50	8.2	95.3	
4-6-83	8533		+385.00	8.3	97.1	
	8534		+385.50	8.1	96.4	
	8535		+386.00	8.0	95.1	

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SUBJECT NRC QUESTION 241.22

DATE TESTED	TEST NUMBER	LOCATION	ELEVATION	MOISTURE CONTENT (%)	COMPACTION (%)	MATERIAL AND ACCEPTANCE CRITERIA
	JSFDR #	SE CORNER RAB-3 AUXILIARY FEEDWATER PIPES				CLASS A1 FILL
4-6-83	8536		+386.50	8.5	96.0	
	8537		+387.00	7.7	97.2	95%
	8538		+387.50	8.7	94.0 -	MINIMUM
	8538 R1		+387.50	9.6	95.9	COMPACTION
	8539		+388.00	7.9	96.9	
	8540		+388.50	7.8	97.4	
	8541		+389.00	8.0	96.2	
	8542		+389.50	7.9	94.9 -	
	8542R1		+389.50	8.0	96.2	
4-7-83	8545		+388.00	7.1	97.6	
	8546		+388.50	6.9	95.1	
	8547		+389.00	6.8	96.7	
	8549		+389.50	7.3	99.7	

Question No.

241.24 (2.5.4) Your response to Question No. 241.9 is inadequate. This response indicated that the basis for selecting a 570 ft. depth of rock column for the deconvolution analysis is given in Subsection 3.7.2.4.1. Our review of this subsection reveals that the requested information is not contained in Subsection 3.7.2.4.1.

Note that the WNP-3 site is essentially a rock site. Again, provide your justification for use of deconvolution as well as your basis for selecting a 570 ft. deep rock column for deconvolution.

Response A 570 ft. depth of rock was selected not for the mere purpose of applying the deconvolution analysis, but as the depth of the finite elements rock-structure model based on the results of the sensitivity studies as described in Subsection 3.7.2.4.1(b) of the FSAR as follows:

> "In order to determine the depth of the finite element model, the rock depth under the mat was gradually increased until no differences in response of the buildings could be detected. The depth of interaction from the sensitivity studies was found to extend to EL. - 180 ft. MSL (570 ft. below grade). This depth was, therefore; chosen as the lower boundary of the finite element models."

Use of the finite element approach necessitates generation of a time-history input motion to be applied at the bottom boundary of the finite element model. The deconvolution analysis using the SHAKE computer program was then used as a means of obtaining such an input motion.

The analysis procedure used for deconvolution, as described in Subsection 3.7.1 of the FSAR, satisfied the acceptance criteria of Subsection 3.7.1 of the Standard Review Plan (NUREG 75/087).

The response to the NRC SEB Question 220.13 contains additional discussion on the subject of deconvolution.

Question No.

241.25 (SRP 2.5.4) In response to Question No. 241.3, you have indicated that the as-built loading on the Containment Building foundation is 13.6 k/ft^2, and not 8 k/ft^2 as previously reported in the PSAR. Revise the affected sections of the FSAR to reflect this change and provide the results of your revised calculations for bearing capacity, estimated settlement of the mat, static and dynamic lateral earth prssures and slope stability analysis results under the revised static and dynamic loadings.

Response The appropriate sections of the FSAR have been revised to reflect the change in the as-built loading from 8 k/ft^2 to 13.6 k/ft^2, as discussed below.

Ultimate bearing capacities for the Category I foundation mat were calculated as described in Subsection 2.5.4.10.1. The values for bearing capacities provided in the response to question 241.3 were based on the updated foundation mat data, including the 13.6 k/ft^2 loading and the 298 ft. x 310 ft. dimensions.

Estimated settlement of the mat is discussed in Subsection 2.5.4.11.8. It will be revised to reflect the updated data.

The static lateral earth pressures discussed in Subsection 2.5.4.11.9, will not be affected by the revised loading. The dynamic lateral earth pressures (Subsection 2.5.4.11.10) were established by rock-structure interaction analysis which incorporated the mass and stiffness properties corresponding to the updated foundation loading of 13.6 k/ft^2.

Both the static and dynamic slope stability analyses have been rerun as described in the response to question 241.6 using the revised foundation loading. The results of this reannalysis have been presented in the revised Subsections 2.5.5.2.2 and 2.5.5.2.3 (Amendment No. 3, dated April 1983).

shear strength into account and selecting a conservative rupture angle of 20^o (this is only one-half of the minimum rupture angle measured in the laboratory in uniaxial compression tests), the equation for the bearing capacity of the common mat at EL. 326 becomes:

$$q_{ult} = 2160\,\bar{\gamma} + 29\ C$$

where: $\bar{\gamma}$ = effective unit weight

C = effective cohesion

Using typical values for the effective unit weight and neglecting the effect of cohesion (Table 2.5-15), the ultimate bearing capacity is found to be in the order of 274 k/ft^2. The bearing stresses beneath the common mat of Category I structure are on the order of 8 k/ft^2 resulting in a minimum factor of safety of 34. In light of the conservative assumptions made in computing the bearing capacity and the resulting factor of safety, bearing capacity is not a factor in design of the plant.

2.5.4.11.8 Design Criteria for Displacement 2

The average displacement of the Category I structures on a common mat was due to the recompression of the fresh sandstone underneath the foundation mat placed at EL. 326. This displacement was caused by the gradual reloading of the fresh sandstone during construction to the bearing stresses of 13.6 approximately 8 k/ft^2. This displacement was elastic in nature and most of it took place during construction. The post-construction displacement is computed using the equation presented in Subsection 2.5.4.10.2 to be less than one-~~quarter~~ half inch (.42) and the differential displacement will be even smaller. Therefore, displacement is not a factor in the design of the plant.

2.5.4.11.9 Design Criteria for Static Lateral Pressures 2

The static lateral pressures to be applied to the Category I structures on the common mat are discussed in detail in Subsection 2.5.4.10.4. In summary, these pressures will be computed as follows:

a) Although the water table will be permanently depressed to the elevation of the common mat, the lower 39 feet of the exterior walls will be designed for hydrostatic pressure to allow for pressure build-ups due to the spacing of the drainage system pipes.

b) To account for minor long-term elastic deformation and creep effects, the exterior walls were designed for the conservative case of full active lateral pressure. This assumes complete relaxation of the cohesion component of shear strength and only considers the frictional component.

c) For computing the lateral pressure due to the surcharge effect of adjacent structures, the exterior walls were designed using the

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281.7 (SRP 9.3.5) The information you provided on the Post-Accident Sampling System (PASS) is inadequate to demonstrate compliance with NUREG-0737, II.B.3. The PASS will be evaluated for compliance with the criteria from NUREG-0737, II.B.3. FSAR Subsection 9.3.5 partially meets some of these criteria. These 11 items have been copied verbatim from NUREG-0737. System schematics with sufficient information to verify flow paths should be included, consistent with documentation requirements in NUREG-0737, with appropriate discussion so that the reviewer can determine whether the criteria have been met. Further information pertaining to the specific clarifications of NUREG-0737, which will be considered;

Criterion: (1) The licensee shall have the capability to promptly obtain reactor coolant samples and containment atmosphere samples. The combined time allotted for sampling and analysis should be three hours or less from the time a decision is made to take a sample.

Clarification: Provide information on sampling(s) and analytical laboratories locations during a discussion of relative elevations, distances and methods for sample transport. Responses to this item should also include a discussion of sample recirculation, sample handling and analytical times to demonstrate that the three-hour time limit will be met (see (6) below relative to radiation exposure). Also describe provisions for sampling during loss of offsite power (i.e., designate an alternative backup power source, not necessarily the vital (Class IE) bus, that can be energized in sufficient time to meet the three-hour sampling and analysis time limit).

Response

The liquid Post-Accident Sampling System sampling station is Skid No. 2. This skid is located at EL. 402 ft., approximately ten (10) feet from the analysis lab, across a corridor (see Figure 1.2-11). The system produces three (3) types of samples, each of which has its own transport container (see Subsection 9.3.5) to facilitate delivery of the Sample to the adjacent lab.

The system design is a once through flow path. (See Figure 9.3.5-1.) No recirculation is required. The time required to flush the system and obtain the samples required is 22.5 minutes.

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281.7 The loss of offsite power will not impact on the reactor coolant pass. Power is available from the Static Uninterruptable Power Supply (SUPS).

For a description of the Containment Atmosphere Post-Accident Sampling System (CA-PASS) see Subsections 6.2.5.3.4 for design analysis and sample times and 6.2.5.2.4.2 for power availability (both subsections are attached).

Consistent with previous Supply System correspondence Procurement of Laboratory Equipment has been suspended until construction activities are resumed at WNP-3.

At that time Laboratory equipment will be designated and procured to meet applicable NRC Requirements.

Criterion: (2) The licensee shall establish an onsite radiological and chemical analysis capability to provide, within the three-hour time frame established above, quantification of the following:

(a) certain radionuclides in the reactor coolant and containment atmosphere that may be indicators of the degree of core damage (e.g., noble gases; iodines and cesiums, and non-volatile isotopes);

(b) hydrogen levels in the containment atmosphere;

(c) dissolved gases (e.g., H_2), chloride (time allotted for analysis subject to discussion below), and boron concentration of liquids;

(d) alternatively, have in-line monitoring capabilities to perform all or part of the above analyses.

Clarification: (a) A discussion of the counting equipment capabilities is needed, including provisions to handle samples and reduce background radiation (ALARA). Also, a procedure is required for relating radionuclide concentrations to core damage. The procedure should include:

1. Monitoring for short- and long-lived volatile and non-volatile radionuclides such as Xe-133, I-131, Cs-137, Cs-134, Kr-85, Ba-140, and Kr-88 (see Vol. II, Part 2, pp. 524-527 of Rogovin Report for further information).

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2. Provisions to estimate the extent of core damage based on radionuclide concentrations and taking into consideration other physical parameters such as core temperature data and sample location.

(b) Show a capability to obtain a grab sample, transport and analyze for hydrogen.

(c) Discuss the capabilities to sample and analyze for the accident sample species listed here and in Regulatory Guide 1.97 Rev. 2.

(d) Provide a discussion of the reliability and maintenance information to demonstrate that the selected on-line instrument is appropriate for this application. (See (8) and (10) below relative to backup grab sample capability and instrument range and accuracy.)

Response

2 (a) Consistent with previous Supply System correspondence Procurement of Laboratory Equipment has been suspended until construction activities are resumed at WNP-3.

At that time Laboratory equipment will be designated and procurement to meet applicable NRC Requirements.

2 (b) See FSAR Subsection 6.2.5.2.1 for description of in-line hydrogen analyzer for containment atmosphere.

2 (c) Capability to sample is discussed in items 2(b) and 2(d).

Consistent with previous Supply System correspondence Procurement of Laboratory Equipment has been suspended until construction activities are resumed at WNP-3.

At that time Laboratory equipment will be designated and procurement to meet applicable NRC Requirements.

2 (d) Refer to FSAR Subsection 9.3.5.1 d, f, g and h for a listing of liquid PASS in-line instrumentation. Subsection 9.3.5.2 discusses the location of the in-line equipment. Subsection 9.3.5.3 addresses the safety evaluation and reliability of the equipment. Maintenance of the in-line instruments is facilitated by the system design (see Figure 9.3.5-1). The design includes the following features: the location of all lines with in-line instrumentation on a common skid

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281.7 (Skid No. 2) in an accessible area; purging and flushing system using deionized water for liquid lines and N_2 for gas lines; routing of purging and flushing flow to containment; in-line automatic calibration of instruments; and probe and probe holder design selected to facilitate replacement.

Containment Atmosphere Hydrogen Analyzer design evaluation addressed in Subsection 6.2.5.3.1.

Criterion: (3) Reactor coolant and containment atmosphere sampling during post-accident conditions shall not require an isolated auxiliary system [e.g., the letdown system, Reactor Water Cleanup System (RWCUS)] to be placed in operation in order to use the sampling system.

Clarification: System schematics and discussions should clearly demonstrate that post-accident sampling, including recirculation, from each sample source is possible without use of an isolated auxiliary system. It should be verified that valves which are not accessible after an accident are environmentally qualified for the conditions in which they must operate.

Response

The sample lines used by the PASS for obtaining samples from and returning samples to the containment are at penetration 56 and 57, respectively. The containment isolation valves are Safety Class 2 seismic Category I valves. The capability for overriding the Containment Isolation Actuation Signal (CIAS) for these valves is provided. The valves on Skids 1 and 3 (Figure 9.3.5-1) are environmentally qualified.

CA-PASS operation is addressed in Subsection 6.2.5.2.4.2 (attached).

Criterion: (4) Pressurized reactor coolant samples are not required if the licensee can quantify the amount of dissolved gases with unpressurized reactor coolant samples. The measurement of either total dissolved gases or H_2 gas in reactor coolant samples is considered adequate. Measuring the O_2 concentration is recommended, but is not mandatory.

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Clarification: Discuss the method whereby total dissolved gas or hydrogen and oxygen can be measured and related to Reactor Coolant System concentrations. Additionally, if chlorides exceed 0.15 ppm, verification that dissolved oxygen is less than 0.1 ppm is necessary. Verification that dissolved oxygen is less than 0.1 ppm by measurement of a dissolved hydrogen residual of 0.1 cc/kg is acceptable for up to 30 days after the accident. Within 30 days, consistent with ALARA, direct monitoring for dissolved oxygen is recommended.

Response

Refer to Figure 9.3.5-1. The liquid is drawn continuously from the bottom of the separator and passed through a magnetic flow meter/controller. The flow rate is continuously indicated and recorded on the control panel in cc/min. Dissolved oxygen is monitored in-line by using a dissolved oxygen probe. The dissolved oxygen concentration is indicated and recorded on the control panel. The purging N_2 used in the gas separator is controlled at 1000 cc/min by a mass flow controller and recorded on the panel in scc/min. The gas withdrawn continuously from the separator passes through a linear mass flow meter and the flowrate is recorded on the panel (scc/min). The hydrogen concentration is arrived at by the following:

$$H_2 = \frac{H_2\ (G - G_{N_2})\ \text{scc of } H_2}{F \quad \text{cc of Reactor Coolant}}$$

where: G - Total gas flow, $\left(\frac{scc}{min}\right)$

G_{N_2} - Nitrogen Sparging Flow (scc) set at 1000 scc. Controlled, indicated, and recorded on the control panel.

F - Reactor coolant sample flow (Kg/min)

The dissolved oxygen concentration is read directly from the panel.

Criterion: (5) The time for a chloride analysis to be performed is dependent upon two factors: (a) if the plant's coolant water is seawater or brackish water and (b) if there is only a single barrier between primary containment

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281.7 systems and the cooling water. Under both of the above conditions the licensee shall provide for a chloride analysis within 24 hours of the sample being taken. For all other cases, the licensee shall provide for the analysis to be completed within four days. The chloride analysis does not have to be done onsite.

Clarification: BWR's on sea or brackish water sites, and plants which use sea or brackish water in essential heat exchangers (e.g., shutdown cooling) that have only single barrier protection between the reactor coolant are required to analyze chloride within 24 hours. All other plants have 96 hours to perform a chloride analysis. Samples diluted by up to a factor of one thousand are acceptable as initial scoping analysis for chloride, provided (1) the results are reported as _____ppm Cl (the licensee should establish this value; the number in the blank should be no greater than 10.0 ppm Cl) in the Reactor Coolant System and (2) that dissolved oxygen can be verified at 0.1 ppm, consistent with the guidelines above in Clarification No. 4. Additionally, if chloride analysis is performed on a diluted sample, an undiluted sample need also be taken and retained for analysis within 30 days, consistent with ALARA.

Response

The source of cooling water for WNP-3 is fresh water. There is a double barrier between primary containment and the cooling water. Sample of reactor coolant shall be analyzed for chlorides at an offsite lab within four (4) days. Chloride analysis can be done on both diluted and undiluted samples. Oxygen levels are measured as stated in response to Criterion (4), above.

Criterion: (6) The design basis for plant equipment for reactor coolant and containment atmosphere sampling and analysis must assume that it is possible to obtain and analyze a sample without radiation exposures to any individual exceeding the criteria of GDC 19 (Appendix A, 10CFR Part 50) (i.e., 5 rem whole body, 75 rem extremities). (Note that the design and operational review criterion was changed from the operational limits of 10CFR Part 20 (NUREG-0573) to the GDC 19 criterion (October 30, 1979 letter from H. R. Denton to all licensees.))

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Clarification: Consistent with Regulatory Guide 1.3 or 1.4 source terms, provide information on the predicted man rem exposures based on person-motion for sampling, transport and analysis of all required parameters.

Response

For Obtaining Sample

Refer to Table 12A-7 (attached) under "Post-Accident Sampling":

grab sample from primary coolant loop and

grab sample from containment atmosphere.

For Transporting Sample

Refer to Table 12A-5 (attached), under post-accident grab sampling action (liquid)

and under post-accident grab sampling (containment air)

Criterion: (7) The analysis of primary coolant samples for boron is required for PWRs. (Note that Rev. 2 of Regulatory Guide 1.97 specifies the need for primary coolant boron analysis capability at BWR plants.)

Clarification: PWR's need to perform boron analysis. The guidelines for BWR's are to have the capability to perform boron analysis but they do not have to do so unless boron was injected.

Response

Since WNP-3 is a PWR, the capability to analyze primary coolant samples for Boron will be available on site.

Criterion: (8) If in-line monitoring is used for any sampling and analytical capability specified herein, the licensee shall provide backup sampling through grab samples, and shall demonstrate the capability of analyzing the samples. Established planning for analysis at offsite facilities is acceptable. Equipment provided for backup sampling shall be capable of providing at least one

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281.7 sample per day for seven days following onset of the accident, and at least one sample per week until the accident condition no longer exists.

Clarification: A capability to obtain both diluted and undiluted backup samples is required. Provisions to flush in-line monitors to facilitate access for repair is desirable. If an offsite laboratory is to be relied on for the backup analysis, an explanation of the capability to ship and obtain analysis for one sample per week thereafter until accident condition no longer exists should be provided.

Response

The liquid PASS has the capability of providing samples of diluted gas, diluted liquid and undiluted liquid once per day for seven (7) days following the onset of the accident. The capabilities to flush the lines containing in-line probes is provided.

Criterion: (9) The licensee's radiological and chemical sample analysis capability shall include provisions to:

(a) Identify and quantify the isotopes of the nuclide categories discussed above to levels corresponding to the source terms given in Regulatory Guides 1.3 or 1.4 and 1.7. Where necessary and practicable, the ability to dilute samples to provide capability for measurement and reduction of personnel exposure should be provided. Sensitivity of onsite liquid sample analysis capability should be such as to permit measurement of nuclide concentration in the range from approximately 1 uCi/g to 10 Ci/g.

(b) Restrict background levels of radiation in the radiological and chemical analysis facility from sources such that the sample analysis will provide results with an acceptably small error (approximately a factor of two). This can be accomplished through the use of sufficient shielding around samples and outside sources, and by the use of a ventilation system design which will control the presence of airborne radioactivity.

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Clarification: (a) Provide a discussion of the predicted activity in the samples to be taken and the methods of handling/dilution that will be employed to reduce the activity sufficiently to perform the required analysis. Discuss the range of radionuclide concentration which can be analyzed for, including an assessment of, the amount of overlap between post-accident and normal sampling capabilities.

(b) State the predicted background radiation levels in the counting room, including the contribution from samples which are present. Also provide data demonstrating what the background radiation levels and radiation effect will be on a sample being counted to assure an accuracy within a factor of two.

Response

a) Using Regulatory Guide 1.4 assumptions, (i.e., 100% NG, 50% I and 1% others), the sump water one hour post-LOCA will have an activity of 1.9×10^{10} photons/sec-cc. This water will be diluted by a factor of 1000 at the sample panel. The sample is handled in a shielded container and a sample size of approximately 5cc is assumed. If a .001cc sample is counted and a 1% counting efficiency is assumed, then the expected count rate will be 190 cps or 11,400 cpm. This counting rate is acceptable for most analyses, however, sample activity can be further varied by standard sample preparation techniques. These include further dilution of the sample in the laboratory, varying the amount of sample counted, and changing the counter geometry and hence the counting efficiency.

By proper sample preparation, the radiochemist can choose any counting rate between 10^6 and 10 cpm. There is no upper limit of concentration since, by dilution, the radiochemist can bring the counting rate down to the desirable range of 10^3-10^4 cpm which could be the same counting range as normal samples. The only concern is whether the sample is too hot to handle. The sump water sample diluted by a factor of 1000 will have dose rate of about 30 mr/hr at the surface of its shield container. For counting purposes only a small aliquot (.1 to .01 cc) will be taken out of the sample by using standard sample syringes. This same technique applies to gaseous sampling.

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281.7 For a discussion of the containment atmosphere sample activity, refer to Subsection 6.2.5.3.4 (attached).

b) The predicted background radiation levels in the counting room (located in the service building with a wall thickness of 2 ft.) is no more than 2.5 mr/hr since it is adequately separated from any high activity sources.

The diluted sample in the lead container will be in the radiochemistry lab and will not increase the background radiation in the counting room above 2.5 mr/hr.

The background radiation as seen by the detectors, which is shielded by several inches of lead, will be much lower.

Criterion: (10) Accuracy, range, and sensitivity shall be adequate to provide pertinent data to the operator in order to describe radiological and chemical status of the Reactor Coolant Systems.

Clarification: The recommended ranges for the required accident sample analyses are given in Regulatory Guide 1.97, Rev. 2. The necessary accuracy within the recommended ranges are as follows:

- Gross Activity, Gamma Spectrum: measured to estimate core damage, these analyses should be accurate within a factor of two across the entire range.

- Boron: measure to verify shutdown margin.

In general this analysis should be accurate within $\pm$5 percent of the measured value (i.e., at 5,000 ppm B the tolerance is $\pm$300 ppm while at 1,000 ppm B the tolerance is $\pm$50 ppm). For concentrations below 1,000 ppm the tolerance band should remain at $\pm$50 ppm.

- Chloride: measured to determine coolant corrosion potential.

For concentrations between 0.5 and 20.0 ppm chloride the analysis should be accurate within $\pm$10 percent of the measured value. At concentrations below 0.5 ppm the tolerance band remains at $\pm$0.05 ppm.

- Hydrogen or Total Gas: monitored to estimate core degradation and corrosion potential of the coolant.

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An accuracy of ±10 percent is desirable between 50 and 2,000 cc/kg but ±20 percent can be acceptable. For concentration below 50 cc/kg the tolerance remains at ±5.0 cc/kg.

- Oxygen: monitored to assess coolant corrosion potential.

For concentrations between 0.5 and 20.0 ppm oxygen the analysis should be accurate within ±10 percent of the measured value. At concentrations below 0.5 ppm the tolerance band remains at ±0.05 ppm.

- pH: measured to assess coolant corrosion potential.

Between a pH of five to nine, the reading should be accurate within ±0.3 pH units. For all other ranges ±0.5 pH units is acceptable.

To demonstrate that the selected procedures and instrumentation will achieve the above listed accuracies, it is necessary to provide information demonstrating their applicability in the post-accident water chemistry and radiation environment. This can be accomplished by performing tests utilizing the standard test matrix provided below or by providing evidence that the selected procedure or instrument has been used successfully in a similar environment.

Response

Consistent with previous Supply System correspondence Procurement of Laboratory Equipment has been suspended until construction activities are resumed at WNP-3.

At that time Laboratory equipment will be designated and procured to meet applicable NRC Requirements.

Criterion: (11) In the design of the post-accident sampling and analysis capability, consideration should be given to the following items:

(a) Provisions for purging sample lines, for reducing plateout in sample lines, for minimizing sample loss or distortion, for preventing blockage of sample lines by loose material in the RCS or containment, for appropriate disposal of the samples, and for flow restrictions to limit reactor coolant loss from a rupture of the sample line. The post-accident reactor coolant and containment atmosphere samples

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281.7 should be representative of the reactor coolant in the core area and the containment atmosphere following a transient or accident. The sample lines should be as short as possible to minimize the volume of fluid to be taken from containment. The residues of sample collection should be returned to containment or to a closed system.

(b) The ventilation exhaust from the sampling station should be filtered with charcoal absorbers and high-efficiency particulate air (HEPA) filters.

Clarification: (11)(a) A description of the provisions which address each of the items in Clarification 11.a should be provided. Such items, as heat tracing and purge velocities, should be addressed. To demonstrate that samples are representative of core conditions a discussion of mixing, both short- and long-term, is needed. If a given sample location can be rendered inaccurate due to the accident (i.e., sampling from a hot or cold leg loop which may have a steam or gas pocket) describe the backup sampling capabilities or address the maximum time that this condition can exist.

BWRs should specifically address samples which are taken from the core shroud area and demonstrate how they are representative of core conditions.

Passive flow restrictors in the sample lines may be replaced by redundant, environmentally qualified, remotely operated isolation valves to limit potential leakage from sampling lines. The automatic containment isolation valves should close on containment isolation or safety injection signals.

(11)(b) A dedicated sample station filtration system is not required, provided a positive exhaust exists which is subsequently routed through charcoal absorbers and HEPA filters.

Response

11 (a) The reactor coolant velocity in the liquid PASS is 15 ft./sec. This velocity is more than adequate to ensure purging. The liquid PASS system also has a "Y" type strainer as a backup to the purging flow rate to ensure against line blockage by loose material. The liquid is

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returned to the containment sump and gases are vented to the containment. The containment penetrations have flow restricting orifices to limit loss of reactor coolant from a sample line rupture. The design of the liquid PASS permits continuous analysis of a reactor coolant sample by the in-line monitoring equipment; this will negate the effect of short term transients. The sample point locations are the reactor coolant hot-leg and the SIS recirculation sump. The hot-leg is the NSSS provided sample point for primary sampling. These points were selected as being locations which would supply representative coolant samples. Since the PASS can withdraw a continuous sample it will be representative of the reactor conditions. Sample lines are as short as practical and are small bore pipe and tubing to minimize the volume of fluid to be taken from containment.

CA-PASS heat tracing provisions are addressed in FSAR Subsection 6.2.5.2.4.2 (attached). The flow velocities used for CA-PASS are described in FSAR Subsection 6.2.5.3.4 (attached).

(b) The sample cabinet vents to plant HVAC system which has both charcoal and HEPA filters.

Ventilation for the CA-PASS is described in Subsection 6.2.5.2.4.2 (attached).

Both sides of this sheet are affected

6.2.5 COMBUSTIBLE GAS CONTROL IN CONTAINMENT

Systems to control the concentration of hydrogen that may be released into containment following a LOCA are provided in accordance with General Design Criteria 41 of 10CFR50, Appendix A, and Regulatory Guide 1.7. These systems are the Containment Hydrogen Analyzers, the Containment Hydrogen Recombiners and the Containment Hydrogen Purge System. The design and functional capabilities of these systems are discussed in this section. In addition, the discuss of the containment atmosphere Post Accident Sampling System has been included in th section since it has been designed as an adjunct to t Containment Hydrogen Analyzer System.

6.2.5.1 Design Bases

The design bases for the systems to control combustible gases inside containment are:

a) Following a loss of coolant accident, to consider sources of hydrogen concentrations within the containment that are the result of:

1) hydrogen dissolved in reactor coolant that may come out of solution.

2) hydrogen production due to the metal-water reaction of zirconium in the reactor core with reactor coolant.

3) hydrogen generated by the radiolytic decomposition of water in the core or on the floor of the containment.

4) hydrogen produced due to corrosion of plant materials such as zinc, zinc-based paint and aluminum from exposure to containment spray solutions.

b) To ensure that hydrogen recombiners are located in the containment in positions where uniform mixing of the containment atmosphere occurs by natural circulation when either hydrogen recombiner is in operation.

c) To permit the sampling and measurement of hydrogen concentration at several points within the containment, for both positive and negative containment pressure, and alert operators in the Main Control Room of the need to activate the hydrogen recombiners or the Containment Hydrogen Purge.

d) To have the capability of controlling combustible gas concentrations in the containment atmosphere to less than four percent by volume as required by Regulatory Guide 1.7.

e) To perform the above functions assuming a single failure.

f) To withstand the dynamic affects associated with a LOCA.

g) To perform the above functions following, but not necessarily during, a Safe Shutdown Earthquake.

h) To remain operable when subjected to the post-accident environment.

i) To provide for testing and inspection during normal plant operation.

j) No sharing of combustible gas control equipment exists at this site.

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k) No portable hydrogen recombiner units are required for this site.

l) Since the recombiner units are located inside containment, protection of personnel from radiation in the vicinity of the recombiners is not required.

m) To provide the capability for containment purging as backup to hydrogen contol by recombination with oxygen in the improbable event that both recombiners fail.

The design bases of the Containment Atmosphere Post Accident Sampling System are described in Subsection 6.2.5.2.4.1

6.2.5.2 System Design

The design of the systems for combustible gas control are discussed herein.

6.2.5.2.1 Containment Hydrogen Analyzer

The piping and instrumentation diagram for the Containment Hydrogen Analyzer is shown on Figure 6.2-37. The Hydrogen Analyzer System piping, from the sample points within the containment and piping returning the sample to the containment up to and including all containment isolation valves, are designed and fabricated in accordance with ASME Section III, Class 2 (1974) and N-Stamped. In accordance with Appendix B of NUREG-0737 and the intent of Regulatory Guide 1.97 Rev. 2, the Hydrogen Analyzer System instrumentation and controls are Class IE and conform to IEEE 323-1974 and IEEE 344-1975. Table 3.2-1 and Figure 6.2-38 detail applicable codes and standards for the system. Each redundant subsystem consists of the sample and return piping, associated valves, hydrogen analyzer package, grab sample cylinder, control panel, recorder, separator cooler, instruments, nitrogen line and span gas line. |1

Each of the redundant subsystems can operate independently of the other, and is powered from an independent onsite power source. No single failure could result in a total loss of hydrogen concentration measurement capability.

All components of the system are accessible for periodic inspection and maintenance as shown on Figure 1.2-10. The system is completely independent of any system used during normal plant operation, so plant operation would not impose restrictions on such testing.

The system is initiated by manual operator action from the Control Room. No action outside the Control Room is necessary for system operation.

Once initiated, the system draws a continuous air sample from one of the sample points inside containment. The air is passed through the detector, analyzed, and pumped back into containment. Analyzer readings are recorded in the Control Room, and an alarm is actuated if concentration is above three percent. When sampling is completed at one point, the system closes the sampling valve at that point and opens the valve to the next point to begin measuring hydrogen concentration at that location.

Containment atmosphere hydrogen analysis can also be conducted via the Containment Atmosphere Post Accident Sampling System described in Subsection 6.2.5.2.4. ~~grab sample chamber. The grab sample chamber requires manual operation and not remote manual as in the hydrogen analyzer.~~ The hydrogen analyzer is relied upon as the primary means of sampling following a LOCA.

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6.2.5.2.4 Containment Atmosphere Post Accident Sampling System

6.2.5.2.4.1

Design Bases

The Containment Atmosphere Post Accident Sampling System (CA-PASS) is designed in accordance with the criteria stated in Regulatory Guide 1.97 Rev 2 and NUREG 0737, Section II.B.3. The design bases for the system are:

(1) to provide, with sufficient rapidity, a sample of containment atmosphere, so that analysis can be completed within 3 hours ~~of~~ from the time of decision to take a sample, without requiring the use of an isolated auxiliary system.

(2) to obtain samples suitable for analysis for hydrogen, and for gamma spectrum analysis for noble gases and iodines.

(3) to obtain, and permit analysis of, a sample without a dose to any person exceeding the criteria of GDC-19 of Appendix A to 10 CFR 50 (i.e., 5 rem whole body, 75 rem extremeties) assuming a fission product release per Reg Guide 1.4, Rev 2.

(4) to provide samples such that background radiation will be low enough to permit sample analysis with an error of approximately a factor of 2.

(5) to be capable of providing at least one sample per day for 7 days and at least one sample per week for the duration of the accident condition.

(6) to give design consideration to:

  (a) provisions for purging, reducing plateout, and preventing blockage in sample lines.

  (b) samples that are representative of the containment atmosphere following a transient or accident.

  (c) minimizing the volume of gas taken from containment and returning residues to containment.

  (d) providing ventilation exhaust from the sample station filtered with charcoal and HEPA filters.

(7) The CA-PASS is classified in Reg Guide 1.97 Rev 2 as Category 3 which specifies "high quality commercial grade" construction "selected to withstand the specific service environment". This equipment is therefore, classified as non-nuclear safety and is non-seismic Category I. The valves isolating this system from the Containment Hydrogen Analyzer System are Class 1E and operated from a Class 1E power source.

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6.2.5.2.4.2

System Description

The Containment Atmosphere Post Accident Sampling System (CA-PASS) consists of the Containment Atmosphere Sampling Panel (CASP), heat traced sample lines, and isolation valves which connect to and isolate from the sample lines of Containment Hydrogen Analyzer A(SA). The CASP piping and instrumentation diagram is shown in Figure 6.2-37A and the relationship to the Hydrogen Analyzer System is shown in Figure 6.2-38. Figure 6.2-38 shows that the CA-PASS can sample and recirculate to containment without use of an isolated auxiliary system. The CA-PASS is located in the RAB at elevation 362.5 ft in the vicinity of Containment Hydrogen Analyzer A(SA) as shown on Figure 1.2-10.

The CA-PASS is designed to facilitate laboratory analysis and limit dose to personnel by the use of a sampling panel designed to permit the collection of samples of the proper size for analysis so that the need for further dilution in the laboratory is minimized. For gas samples this is done by prior dilution, for condensate samples by the use of microliter range syringes to collect appropriate sample volumes.

Class IE isolation valves for the system, which are qualified to heat tracing temperatures, are operated from the control room so that the sample lines can be prepurged to limit the time the operator must spend at the CASP. The remainder of the sampling operation is done locally. Sample lines to the CASP are heat traced to prevent sample loss due to condensation in the lines.

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Samples may be taken from any of the Hydrogen Analyzer sample points as can be seen in Figure 6.2-38. Power input can be manually transferred to the plant diesel in the event of loss of off-site power.

The sample stream entering the CASP first passes through a cooler. The water vapor along with water soluble constituents are condensed into the H_2O Trap. The noncondensable portion of the sample passes through a ball valve with calibrated bore volume. Rotation of the ball valve permits a nitrogen stream to flush this trapped sample volume into the pre-evacuated dilution cylinder. A single bore volume will produce a dilution ratio of approximately 6×10^3. Sample concentration can be increased by introduction of multiple bore volumes.

Samples are taken by syringe. Separate samples are taken of diluted gas and condensate. Condensate samples as small as 1×10^{-3} cm^3 may be taken with microliter syringes. Gas samples of 1-10 cm^3 are expected. Samples are transferred to pre-evacuated septum sealed vials for transport to the laboratory. The low activity and low volume of the samples permit hand carry in light weight shields. At the conclusion of sampling the CA-PASS is purged with nitrogen, the dilution cylinder evacuated, and the isolation valves closed. Hydrogen sampling and analysis are provided by the on-line Containment Hydrogen Analyzers (Subsection 6.2.5.2.1.1). Backup grab samples of undiluted containment atmosphere may be taken by syringe for laboratory analysis.

Radiation protection to personnel is provided by an 18 inch thick concrete stub wall for shielding from direct radiation from containment and by the 2 inch thick lead shot filled CASP which shields against sample system activity (panel shielding is supplemented by 2 inches of solid lead in selected areas). Ventilation is provided by an internal exhaust blower which maintains the CASP under negative pressure and exhausts to the overhead HVAC return duct. The HVAC exhaust is filtered through HEPA and charcoal filters before leaving the plant.

The CA-PASS is tested periodically to assure operability as specified in the Technical Specifications. A design evaluation of the system is presented in Subsection 6.2.5.3.4.

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6.2.5.3.4 CA-PASS Design Evaluation

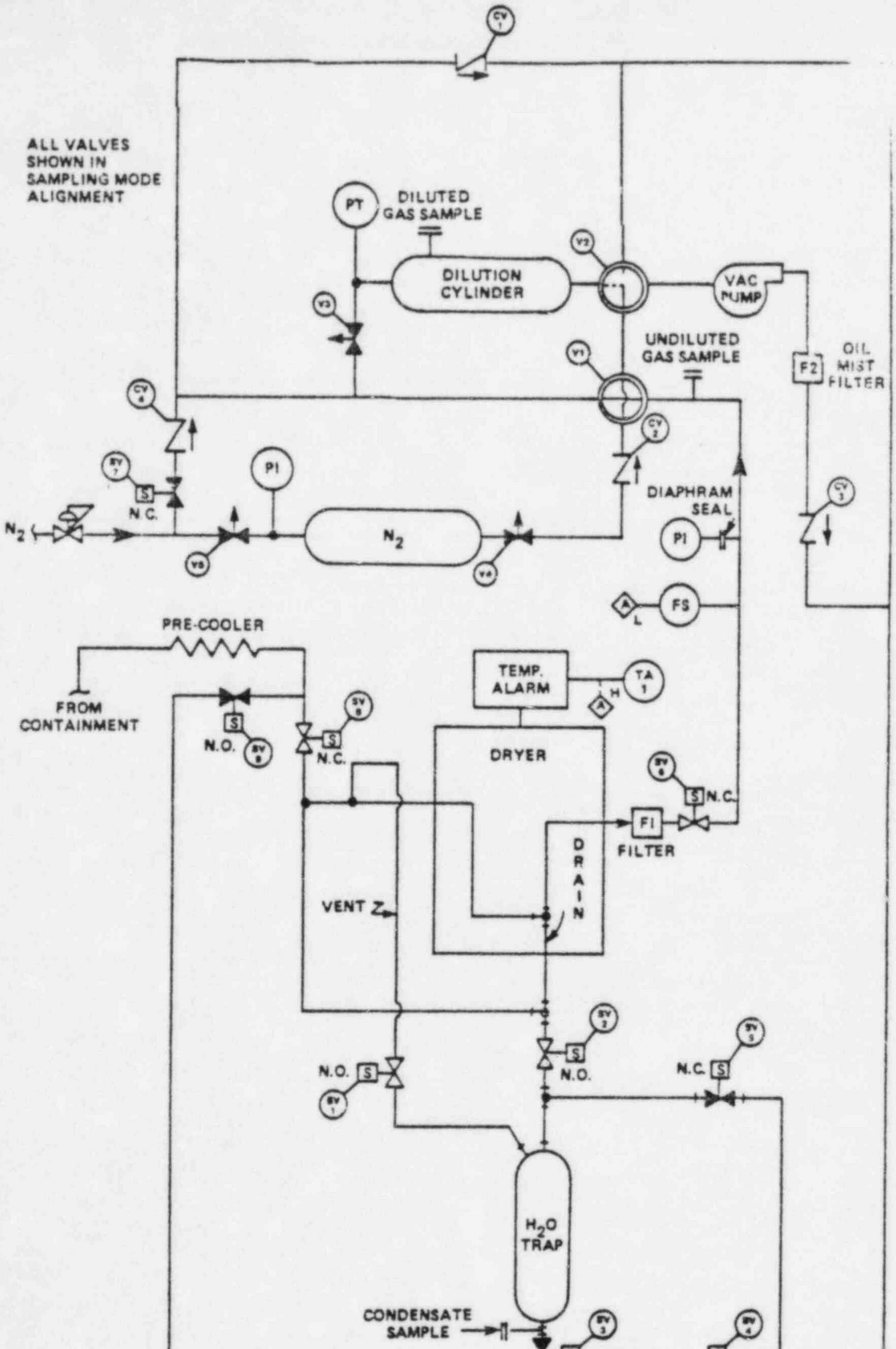
The design evaluation is based on the initial sample, taken at 1 hr after a Reg. Guide 1.4 LOCA release. At this time, sample flow velocity is greater than 200 ft/min based on Hydrogen Analyzer flow rate.

(1.44×10^8 photons/sec-cm^3) Gaseous (noncondensable) sample activity is estimated at 4.0×10^3 microcuries/cm^3, giving an activity in the diluted sample of 0.6 microcuries/cm^3. A 1 cm^3 sample of this activity is suitable for counting with a Ge-Li detecter without further dilution and may be handled without shielding. An undiluted sample for chemical analysis would be carried in a 1 inch lead cask.

Liquid sample iodine gamma activity is estimated to be 0.70 Curies/cm^3 (2.59×10^{10} photons/sec-cm^3) assuming that all but organic iodine condenses. A one microliter sample would therefore have a gamma activity of 0.70 millicuries. It would be diluted into 1-10 ml of water in a septum sealed vial for transportation in a hand carried 1 inch lead cask. A suitable aliquot of this would be taken in the hot laboratory for counting.

Sampling time and dose is given in Table 12A-7. The access routes and dose for sample transport are listed in Table 12A-5 and shown on Figures 12A-3 and 12A-4.

Q281.7



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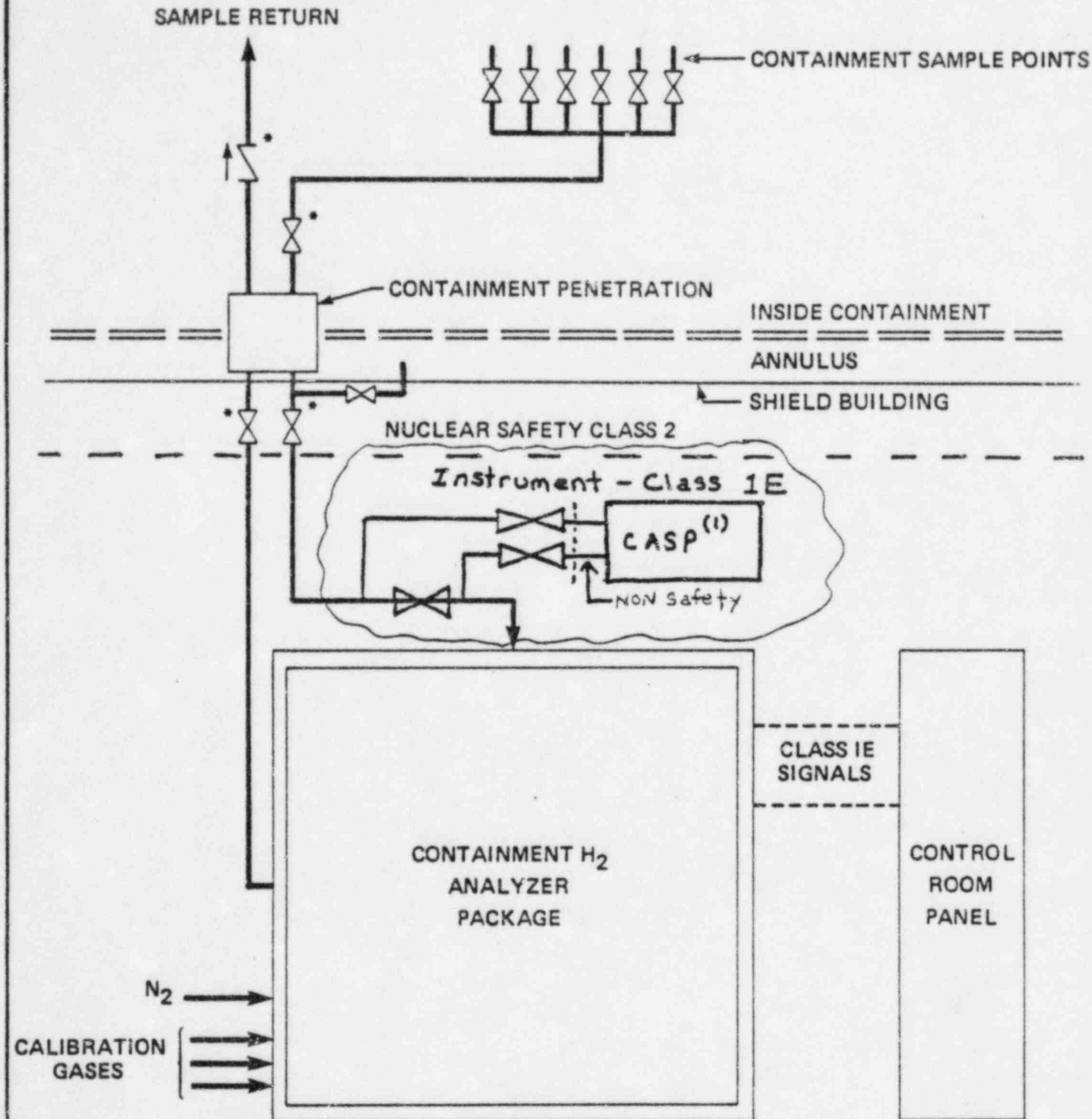
WASHINGTON PUBLIC POWER SUPPLY SYSTEM Nuclear Projects 3 & 5 FINAL SAFETY ANALYSIS REPORT	FLOW DIAGRAM CONTAINMENT ATMOSPHERE SAMPLING PANEL	FIGURE 6-2-37A



*CONTAINMENT ISOLATION VALVES

(1) CONTAINMENT ATMOSPHERE SAMPLING PANEL (CASP)

Q281.7

AMENDMENT NO. 1 (10/82)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM WPPSS Nuclear Projects 3 & 5 FINAL SAFETY ANALYSIS REPORT	CONTAINMENT HYDROGEN ANALYZER SYSTEM APPLICABLE CLASSIFICATIONS	FIGURE 6.2-38

TABLE 12A-5 (Cont'd)

GROUP 4 (TRAIN A) TO BE OPERATED 1/2 HRS POST-LOCA OR LATER

										MREM TOTAL (Oneway)	VALVES TO BE OPERATED
ACCESS ROUTE	16	17	20	21	23	25	27	30	31		
DOSE RATE (MR/HR)	25	25	5	10	70	70	100	4(3)	4.6(3)		2CS-VS330SA
INTEGRATED DOSE (MREM)	.09	.03	.01	.04	.22	.11	1.6	16.7	1.3	20	

GROUP 4 (TRAIN B) TO BE OPERATED 1/2 HRS POST-LOCA OR LATER

										MREM TOTAL (Oneway)	VALVES TO BE OPERATED
ACCESS ROUTE	16	17	20	21	23	25	27	28	32		
DOSE RATE (MR/HR)	25	25	5	10	70	70	1(2)	4.6(3)	4.6(3)		2CS-VS331SB
INTEGRATED DOSE (MREM)	.09	.03	.01	.04	.22	.11	1.6	29	1.3	32	

GROUP 5 FAILURE OF DIESEL GENERATOR A - 1HR POST-LOCA***

					MREM TOTAL (Oneway)	VALVES TO BE OPERATED
ACCESS ROUTE	1	2	38	37		
DOSE RATE (MR/HR)	25	25	5	5.2(2)		3PV-B063SA
INTEGRATED DOSE (MREM)	.08	.04	.01	2.3	2.4	

GROUP 5 FAILURE OF DIESEL GENERATOR B - 1HR POST-LOCA***

				MREM TOTAL (Oneway)	VALVES TO BE OPERATED
ACCESS ROUTE**	16	17	39		
DOSE RATE (MR/HR)	25	25	5.2(2)		3PV-B161SB
INTEGRATED DOSE (MREM)	.09	.03	2.6	2.7	

POST ACCIDENT GRAB SAMPLING ACTION (liquid)

							MREM TOTAL (Oneway)
ACCESS ROUTE A	16	17	20	22	45	47	
DOSE RATE (MR/HR)	25	25	5	2	1	5	
INTEGRATED DOSE (MREM)	.09	.03	.01	.002	.02	.024	.18

* Number in () denotes power of ten.
** See Figures 2 through 6 for access route.
*** See discussion in the report for clarification.

Post Accident Grab Sampling Action (Containment Air)

											MREM TOTAL
Access Route	16	17	20	21	23	48	49	50	51	52	
Dose Rate (mR/Hr)	25	25	5	10	70	70	60	1	5000	100	
Integrated Dose (mRem)	.09	.03	.01	.04	.22	.16	.1	.01	4.17	.03	.49

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TABLE 12A-7 (Cont'd)

GROUP	CONDITION	REASON	VALVE TAG NO.	ACTION AND TIME REQUIRED*		RADIOLOGICAL DOSE (MREM)	REMARKS
4. Leak off valves isolation	LOCA, ECCS injection phase completed and the first set of packing of the SIS sump isolation Valves fail post-LOCA	To maintain containment integrity is, no radioactive fluids escape from the containment	2CSVS330SA 2CSVS331SB	Close Close	10 Sec 10 Sec	13 13	If valve 2CSB001SA leaks If valve 2CSB002SB leaks
5. Control Room Ventilation	Failure of one emergency diesel generator post-LOCA	To provide Control Room air	3PVB063SA 3PVB161SB	Open Open	45 Sec 45 Sec	6.5 6.5	Failure of A Generator Failure of B Generator
Post Accident Sampling							
Grab sample from primary coolant loop	Post-LOCA	To estimate reactor core damage	-	Take grab sample ~~15~~ 30 min		~~22~~ 44	
Grab sample from Containment Atmosphere		~~To estimate level of H_2 in Containment atmosphere~~ To estimate reactor CORE DAMAGE		Take grab sample ~~60~~ 30 min		~~1000~~ 120 250	 whole body extremity (below Kne

* The opening and closing time is based on vendor's information. No time is allowed for locating valves.

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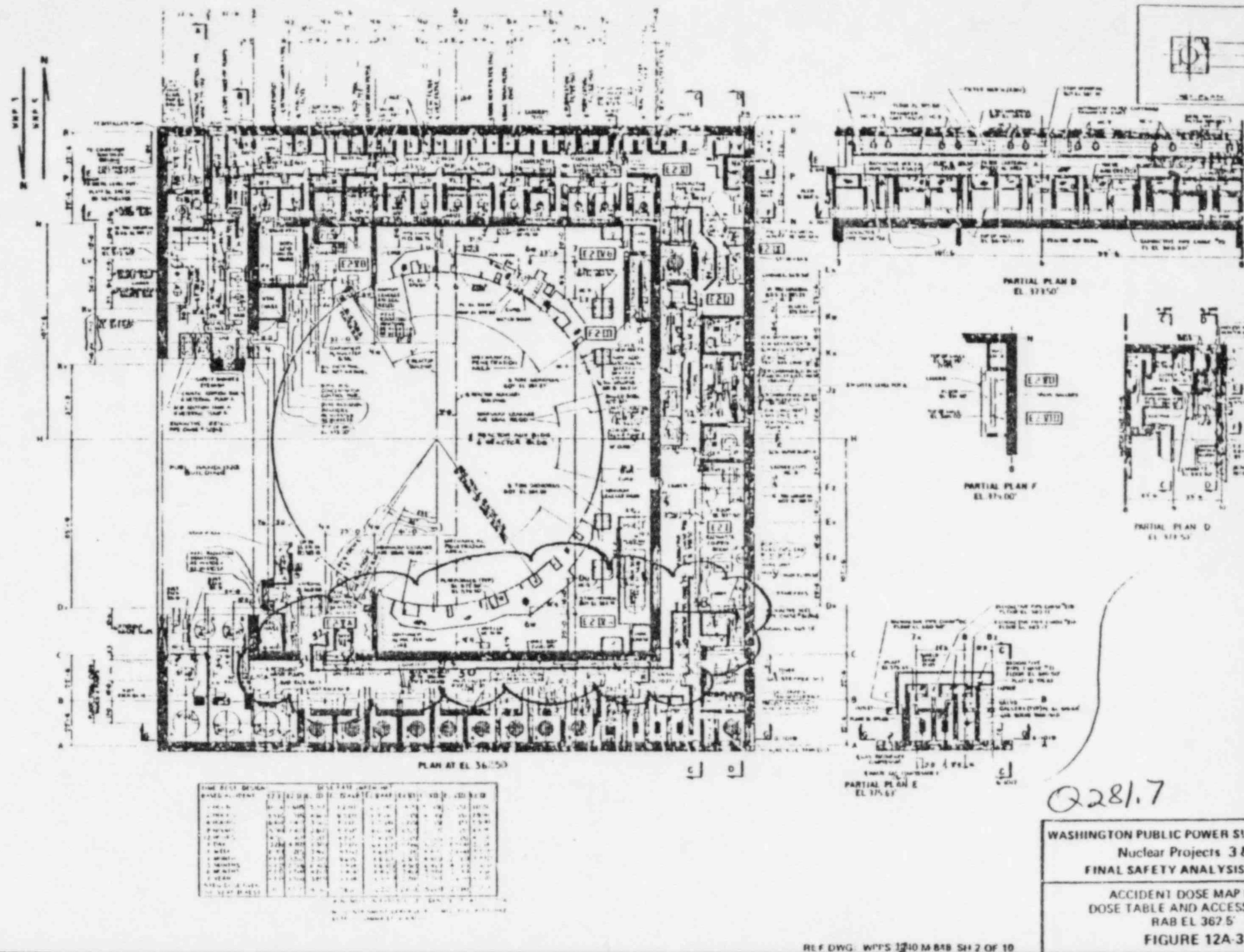

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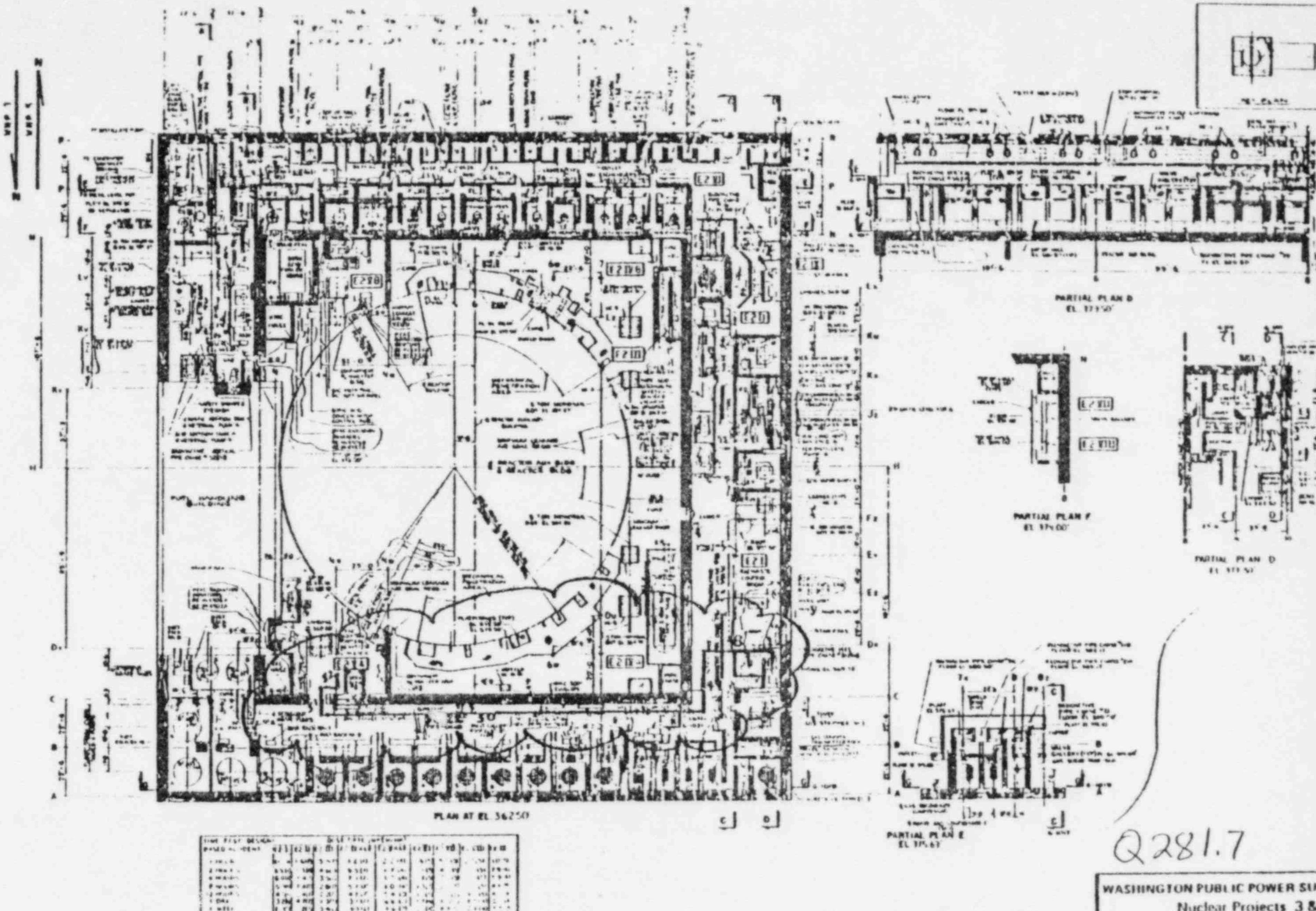
WASHINGTON PUBLIC POWER SUP
Nuclear Projects 3 &
FINAL SAFETY ANALYSIS R

ACCIDENT DOSE MAP W
DOSE TABLE AND ACCESS
RAB EL 367.5'
FIGURE 12A-3

REF DWG WPPS 3240 M 848 SH 2 OF 10



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WASHINGTON PUBLIC POWER SUP
Nuclear Projects 3 & 5
FINAL SAFETY ANALYSIS R

ACCIDENT DOSE MAP WI
DOSE TABLE AND ACCESS R
RAB EL 367.5'

FIGURE 12A-2

Question No.

281.13 (SRP 9.3.4) Section 9.3.4 indicates that the design of the CVCS conforms to CE interface requirements as described in CESSAR-F Subsection 9.3.4.6.A.1 through item R.1. You have not described how the interface requirements are met. Provide a CESSAR interface evaluation similar to that provided in Palo Verde FSAR Section 9.3.4.2.

Response The interface requirements listed in CESSAR-F Section 9.3.4.6 are met by the WNP-3 design as follows:

A. Power

1. Normal Power Requirements

a. During the startup and shutdown modes of the operation, power is obtained from either the 500 kV offsite source with the main generator breaker in the open position or from the 230 kV offsite source.

During normal operation, all loads are fed by the main turbine generator through various unit auxiliary transformers.

In the event that the turbine generator becomes unavailable, all plant auxiliary loads will be transferred automatically to either one of the two aforementioned offsite sources.

b. Within the plant distribution system, the CVCS equipment loads are supplied by separate buses and motor control centers witn the exception of the following non-safety-related equipment:

1. Reactor Drain Pumps
2. Holdup Pump
3. Boric Acid Concentrator Pumps
4. Gas Stripper Pumps

c. In the event of a failure of a bus, the standby equipment connected to other tuses can be placed in operation.

Question No. 281.13

Response (Cont'd)

2. Emergency Power Requirements

   a. Charging Pumps - Each emergency power bus supplies one pump. Additionally, the third charging pump can receive power from either emergency power bus. The charging pumps are not automatically sequenced on the emergency power buses.

   b. The following are emergency power supply arrangements for the CVCS instrumentation:

Instrument	Control Location (1)	Emergency Bus
L-200 (RWT Level)	A/C	A
L-201 (RWT Level)	A/C	B
F-212 (Charging Flow)	A/C	B
P-212 (Charging Pressure)	A/C	A
L-203A (RWT RAS Level)	A	A
L-203B (RWT RAS Level)	A	B
L-203C (RWT RAS Level)	A	C
L-203D (RWT RAS Level)	A	D

   c. The following are emergency power supply arrangements for the CVCS valves:

Valve	Emergency Bus	Control Location (1)
CH-515 (receives SIAS)	B	A/C
CH-516 (receives SIAS) & CIAS	A	A/C
CH-560 (receives CIAS)	A	A
CH-561 (receives CIAS)	B	A
CH-580 (receives CIAS)	A	A
CH-506 (receives CIAS)	A	A/C
CH-505 (receives CIAS)	B	A/C
CH-523 (receives CIAS)	B	A
CH-507	A	A/C
CH-530	B	A
CH-531	A	A
CH-203	B	A/C
CH-205	A	A/C
CH-581	B	A
CH-582	B	A
CH-583	A	A

Question No. 281.13

Response (Cont'd)

Valve	Emergency Bus	Control Location (1)
CH-584	A	A
CH-255	A	A
CH-501	A	A
CH-524	B	A
CH-536	A	A

Note (1): Location code is as follows:

A - Control Room
B - Local
C - Remote Shutdown Panel
D - Location Outside Control Room

B. Protection From Natural Phenomena

1. All of boron addition, charging and letdown portions of the CVCS are located in the Reactor Auxiliary Building, Fuel Building and Containment Building. All buildings are located above the maximum flood elevation. The RWST is located in the yard and above the maximum flood elevation.

   The maximum probable flood or phenomena defined by GDC 2 is discussed in Subsection 3.1.2.

   The Reactor Auxiliary Building, Containment Building, Fuel Building and RWST are seismic Category I structures. The protection against flood or phenomena defined by GDC 2 is discussed in Section 3.4.

2. With the exception of the RWST and the charging pump gravity feedlines in the RWST area, all other CVCS components are located in the Reactor Auxiliary Building, Containment Building and Fuel Building. These buildings are designed against the wind and tornado.

   The protection against winds and tornados as defined by GDC 2 is discussed in Section 3.3.

Response (Cont'd)

The RWST and charging pump gravity feedlines are designed against wind loading. It is not required to be designed against tornado, because an alternate water source from the spent fuel pool is available. The piping from the spent fuel pool to the charging pump suction is located inside the Fuel Building and Reactor Auxiliary Building.

3. The RWST charging pump gravity feedlines, charging pumps, charging pump discharge lines, the letdown line between the RCS and letdown containment isolation valves, and SIS suction lines are seismic Category I components constructed in accordance with ASME III, Class 2 requirements.

   Non-seismic systems in the Reactor Auxiliary Building, where CVCS components are located, are seismically supported such that their failure will not cause loss of either SIS train.

C. Protection from Pipe Failure

All piping and associated valves as specified in CESSAR-F are protected from loss of function from the effects of pipe rupture such as pipe whip, jet impingement, jet reaction, pressurization and flooding. The effects of pipe rupture are discussed in Subsections 3.6A.1, 3.6A.2, and 3.6A.3.

D. Missile

Inside Containment - All Class I piping and components and those related to the safe plant shutdown are protected from loss of function from the effects of missiles.

Outside Containment - all piping and components related to the safe plant shutdown, are protected from loss of function from the effects of missiles. Refer to Subsection 3.5.1.1.

E. Separation

1. Adequate physical separation is maintained as specified by CESSAR-F with the exception of the normal charging line and alternate charging line at Elevation 335 ft. and the gravity feedlines from the RWST to the charging pump suction in the RWST area.

Question No. 281.13

Response (Cont'd)

The lines in the above area are routed in parallel. Pipe whip and jet impingement analysis was performed for the normal and alternate charging lines. The analyses concluded that CVCS function will not be impaired by pipe whip and jet impingement. These analyses are discussed in Subsections 3.6A.2.1 and 3.6A.2.2.

The gravity feedlines from the RWST are surrounded by a 22.5 high dike, which is designed against wind, tornado and earthquake as defined in GDC 2 and discussed in Sections 3.2, 3.3, 3.4, 3.5 and 3.8. All non-safety-related piping in the RWST area is seismically supported such that its failure will not impair the function of the gravity feedlines. No high energy lines are located near the feedlines.

2. Physical independence of electrical system for safety-related function is provided to preserve redundancy and to prevent a single event from causing multiple channel malfunctions or interactions between channels. Refer to Subsections 8.3.1.2.8.15 for further discussion.

F. Independence

Two independent power sources are available to provide electric power to CVCS equipment (see A.1). Refer to Subsection 8.3.1 for further discussion.

G. Thermal Limitation

The ventilation systems are provided to maintain suitable ambient conditions for equipment and instrumentation. Refer to Sections 9.4 and 6.4 for discussion. All BOP supplied CVCS safety-related components are environmentally qualified in accordance with the environmental conditions specified in Section 3.11.

H. Monitoring

Not Applicable.

I. Operational/Control

Not Applicable.

Question No. 281.13

Response (Cont'd)

J. Inspection and Testing

Refer to Chapter 16.

K. Chemistry/Sampling

Not Applicable.

L. Material

The fabrication and processing of Austenitic Stainless Steel is in conformance with Regulatory Guides 1.31, 1.36, 1.37, 1.38 and 1.44.

M. System/Component Arrangement

1. The reactor drain tank rupture disc is located about 7 feet below a concrete ceiling to help shield other components from rupture disc fragments which may result from disc rupture.

2. The CVCS is installed to permit access for inservice inspection in accordance with Section XI of the ASME Code and Testing of ASME Class 2 and 3 components. (Refer to Section 6.6)

3. a. The following approach will be taken to satisfy the interface requirements of CESSAR-F:

During preoperational vibration testing program, modification and relocation will be made, if necessary, tc alleviate possible excessive piping vibration. Following corrective action, additional testing may be performed to determine if the vibration has been sufficiently reduced to satisfy the acceptance criteria. Additional testing will not be required if the initial results of the test make it obvious that the corrective action will achieve the desired results. In case the corrective action is taken, the piping stress analysis will be revised to include the corrective measures.

In addition to the above, pulsation dampners are coupled directly to the charging pump no further than 5 feet away. The piping between the pump and dampner is straight.

b. The straight run of pipe at pump discharge and suction is 5 feet and 4.5 feet, respectively.

   Pipe bends and long radius elbow are used. The bends are not installed directly adjacent to the pump.

c. The charging pumps are located at the lowest point in the system to preclude the collection of vapor or gas. All piping is welded. The pump flange connections (suction) are provided with Spiral Wound Type 304SS asbestos fill flexitallic Style CG Gaskets.

4. The location, arrangement, and installation of the charging pump gravity feed piping, charging pumps, charging pump discharge piping, the letdown line between the RCS and letdown containment isolation valves, and SIS trains suction piping is such that internal floods will not prevent them from performing their safety functions. Refer to Subsection 3.6A.3 for further discussion.

N. Radiological Waste

   1. CESSAR-F Tables 11.1.1-1, 11.1.1-2 and 11.1.1-3 are utilized in determining waste management system input from the CVCS.

O. Overpressure Protection

   1. The RWST vent is sized to prevent pressurization of the tank during maximum filling rate operation and to prevent vacuum formation during maximum pumpdown rate operation.

Response (Cont'd)

P. Related Service

1. The RWST is sized to satisfy the requirements specified in CESSAR-F Subsection 9.3.4.6.P.1, a, b and c.

   Strainers are provided at the Engineering Safety Feature Pump suction lines to prevent particles larger than 0.09 inch diameter from entering the pumps.

2. The spent fuel pool provides an alternate source of borated water to the CVCS.

   a. A minimum of 33,500 gallons is available.

   b. The boric acid makeup water pumps can be realigned to take suction from the spent fuel pool.

3. A fire protection system is provided to protect the CVCS as discussed in FSAR Subsection 9.5.1.

4. The RWST, located in the yard, interconnecting piping to the safety injection pump trains and instrument lines will be maintained at a minimum temperature of 60F by electrical heat tracing. The electrical heat tracing is installed in duplicate to provide an independent and redundant heating system.

   Four electric heaters are provided to each RWST to maintain a minimum temperature of 60F. Insulation is also provided for the tanks. Since the RWST is an atmospheric tank, a loop seal is not required.

5. Oil-free, clean and dry instrument air is provided to all CVCS pneumatic valve operators as described in FSAR Subsection 9.3.1.

Q. Environmental

An environmental control system is provided. The environmental conditions which the safety-related equipments are qualified for, are specified in FSAR Section 3.11.

Question No. 281.13

Response (Cont'd)

R. Mechanical Interaction Between Components

The portions of the CVCS that are part of the reactor coolant pressure boundary are designed to tolerate the events described in CESSAR-F Table 9.4.3-2.

FSAR subsection 9.3.4 will be revised to reflect how WNP-3 conforms with each interface requirement in CESSAR-F Subsection 9.3.4.6 items A1 through R1.

Q 281.13

SAR CHANGES

9.3.4 CHEMICAL AND VOLUME CONTROL SYSTEM

Refer to CESSAR-F Subsections 9.3.4.1 through 9.3.4.2.1 replace only the sixth paragraph with Subsection 9.3.4.2.1 of the following: ~~The design of the CVCS System conforms to GE interface requirements as described in CESSAR-F Subsection 9.3.4.6.A.1 through item R.1.~~

Reactor coolant collected in the Reactor Drain and Equipment Drain Tanks is periodically discharged by the Reactor Drain Pumps through the reactor drain filter and preholdup ion exchanger. The diverted letdown flow, which has been previously passed through a purification filter and ion exchanger, also passes through the preholdup ion exchanger. The preholdup ion exchanger contains mixed bed resin in the form, thereby removing cesium, lithium, and other ionic radionuclides with high efficiency. The process flow then passes through the gas stripper where hydrogen and fission gases are removed with high efficiency, thus precluding the buildup of explosive gas mixtures in the holdup tank and minimizing the release of radioactive fission product gases via aerated vents and in any liquid discharge. The degassed liquid is automatically pumped from the gas stripper to the holdup tank. The holdup tanks are sized to store all recoverable reactor coolant generated by back-to-back cold shutdowns to five percent subcritical and subsequent startups at 90 percent core life. There are five holdup tanks. Tank level indication is available to the operator so that he may manually switch influent flow to the next empty tank. When a sufficient volume accumulates in the holdup tanks, it is pumped through a series of manually aligned interconnected flow paths to the two holdup pumps. It is pumped to the boric acid concentrator where the bottoms are concentrated to within the range of 4000 to 4400 ppm boron.

Refer to CESSAR-F Subsection 9.3.4.2.1 paragraphs 7 through 12 and replace the thirteenth paragraph with the following.

Boric acid solution stored in the Refueling Water Tank is supplied via the Boric Acid Makeup Pumps, while the reactor makeup water stored in the Reactor Makeup Water Tank is supplied via the Reactor Makeup Water Pumps. Four operational modes of the makeup portion of the CVCS are provided. In the dilute mode, a preset quantity of reactor makeup water is introduced into the Volume Control Tank or directly into the charging pump suction header via the Volume Control Tank Bypass Valve at a preset rate. In the borate mode, a preset quantity of boric acid is introduced into the Volume Control Tank or directly into the charging pump suction header via the Volume Control Tank bypass valve at a preset rate. In the manual mode, the flow rates of the reactor makeup water and the boric acid can be preset to give any blended boric acid solution between zero and the boric acid solution concentration in the RWT (4000-4400 ppm). In the automatic mode, a preset blended boric acid solution is automatically introduced into the Volume Control Tank upon demand from the volume control tank level controller. The preset solution concentration is adjusted periodically by the operator to match the boric acid concentration being maintained in the RCS.

Refer to the remainder of CESSAR-F Subsection 9.3.4.2.1.

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Both sides of this sheet are affecte

The process radiation monitor continuously monitors a side stream off the letdown flow path.

Flow through the process radiation monitor is controlled by a throttling valve located in the letdown line in parallel with the process radiation monitor. Another valve is located upstream of the process radiation monitor stops flow to the instrument on high letdown temperature in order to protect against possible damage.

The detector is located in a shielded steel well abutting the sample chamber and continuously measures the gamma activity of the sample water. The transient time of the coolant from the reactor core to the detector is less than six minutes. After processing by a local amplifier, the detector output signal is fed to a local microprocessor which converts it to engineering units and transmits the result to the radiation monitoring system computer which is located in the Main Control Room. The microprocessor also compares the results with adjustable alarm setpoints. The system computer automatically records the measured radioactivity level. Historical records of the measured activity may be displayed on the system's CRT and/or reduced to hard copy at the operator's command. The occurrence of an alarm will automatically be brought to the operator's attention. More information about this monitor may be found in Section 11.5.

The tests and inspections performed on the process radiation monitor are described in Subsection 9.3.4.4.

9.3.4.5.6.2 Gas Stripper Monitor

This monitor provides a continuous recording in the Control Room of the gross gamma activity leaving the gas stripper and entering the holdup tank. A high alarm indicates improper operation of upstream purification equipment. Normally, however, an increasing activity trend will allow operators to take corrective measures (replace ion exchanger resin or filter cartridge) before significant activity increase occurs in the holdup tank.

The radiation monitor includes a shielded sample chamber with a gamma radiation sensitive detector. The detector output signal is fed to a local microprocessor which converts it to engineering units and transmits the result to the radiation monitoring system computer which is located in the Main Control Room. The microprocessor also compares the results with adjustable alarm setpoints. The system computer automatically records the measured radioactivity level. Historical records of the measured activity may be displayed on the system's CRT and/or reduced to hard copy at the operator's command. The occurrence of an alarm will automatically be brought to the operator's attention. More information about this monitoring may be found in Section 11.5.

~~Refer to CESSAR-F Subsection 9.3.4.6 and replace item (A.2(e)) with the following:~~ 2

The design of the CVCS system conforms to CE interface requirements as described in CESSAR-F Subsection 9.3.4.6.A.1 through item R.1 as follows:

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⇒ Insert I

c) The following are emergency power supply requirements for CVCS valves:

Valve	Emergency Bus	Control Location (1)
CH-515 (receives SIAS)	B	A/C
CH-516 (receives SIAS & CIAS)	A	A/C
CH-560 (receives CIAS)	A	A
CH-561 (receives CIAS)	B	A
CH-580 (receives CIAS)	A	A
CH-506 (receives CIAS)	A	A/C
CH-505 (receives CIAS)	B	A/C
CH-523 (receives CIAS)	B	A
CH-507	A	A/C
CH-530	B	A
CH-531	A	A
CH-203	B	A/C
CH-205	A	A/C
CH-581	B	A
CH-582	B	A
CH-583	A	A
CH-584	A	A

Note (1): Location code is as follows; A-Control Room, B-Local, C-Remote Shutdown Panel, D-Location outside Control Room.

Refer to CESSAR-F Subsections 9.3.4.6.B through 9.3.4.6.M.3.a. Replace item 9.3.4.6.M.3.b with the following.

Suction and discharge piping should be as straight as possible. WNP-3/5 has six feet of straight pipe directly connected to the suction and discharge of the charging pump. When bends are necessary, 45 degree elbows or long radius elbows shall be used. A bend shall not be installed directly adjacent to the pump.

Refer to CESSAR-F Subsections 9.3.4.6.M.3.c through 9.3.4.P.3. Replace item 9.3.4.6.P.4 with the following.

Redundant means shall be provided to maintain the RWT contents, interconnecting piping to the safety injection pump trains, and instrumentation lines, above the minimum operating temperature of 60F and below the maximum operating temperature of 120F. Ensuring that the Auxiliary Building, Annulus Building, and Containment Building ambient temperatures remain between 60F and 120F during all normal reactor operations may be done to meet this requirement. All other RWT interconnecting piping, including the vent line, which is located outside of the Auxiliary Building shall be maintained at a minimum temperature of 40F to prevent freezing. A steam or electric heater installed in an RWT recirculation line or a separate recirculation line for tank heating and heat tracing on piping as necessary may be used to meet these requirements. If steam is used for heating, means shall be provided to ensure that the steam will not mix with the tanks contents. The capacity of any heater shall be based upon the maximum tank capacity. 3

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Insert 1 (NRC Q 281.13, SCN 530)

A. Power

1. Normal Power Requirements

a. During the startup and shutdown modes of the operation, power is obtained from either the 500 kV offsite source with the main generator breaker in the open position or from the 230 kV offsite source.

During normal operation, all loads are fed by the main turbine generator through various unit auxiliary transformers.

In the event that the turbine generator becomes unavailable, all plant auxiliary loads will be transferred automatically to either one of the two aforementioned offsite sources.

b. Within the plant distribution system, the CVCS equipment loads are supplied by separate buses and motor control centers with the exception of the following non-safety-related equipment:

1. Reactor Drain Pumps
2. Holdup Pump
3. Boric Acid Concentrator Pumps
4. Gas Stripper Pumps

c. In the event of a failure of a bus, the standby equipment connected to other buses can be placed in operation.

Response (Cont'd)

2. Emergency Power Requirements

   a. Charging Pumps - Each emergency power bus supplies one pump. Additionally, the third charging pump can receive power from either emergency power bus. The charging pumps are not automatically sequenced on the emergency power buses.

   b. The following are emergency power supply arrangements for the CVCS instrumentation:

Instrument	Control Location (1)	Emergency Bus
L-200 (RWT Level)	A/C	A
L-201 (RWT Level)	A/C	B
F-212 (Charging Flow)	A/C	B
P-212 (Charging Pressure)	A/C	A
L-203A (RWT RAS Level)	A	A
L-203B (RWT RAS Level)	A	B
L-203C (RWT RAS Level)	A	C
L-203D (RWT RAS Level)	A	D

   c. The following are emergency power supply arrangements for the CVCS valves:

Valve	Emergency Bus	Control Location (1)
CH-515 (receives SIAS)	B	A/C
CH-516 (receives SIAS) & CIAS	A	A/C
CH-560 (receives CIAS)	A	A
CH-561 (receives CIAS)	B	A
CH-580 (receives CIAS)	A	A
CH-506 (receives CIAS)	A	A/C
CH-505 (receives CIAS)	B	A/C
CH-523 (receives CIAS)	B	A
CH-507	A	A/C
CH-530	B	A
CH-531	A	A
CH-203	B	A/C
CH-205	A	A/C
CH-581	B	A
CH-582	B	A
CH-583	A	A

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Response (Cont'd)

Valve	Emergency Bus	Control Location (1)
CH-584	A	A
CH-255	A	A
CH-501	A	A
CH-524	B	A
CH-536	A	A

Note (1): Location code is as follows:

A - Control Room
B - Local
C - Remote Shutdown Panel
D - Location Outside Control Room

B. Protection From Natural Phenomena

1. All of boron addition, charging and letdown portions of the CVCS are located in the Reactor Auxiliary Building, Fuel Building and Containment Building. All buildings are located above the maximum flood elevation. The RWST is located in the yard and above the maximum flood elevation.

   The maximum probable flood or phenomena defined by GDC 2 is discussed in Subsection 3.1.2.

   The Reactor Auxiliary Building, Containment Building, Fuel Building and RWST are seismic Category I structures. The protection against flood or phenomena defined by GDC 2 is discussed in Section 3.4.

2. With the exception of the RWST and the charging pump gravity feedlines in the RWST area, all other CVCS components are located in the Reactor Auxiliary Building, Containment Building and Fuel Building. These buildings are designed against the wind and tornado.

   The protection against winds and tornados as defined by GDC 2 is discussed in Section 3.3.

Response (Cont'd)

The RWST and charging pump gravity feedlines are designed against wind loading. It is not required to be designed against tornado, because an alternate water source from the spent fuel pool is available. The piping from the spent fuel pool to the charging pump suction is located inside the Fuel Building and Reactor Auxiliary Building.

3. The RWST charging pump gravity feedlines, charging pumps, charging pump discharge lines, the letdown line between the RCS and letdown containment isolation valves, and SIS suction lines are seismic Category I components constructed in accordance with ASME III, Class 2 requirements.

   Non-seismic systems in the Reactor Auxiliary Building, where CVCS components are located, are seismically supported such that their failure will not cause loss of either SIS train.

C. Protection from Pipe Failure

All piping and associated valves as specified in CESSAR-F are protected from loss of function from the effects of pipe rupture such as pipe whip, jet impingement, jet reaction, pressurization and flooding. The effects of pipe rupture are discussed in Subsections 3.6A.1, 3.6A.2, and 3.6A.3.

D. Missile

Inside Containment - All Class I piping and components and those related to the safe plant shutdown are protected from loss of function from the effects of missiles.

Outside Containment - All piping and components related to the safe plant shutdown, are protected from loss of function from the effects of missiles. Refer to Subsection 3.5.1.1.

E. Separation

1. Adequate physical separation is maintained as specified by CESSAR-F with the exception of the normal charging line and alternate charging line at Elevation 335 ft. and the gravity feedlines from the RWST to the charging pump suction in the RWST area.

Q281.13

Response (Cont'd)

The lines in the above area are routed in parallel. Pipe whip and jet impingement analysis was performed for the normal and alternate charging lines. The analyses concluded that CVCS function will not be impaired by pipe whip and jet impingement. These analyses are discussed in Subsections 3.6A.2.1 and 3.6A.2.2.

- The gravity feedlines from the RWST are surrounded by a 22.5 high dike, which is designed against wind, tornado and earthquake as defined in GDC 2 and discussed in Sections 3.2, 3.3, 3.4, 3.5 and 3.8. All non-safety-related piping in the RWST area is seismically supported such that its failure will not impair the function of the gravity feedlines. No high energy lines are located near the feedlines.

2. Physical independence of electrical system for safety-related function is provided to preserve redundancy and to prevent a single event from causing multiple channel malfunctions or interactions between channels. Refer to Subsections 8.3.1.2.8.15 for further discussion.

F. Independence

Two independent power sources are available to provide electric power to CVCS equipment (see A.1). Refer to Subsection 8.3.1 for further discussion.

G. Thermal Limitation

The ventilation systems are provided to maintain suitable ambient conditions for equipment and instrumentation. Refer to Sections 9.4 and 6.4 for discussion. All BOP supplied CVCS safety-related components are environmentally qualified in accordance with the environmental conditions specified in Section 3.11.

H. Monitoring

Not Applicable.

I. Operational/Control

Not Applicable.

Response (Cont'd)

J. Inspection and Testing

Refer to Chapter 16.

K. Chemistry/Sampling

Not Applicable.

L. Material

The fabrication and processing of Austenitic Stainless Steel is in conformance with Regulatory Guides 1.31, 1.36, 1.37, 1.38 and 1.44.

M. System/Component Arrangement

1. The reactor drain tank rupture disc is located about 7 feet below a concrete ceiling to help shield other components from rupture disc fragments which may result from disc rupture.

2. The CVCS is installed to permit access for in-service inspection in accordance with Section XI of the ASME Code and Testing of ASME Class 2 and 3 components. (Refer to Section 6.6.)

3. a. The following approach will be taken to satisfy the interface requirements of CESSAR-F:

During preoperational vibration testing program, modification and relocation will be made, if necessary, to alleviate possible excessive piping vibration. Following corrective action, additional testing may be performed to determine if the vibration has been sufficiently reduced to satisfy the acceptance criteria. Additional testing will not be required if the initial results of the test make it obvious that the corrective action will achieve the desired results. In case that the corrective action is taken, the piping stress analysis will be revised to include the corrective measures.

Q281.13

Response (Cont'd)

In addition to the above, pulsation dampners are coupled directly to the charging pump no further than 5 feet away. The piping between the pump and dampner is straight.

b. The straight run of pipe at pump discharge and suction is 5 feet and 4.5 feet, respectively.

Pipe bends and long radius elbow are used. The bends are not installed directly adjacent to the pump.

c. The charging pumps are located at the lowest point in the system to preclude the collection of vapor or gas. All piping is welded. The pump flange connections (suction) are provided with Spiral Wound Type 304SS asbestos fill flexitallic Style CG Gaskets.

4. The location, arrangement, and installation of the charging pump gravity feed piping, charging pumps, charging pump discharge piping, the letdown line between the RCS and letdown containment isolation valves, and SIS trains suction piping is such that internal floods will not prevent them from performing their safety functions. Refer to Subsection 3.6A.3 for further discussion.

N. Radiological Waste

1. CESSAR-F Tables 11.1.1-1, 11.1.1-2 and 11.1.1-3 are utilized in determining waste management system input from the CVCS.

O. Overpressure Protection

1. The RWST vent is sized to prevent pressurization of the tank during maximum filling rate operation and to prevent vacuum formation during maximum pumpdown rate operation.

Q281.13

Response (Cont'd)

P. Related Service

1. The RWST is sized to satisfy the requirements specified in CESSAR-F Subsection 9.3.4.6.P.1, a, b and c.

   Strainers are provided at the Engineering Safety Feature Pump suction lines to prevent particles larger than 0.09 inch diameter from entering the pumps.

2. The spent fuel pool provides an alternate source of borated water to the CVCS.

   a. A minimum of 33,500 gallons is available.

   b. The boric acid makeup water pumps can be realigned to take suction from the spent fuel pool.

3. A fire protection system is provided to protect the CVCS as discussed in FSAR Subsection 9.5.1.

4. The RWST, located in the yard, interconnecting piping to the safety injection pump trains and instrument lines will be maintained at a minimum temperature of 60F by electrical heat tracing. The electrical heat tracing is installed in duplicate to provide an independent and redundant heating system.

   Four electric heaters are provided to each RWST to maintain a minimum temperature of 60F. Insulation is also provided for the tanks. Since the RWST is an atmospheric tank, a loop seal is not required.

5. Oil-free, clean and dry instrument air is provided to all CVCS pneumatic valve operators as described in FSAR Subsection 9.3.1.

Q. Environmental

An environmental control system is provided. The environmental conditions which the safety-related equipments are qualified for, are specified in FSAR Section 3.11.

Q281.13

Response (Cont'd)

R. Mechanical Interaction Between Components

The portions of the CVCS that are part of the reactor coolant pressure boundary are designed to tolerate the events described in CESSAR-F Table 9.4.3-2.

Q281.13

Question No.

281.14
SRP
(10.3.b)
MTEB BTP
5-3 SRP
5.4.21

The information that you have provided is insufficient for us to evaluate the secondary water chemistry control program. Provide a summary of operative procedures to be used for the steam generator secondary water chemistry control and monitoring program, accessing the following:

1. Identify the sampling schedule for the critical chemical and other parameters and the control points or limits for these parameters for each operating mode of the plant, i.e, dry lay-up, cold shutdown, hot standby/shutdown, and power operation.

2. Identify the procedures used to measure the values of the critical parameters, i.e., standard identifiable procedures and/or instruments.

3. Identify the sampling points, considering as a minimum the steam generator blowdown, the hot well discharge, the feedwater, and the demineralizer effluent. We recommend a process flow chart similar to that in EPRI NP-2704-SR "PWR Secondary Water Chemistry Guidelines".

4. State the procedures for recording and management of data, defining corrective actions for various out-of-specification parameters.

5. Identify (a) the authority responsible for interpreting the data and initiating action (b) the sequence and timing of administrative events required to initiate corrective action.

Response

The operative procedures for the steam generator secondary water chemistry control and monitoring program have not been formulated at this time. The Supply System will respond to this question when the procedures are completed.

Question No.

281.16 (SRP 9.1.2) Provide a description of any materials monitoring program for the pool. In particular provide information on the frequency of inspection and type of samples used in the monitoring program.

Response

The subject monitoring program would have been used for vented poison plates, which were being considered to alleviate concerns associated with postulated plate swelling. Testing and elavuations conducted to date have shown that irradiation induced swelling of the WNP-3 poison plates is highly unlikely. Further, in the highly unlikely event that swelling did occur, the fuel could ultimately be disassemblied in place if the fuel handling equipment approached the tensil handling limits (5000 lbs) of the fuel during removal activities.

Based on the above, the WNP-3 poison plates will not be vented and as such a poison monitoring program is considered unnecessary. The FSAR will be revised to reflect this deletion.

The majority of the calculations were performed with methods commonly employed in light water reactor design, i.e., four-group diffusion theory cell calculations using PDQ-07. The cross sections for these calculations are generated with NUMICE, the NUS version of LEOPARD. The code uses the same cross section library tape and calculational techniques as LEOPARD. 1

The cross sections for the poison are generated using "blackness theory" routines available in NUMICE. This is a well-established technique for treating slab absorbers in diffusion calculations and has been used in previous poisoned rack analyses approved by the NRC, specifically Connecticut Yankee.

Selected cases were checked and the final design multiplication factors were verified with Monte Carlo criticality calculations using KENO with 123-group cross sections. The 123-group cross section library is generated from the basic GAM-THERMOS library using AMPX.

The racks in the storage pool are designed for an 11.12 inches x 11.12 inches rectangular spacing with B_4C plates around each assembly. The result of the criticality analysis is as follows: 1

> The center-to-center spacing of 11.12 inches between fuel assemblies with neutron absorber surrounding each fuel assembly results in a k of 0.898 under nominal conditions.

III - <u>Design Basis Events</u>

The worst case Design Basis Event (Safe Shutdown Earthquake), considering maximum variations in the position of fuel assemblies within the storage rack, neutron absorber positioning, variations in can dimensions, the most reactive temperature and calculational uncertainties a k_∞ of 0.933 with a confidence level of 95 percent is calculated. This is achieved by assuring that stresses in rack structural elements remain within elastic limits as described in the discussion on structural integrity in Subsection 9.1.2.2.2. The assumptions of Subsection 9.1.2.3.2 II also apply for the DBE. 1

~~In order to assure that subcriticality margins are maintained, a periodic testing program is conducted to verify the neutron absorbing capabilities of the B_4C poison plates. This program is discussed in Chapter 12.~~

9.1.2.3.3 Seismic Classification

The spent fuel racks, Fuel Building and fuel pool (including the liner) are all seismic Category I structures, as discussed in Subsection 3.8.4.4. 1

Delete

Q281.16

<u>Question No.</u>

281.17 (SRP 9.1.2) Provide a list of the Codes and Standards used in the design and fabrication of the spent fuel racks.

<u>Response</u> Attached you will find a list of codes and standards used in the design and fabrication of the spent fuel locks.

FSAR Section 9.1.2 will be amended to reflect this information.

f) $D + T_o + L_{FAS}$ 1.6S (Note exception described below)

where:

- D = Dead loads which include dead weight of rack and fuel assemblies. | 1
- L = Live loads due to lifting the empty rack during installation.
- T_o = Thermal loads due to the uniform thermal expansion of racks. An average pool temperature change from 40F to 150F at a 20F thermal gradient between adjacent storage locations.
- E = Loads generated by the OBE (severe environmental load)
- E^1 = Loads generated by the SSE (extreme environmental load)
- L_{FAD} = Accidental spent fuel assembly drop.
- L_{FAS} = Postulated fuel assembly stuck causing 5000 lb. upward force. | 1
- S = Required section strength based on the elastic design methods and allowable stresses defined in Part 1 of the AISC "Specification for the Design Fabrication and Erection of Structural Steel for Buildings."

Note that local stresses may be allowed to exceed limits in load combinations e and f. The seismic load for the fuel rack was determined from a response spectrum model dynamic analysis in which the stiffness of the fuel assembly is neglected. Damping factors of two percent for the OBE and four percent for the SSE were used in conformance with Regulatory Guide 1.61. Closely spaced modes were combined directly and then combined with other significant modes using the SRSS method. The structural responses to each of the three components of earthquake motion were combined by taking the SRSS of the maximum representative values of the co-directional responses in conformance with Regulatory Guide 1.92.

Impact loads caused by fuel movement within the can during the seismic event were considered in the analysis. Since a gap on the order of 1/4 in. exists between the sides of a fuel assembly and the can, the fuel will actually move within the can during a seismic event and cause impact loads to be transmitted to the fuel rack restraints. The effects of this fuel-can interaction were analyzed using an energy balance technique. An analysis of a single can and fuel assembly is performed to determine the shear force and bending moment which may occur at critical sections of the can as a result of the fuel assembly impacting the can. These forces were added directly to those obtained from the modal analysis. The impact velocity is taken to be a fraction of the peak velocity representative of a can within a rack as determined from the modal analysis of the rack. This factor was used to account for hydrodynamic coupling, as treated by Fritz (Reference 4) between the fuel and can. 1

The can has stiffness characteristics representative of a can within a rack. The can is restrained at the upper grid elevation by a spring representative of the average grid and horizontal rack restraint stiffness.

Results of the structural and seismic analyses demonstrated that the spent fuel racks are structurally adequate and meet the design criteria.

INSERT Additional codes and standards used in the design and fabrication of the spent fuel racks are detailed in Table 9.1.2-1

9.1.2.3 Safety Evaluation

The spent fuel pool storage rack design and location, discussed in Subsection 9.1.2.2 provides assurance that the design bases of Subsection 9.1.2.1 are met as discussed below:

Q281.17

Table 9.1.2-1

Codes and Standards Used for
Design and Fabrication of
Spare Fuel Racks

A. American Society for Testing and Materials (ASTM)

ASTM A240-77	Specifications for heat-resisting chromium and chromium-nickel stainless steel plate, sheet, and strip for fusion-welded unfired pressure vessesl
ASTM A262-77a	Standard recommended practices for detecting susceptibility to intergranular attack in stainless steels
ASTM A269-76	Seamless and welded austenitic stainless steel tubing for general service
ASTM A276-77	Specification for stainless and heat-resisting steel bars and shapes
ASTM A312-76	Specification for seamless and welded austenitic stainless steel pipe
ASTM A320-77a	Specification for alloy-steel bolting materials for low-temperature service
ASTM A380-72	Standard recommended practive for cleaning and descaling stainless steel parts, equipment, and systems
ASTM A479-78	Specification for stainless and heat-resisting steel bars and shapes for use in boilers and other pressure vessels
ASTM A480-75	Specification for general requirements for flat-rolled stainless and heat-resisting steel plates, sheet, and strip
ASTM A564-74	Specification for hot-rolled and cold-finished age-hardening stainless and heat-resisting steel bars and shapes, type 630 material

ASTM #11	1977	Standard Specifications for Wire-Cloth Lines for testing purposes

T 9.1.2-1 (CONT'D)

B. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code - 1977 Edition - Amended through Winter of 1978

Section II	Material Specifications
Section V	Nondestructive Examination
Section IX	Welding and brazing Qualifications

C. American Society for Nondestructive Testing (ASNT)

ASNT SNT-TC-1A	Recommended Practice for Nondestructive Testing Personnel Qualification and Certification, June 1975 Edition and Supplements

D. American National Standards Institute (ANSI)

ANSI 45.2-71	Quality Assurance Program Requirements for Nuclear Facilities
ANSI N45.2.1-73	Cleaning of Fluid Systems and Associated Components During Construction Phase of Nuclear Power Plants
ANSI N45.2.2-72	Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants
ANSI 45.2.6-73	Qualification of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants.
ANSI N45.2.9-74	Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants
ANSI 45.2.13-76	Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants
ANSI B46.1-78	Surface Texture
ANSI Y14.5-73	Dimensioning and Tolerancing for Engineering Drawings

E. American Welding Society (AWS)

AWS A2.4-76	Symbols for Welding and Nondestructive Testing
AWS A3.0-76	Welding Terms and Definitions

T 9.1.2-1 (CONT'D)

AWS A5.4-add. 1-75	Corrosion-Resisting Chromium and Chromium-Nickel Steel-Covered Welding Electrodes
AWS A5.9-77	Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes
AWS A5.11-76	Nickel and Nickel-Alloy Covered Welding Electrodes
AWS A5.12-69	Tungsten Arc-Welding Electrodes
AWS QC1-77	Qualification and Certification of Welding Inspectors

F. Military Standards

MIL-STD-105D & Change 2	4/29/63 3/20/64	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-414 & Change 1	6/11/57 5/8/68	Sampling Procedures and Tables for Inspection by Variables for Percent Defective

Question No.

321.1 (SRP 6.5.1) Table 6.5.1-1 of SRP 6.5.1, providing guidance on minimum instrumentation for ESF atmosphere cleanup systems and Position C.2.g both call for signal, alarm, and recording of system flow rates in the Control Room. Subsection 6.5.1.5 of the WNP-3 FSAR does not indicate provisions for flow rate instrumentation on any of the three ESF atmosphere cleanup systems. Provide your justification for not including this instrumentation in the WNP-3 design.

Response The ESF atmosphere cleanup units are instrumented to comply with Regulatory Position C.2.g of Regulatory Guide 1.52 Rev. 2 March 1978 which is consistent with NUREG-75/087. Table 6.5.1-1 of SRP 6.5.1 appeared in NUREG-0800.

However, each of the ESF atmosphere cleanup systems is provided with a low air flow rate alarm and monitoring provision with air flow rate continuous recording (Section 6.5.1.5, items a.6 and a.9, respectively).

High flow alarms are not provided because the maximum air flow rate associated with clean filters will not exceed 1.25 times the nominal design flow rate for each system. At this maximum air flow rate, the residence time through the charcoal adsorber beds will remain within the range of 0.4 to 0.5 seconds.

Question No.

321.2 (SRP 10.4.2, 11.3) In the last paragraph of Subsection 10.4.2.1, page 10.4-6, it is stated that an evaluation of the radioactive discharge from the Main Condenser Evacuation System is discussed in Section 11.3, together with the basis. Tables 11.3.3-1 and 11.3.3-3 of the FSAR contain entries for the Condenser Evacuation System exhaust, however, the discussion of the evaluation does not appear in Section 11.3.

Provide a description of the release path for the discharge from the mechanical vacuum pumps of the Main Condenser Evacuation System in the non-radioactive operational mode, including the designation of the normal (non-radioactive) atmosphere release point, together with the height, dimensions, average temperature of exhaust air, and expected range of airflow in either volumetric flow rate or linear velocity at the point of discharge; describe the procedure or mechanism for diverting flow to the Reactor Auxiliary Building Exhaust Ventilation System upon detection of radioactivity in the mechanical vacuum pump exhaust.

Response The Main Condenser Air Evacuation System (CAES) is designed to perform two (2) independent operations.

1. Hogging operation during startup

2. Holding operation during normal operation

A separate description of the above operations is provided below;

1. Hogging Operation:

During initial condenser hogging, the exhaust from the vacuum pumps is discharged directly to the atmosphere via a 16-inch diameter discharge header 6AE16-021 which conveys the noncondensible gases to the Turbine Building Roof (Refer to FSAR Figure 10.4-3). The release point on vent header 6AE16-018 is 12 feet above the Turbine Building Roof at El. 488.00 ft. The noncondensible gases are released to the atmosphere at an average rate of 9,800 CFM. The temperature of the exhaust gases is estimated at 125°F.

2. Holding Operation:

During normal operation, noncondensible gases are continuously monitored for radioactivity by a radiation monitor (See Figure 10.4-3). The isolation valve 6AEB-001 on the Turbine Building vent header 6AE16-018 remains closed.

To preclude the possibility of releasing the radioactive noncondensible gases to the atmosphere, the vacuum pumps exhaust is continuously discharged through the charcoal filters associated with the RAB exhaust system. During this operation, one of the two booster fans (E-44A or E-44B) is placed in service. The noncondensible gases from the operating fan are discharged by a 3-inch diameter common header 6AE3-015 to the RAB main ventilation system exhaust duct at EL. 379.00 ft. at a maximum rate of 75 SCFM and an operating temperature of 125°F.

The gases then flow upward to the operating nonsafety air cleaning units which provide filtering through a prefilter, HEPA filter and charcoal adsorber, before it is discharged into HVAC Vent Stack No. 1. The vent stack which is 8'-6" diameter has an atmospheric release point at El. 501 ft. to release effluent at a volumetric flow rate ranging between 76,200 and 199,550 CFM The average effluent temperature at HVAC Vent Stack No. 1 has a range between 60°F and 104°F.

For further discussion of the plant stacks and effluents, see the response to Question 321.3.

10.4.2 MAIN CONDENSER EVACUATION SYSTEM

The main condenser evacuation is accomplished by the Condenser Air Evacuation System (CAES). This system evacuates the main condenser and turbine steam space during plant startup and thereafter maintains the condenser design vacuum of 2.24/3.08/4.14 in. of Hg. Absolute in LP/IP/HP condenser shell during normal plant operation. The CAES maintains this vacuum by continuously removing noncondensible gases and air in leakage from the three condenser shells. The noncondensible gases are monitored prior to exhausting to the atmosphere. The Gland Steam Condenser Air and Evacuation System is not part of the CAES. The CAES does not perform a safety function, and is a non-safety, non-seismic Category I, Supply System Quality Class G system. The CAES system components design is in compliance with the provisions of NRC, Regulatory Guide 1.26 Quality Group D for Piping, Pumps and Valves.

The CAES is designed with provision to reroute potentially radioactive noncondensible gases from the main condenser exhaust to the Reactor Auxiliary Building (RAB) Gaseous Waste Management System.

10.4.2.1 System Description

The CAES, shown schematically on Figure 10.4-3, consists of four two-stage mechanical vacuum pumps, a moisture separator tank, booster fans, radiation monitor, and associated valves and piping. During startup all four vacuum pumps are used for main condenser and turbine steam space evacuation and the evacuated air is discharged directly to the atmosphere. Operation of the vacuum pumps is initiated from the Main Control Room. The four pumps reduce the condenser pressure to 5 in. Hg Absolute for startup recirculation to perform pre-operational cleanup of the condensate-feedwater water system.

After design vacuum is established and the plant is in operation, the noncondensible gases are monitored continuously for radioactivity (Refer to SubSection 11.5) and if radioactive are discharged through charcoal bed filters associated with the RAB exhaust systems, prior to being released to the atmosphere. The booster fan is placed in service to convey noncondensible gases to the RAB exhaust systems (Subsection 9.4.3).

During normal plant operation, one mechanical vacuum pump is sufficient to evacuate all noncondensible gases from the condenser. However, in the event of abnormally high air inleakage, three vacuum pumps are always available and the fourth is on standby.

In the event that a steam generator develops a primary to secondary leak, the gaseous CAES effluents will contain a detectable quantity of radionuclides. ~~A radiological evaluation of the discharge from CAES and the basis for this evaluation are discussed in Section 11.3.~~ The average and maximum steam generator tube leakage is given in Section 11.1 along with release rates of radionuclide materials.

← Insert 1

Q 321.2
SCN 492

INSERT 1

The Main Condenser Air Evacuation System (CAES) is designed to perform two (2) independent operations.

1. Hogging operation during startup

2. Holding operation during normal operation

A separate description of the above operations is provided below;

1. Hogging Operation:

   During initial condenser hogging, the exhaust from the vacuum pumps is discharged directly to the atmosphere via a 16-inch diameter discharge header 6AE16-018 which conveys the noncondensible gases to the Turbine Building Roof (Refer to FSAR Figure 10.4-3). The release point on the discharge header is 12 feet above the Turbine Building Roof at El. 488.00 ft. The noncondensible gases are released to the atmoshphere at an average rate of 9,800 CFM. The temperature of the exhaust gases is estimated at 125°F.

2. Holding Operation:

   During normal operation, noncondensible gases are continuously monitored for radioactivity by a radiation monitor (See Figure 10.4-3). The isolation valve 6AEB-001 on the Turbine Building vent header 6AE16-018 remains closed.

   To preclude the possibility of releasing the radioactive noncondensible gases to the atmosphere, the vacuum pumps exhaust is continuously discharged through the charcoal filters associated with the RAB exhaust system. During this operation, one of the two booster fans (E-44A or E-44B) is placed in service. The noncondensible gases from the operating fan are discharged by a 3-inch diameter commom header 6AE3-015 to the RAB main ventilation system exhaust duct at EL. 379.00 ft. at a maximum rate of 75 SCFM and an operating temperature of 125°F.

   The gases then flow upward to the operating nonsafety air cleaning units which provide filtering through a prefilter, HEPA filter and charcoal absorber, before it is discharged into HVAC Vent Stack No. 1. The vent stack which is 8'-6" diameter has an atmospheric release point at El. 501 ft. to release effluent at a volumetric flow rate ranging between 76,200 and 199,550 CFM. The average effluent temperature at HVAC Vent Stack No. 1 has a range between 60°F and 104°F.

Q 321.2
SCN492

Question No.

321.3 (SRP 11.1, 11.3)	There are several discrepancies in the descriptions of radioactive gaseous effluent release points between the text, tables and figures in the Environmental Report and the Safety Analysis Report. For example, Table 3.5-8 (ER) identifies six release points, referencing ER Figure 3.5-8 as a pictorial guide. In the FSAR, the six release points are designated "HVAC Vent Stacks #1 through #6," while Table 3.5-8 (ER) gives such titles as "Fuel Handling Building Vent." Figure 3.5-8 and Figure 1.2-15a (FSAR) show discrepancies in stack height; for example, Vent Stack #4 on Figure 1.2-15a is shown to be 485 feet above mean sea level (msl) while Figure 3.5-8 (ER) shows the same vent at 502.8 feet above msl. No release point is shown for the effluent from the main condenser air ejector during normal operation -- only the alternate is shown for use during periods of known radioactive release. For all radioactive effluent release points, please provide corrected and consistent tables, diagrams and text showing location, designation or title, release point elevation, shape and inside dimensions of release point cross section, average effluent temperature and either exit velocity or volumetric flow rate. The requested data is needed to adequately assess the meteorological dispersion conditions attending gaseous effluent releases.

Response

Figure 3.5-8 of the Environmental Report identifies the location of the radiological and toxic release points for WNP-3. The radiological release points have been extracted and shown in Figure 1 (attached). Table 1 (also attached) indicates the designation, elevation, inside diameter, flow rate and temperature of each release point, as well as the various systems/components exhausted.

HVAC Vent Stacks #1 and #4 handle the exhaust from the RAB Main Ventilation System, Diesel Generator Area Ventilation System and the Shield Building Annulus Vacuum Maintenance System. Stack #1 additionally handles the Reactor Building Ventilation System, Containment Purge System and the exhaust from the Mechanical Vacuum Pumps (see response to Question 321.2).

Stack #4 also handles the exhaust from the Fuel Handling Building Ventilation System. Stacks #2 and #3 serve the Control Room Ventilation System and the Electrical/Battery Room Ventilation System.

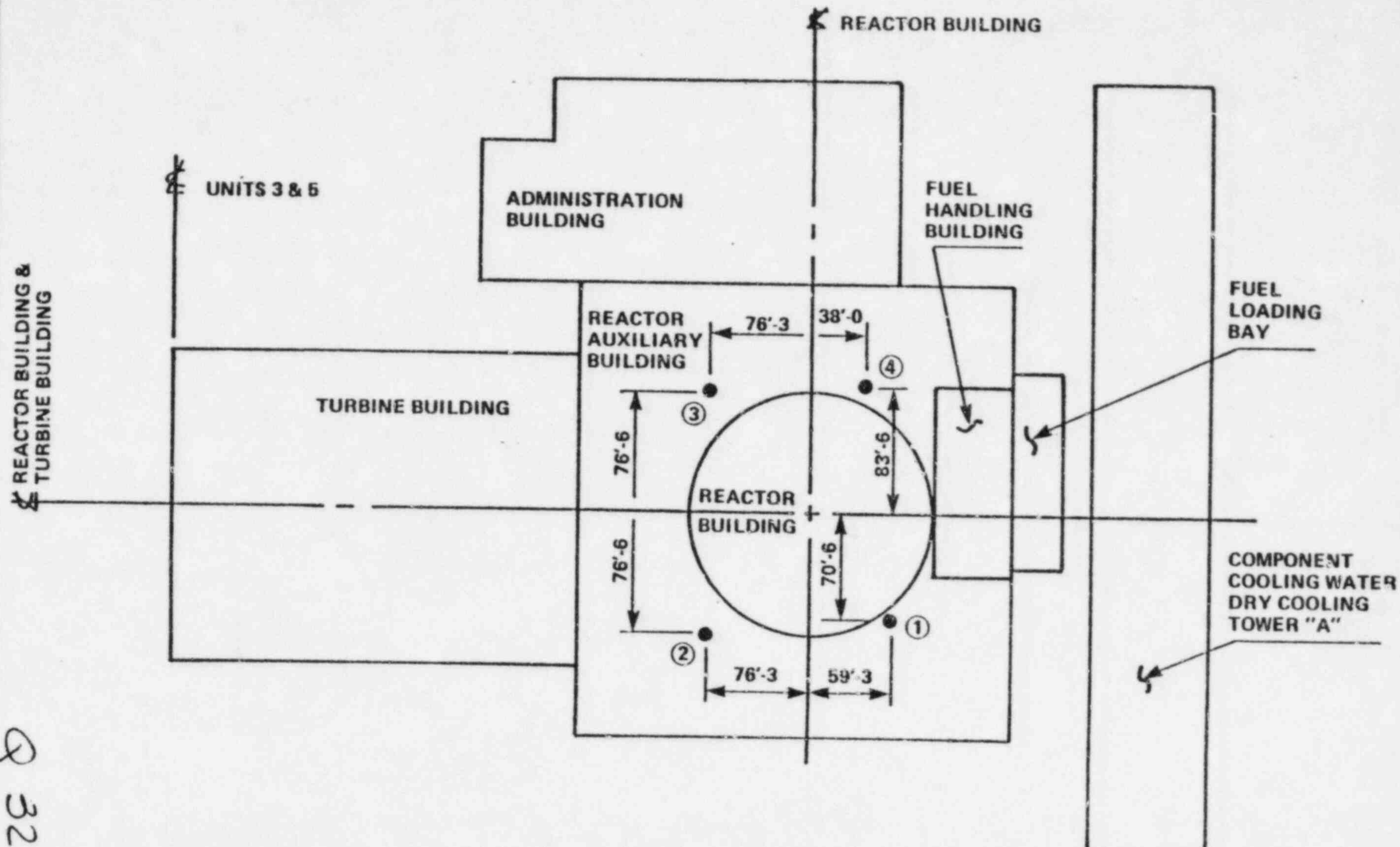
FSAR Sections 11.3 and 6.4 will be revised to reflect this information as attached. FSAR Figures 9.4.3-1, 1a, 1b & 1c will be updated by November 1983 to reflect the revised flow rates of 76,200 cfm and 199,500 cfm in the RAB Main Ventilation System. The ER will also be updated accordingly.

QUESTION 321.3

TABLE 1

POTENTIALLY RADIOACTIVE GASEOUS EFFLUENT RELEASE POINTS

Release Point	Elevation (ft MSL)	Inside Diameter (ft)	Normal Flow Rate (cfm)	Temperature (°F)	Systems/Components Exhausted
1 (Stack #1)	501.00	8.50	76,200 (min) 199,550 (max)	60 (min) 115 (max)	RAB Main Ventilation, DG Area Ventilation, RB Ventilation, Shield Building Annulus Vacuum Maintenance Containment Purge, Mechanical Vacuum Pumps.
2 (Stack #2)	483.33	5.50	4,800 (min) 50,200 (max)	60 (min) 104 (max)	Control Room Ventilation, Electrical Battery Room Ventilation.
3 (Stack #3)	483.33	5.50	4,800 (min) 50,200 (max)	60 (min) 104 (max)	Control Room Ventilation, Electrical Battery Room Ventilation.
4 (Stack #4)	502.83	9.17	76,310 (min) 228,355 (max)	60 (min) 104 (max)	RAB Main Ventilation, DG Area Ventilation, Shield Building, Annulus Vacuum Maintenance, FHB Ventilation.



Q 321.3

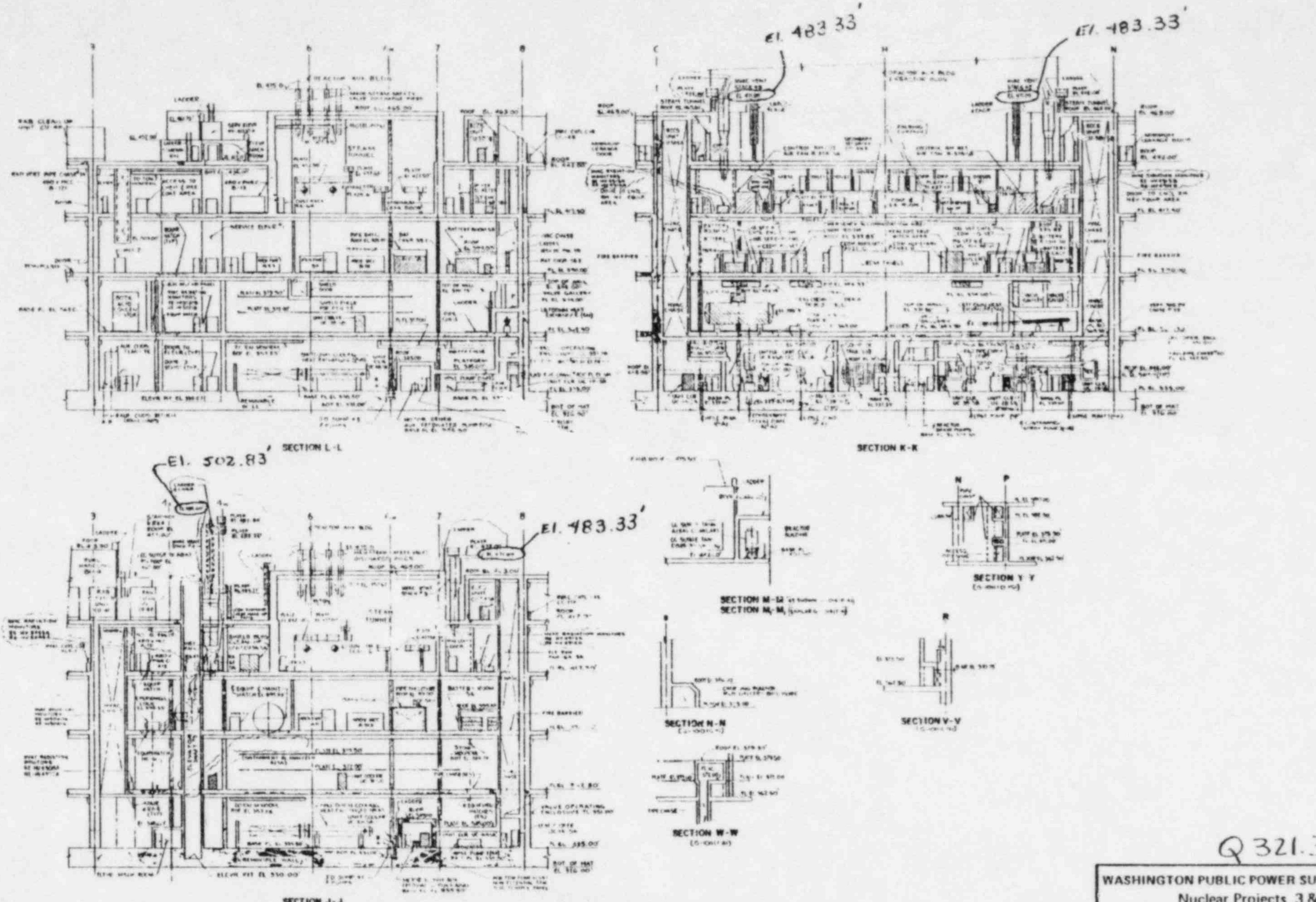
WASHINGTON PUBLIC POWER SUPPLY SYSTEM

~~Nuclear Projects 3 & 5~~

~~FINAL SAFETY ANALYSIS REPORT~~

POTENTIAL RADIOACTIVE GASEOUS EFFLUENT RELEASE POINTS

FIGURE Q321.3-1



Q 321.3

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Nuclear Projects 3 & 5
FINAL SAFETY ANALYSIS REPORT

REACTOR AUXILIARY BUILDING
SECTIONS JJ THROUGH MM
FIGURE 1.2-15a

REF DWG: WPPS-3240-G-1021

6.4.4 DESIGN EVALUATION

6.4.4.1 Radiological Protection

The evaluation of the radiological exposure to the Control Room Operators is presented in the Control Room accident dose analyses given in Chapter 15, Appendix 15I shows the doses following the design basis accident (LOCA) and demonstrates compliance with GDC 19.

Table 6.4-2 is a summary sheet of the Control Room HVAC System parameters used in the Main Control Room dose analysis.

Figure 6.4-2 is a plot plan showing the plant layout, including the location of onsite potential radiological and toxic gas release points with respect to the main control room air intakes. More specific information regarding the radioactive release points is contained in subsection 11.3.3 Elevation and plan drawings showing building dimensions are given in Section 1.2. Potential sources of toxic gas release are identified in Section 2.2.

A description of system controls and instruments is provided in Subsection 6.4.6. Redundant Class IE radiation monitors located at the outside air intakes are discussed in Subsection 12.3.4.

6.4.4.2 Toxic Gas Protection

a) Protection from Chlorine

Seismic Category I chlorine detectors located in each outside air intake of the Control Room Area Ventilation System are capable of detecting a minimum level of one ppm chlorine and will provide signals for isolation valves to start closing within five seconds from detection of chlorine. The delay time for automatic isolation of the Control Room is eight seconds. This delay time includes detector response time and valve closure time. The Control Room operator will assure that at least one of the two air cleaning Units is operating in the recirculation mode throughout the accident period. 1

b) Carbon Dioxide Generation and Oxygen Depletion

The following assumptions were used for determining carbon dioxide generation and oxygen depletion of the Control Room during a postulated accident.

1) The number of personnel in the Control Room envelope during a toxic gas accident is conservatively selected to be twelve.

2) The Control Room HVAC system is in the isolated mode with both outside air intakes closed to prevent infiltration of toxic gas into the Control Room envelope (i.e., valves 3PV-B061SA or 3PV-B161SB and 3PV-B063SA or 3PV-B163SB are closed upon actuation signals addressed in Subsection 6.4.3).

Q 321.3

NOTES TO FIGURE 6.4-2

Release Point	Release Point Elevation (Ft. + MSL)	Normal Flow Rate (cfm)	Systems/Components Exhausted
1	501.00	~~61,150~~ 76,200 to 199,550	RAB Main Ventilation System, Diesel Generator Area Ventilation System. (ECCS/FHB Filtered Exhaust, SBVS)
2	483.3~~0~~3	4,800 to 50,200	Control Room and Electric and Battery Room Air Conditioning Vent Train B
3	483.3~~0~~3	4,800 to 50,200	Control Room and Electric and Battery Room Air Conditioning Vent Train A
4	502.83	~~105,635~~ 76,310 to 228,355	RAB Main Ventilation System, Fuel Handling Building Ventilation System, Diesel Generator Area Ventilation System (ECCS/FHB Filtered Exhaust, SBVS)
5	~~485.00~~ 497.70	140,000	Turbine Building Ventilation System
6	~~485.00~~ 497.70	140,000	Turbine Building Ventilation System
7	470.00	1,565	Administration Building Air Conditioning Vent
8	470.00	5,165	Administration Building Air Conditioning Vent
9	425.00	19,600	Administration Building Vent (CU-51)
10	497.00	1,510	Vent from the Main Turbine Lube Oil Reservoir
11	497.00	100 (each)	Feed Pump Lube Oil System Vent (2 release points next to each other)
12	497.00	70	Turbine Generator Loop Seal Tank
13	497.00	Natural Ventilation	Lube Oil Batch Tank Vent
14	435.00	Natural Ventilation	Refueling Water Storage Tanks A and B
15	432.00	Natural Ventilation	Reactor Makeup Storage Tank

Q 321.3

The values presented in Tables 11.3.3-4 and 11.3.3-6 are only a small fraction of the release limits found in 10CFR20, Appendix B, Table 2, Column 1.

Figure 6.4-2 shows the location of all gaseous release points along with the elevation, of each release point and release rate. For additional discussion on ventilation systems see FSAR Section 9.4 and Subsection 12.3.3. | 2

For the potentially radioactive release points, Table 11.3.3-7 shows the elevations, inside diameters, normal flow rates, temperatures, and the systems/components exhausted. HVAC Vent Stacks #1 and #4 handle the exhaust from the RAB Main Ventilation System, Diesel Generator Area Ventilation System, and the Shield Building Annulus Vacuum Maintenance System. Stack #1 additionally handles the Reactor Building Ventilation System, Containment Purge System, and the exhaust from the Mechanical Vacuum Pumps. Stack #4 also handles the exhaust from the Fuel Handling Building Ventilation System. Stack #2 and #3 serve the Control Room Ventilation System and the Electrical/Battery Room Ventilation System.

Q 321.3

Question No.

321.4 Your description of the Gas Analyzer Package, beginning on page 11.3-2 (Amendment 2, 12/82) does not meet the acceptance criteria of SRP 11.3. For systems which are not designed to withstand a hydrogen explosion, Section II.8.5 of SRP 11.3 states "...(gaseous waste management systems) should be provided with dual gas analyzers with automatic control functions to preclude the formation of buildup of explosive mixtures...with dual being defined as two independent gas analyzers continuously operating and providing two independent measurements verifying that hydrogen and/or oxygen are not present in potentially dangerous concentrations...control features to reduce potential for explosion should be automatically initiated...The automatic control features should be as follows...for systems designed to preclude explosions by maintaining either hydrogen or oxygen below 4%, the source of hydrogen or oxygen...should be automatically isolated from the system...(or) injection of diluents to reduce concentrations below the limits specified...If gas analyzers are to be used to sequentially measure several points in a system not designed to withstand a hydrogen explosion, at least one gas analyzer which is continuously on-stream is required...(and) should be at a point common to streams monitored sequentially..."

Your design provisions for one sequential hydrogen analyzer and one sequential oxygen analyzer, with no provisions for automatic control features, do not comply with the minimum acceptance criteria of SRP 11.3. You should provide an additional continuously-operating gas analyzer serving one fixed point, preferably between the waste gas compressor and the on-line gas decay tank. You should additionally provide for one of the automatic control features described in SRP 11.3.

Response: The gas analyzer package is provided to monitor hydrogen and oxygen concentrations in various plant components where potentially explosive mixtures could develop. The gas analyzer operates continuously by monitoring through a programmed sequence of sample sources. The gas analyzer is also capable of monitoring a single sample source for as long as desired by manually overriding the sequence selector. Each sample source is purged - analyzed and recorded. Continuous recording of sample concentrations allows for the detection and observation of trends which may be developing. When the analysis indicates that the hydrogen or oxygen concentration of a sample exceeds a predetermined setpoint an alarm is annunciated.

Response

Q321.6 (Cont'd)

(ii) High Range Monitor (KSC Model KMG-HRH) (Cont'd)

The high range GM detector is mounted to monitor the inlet/outlet tubing of the sample chamber with the necessary attenuation and collimation to cover the following range:

1×10^1 µCi/cc to 1×10^5 uCi/cc for Xe-133

Each of the two GM detector assemblies (Model KDGM) consists of a Geiger-Mueller tube and associated preamplifier assembly. The Geiger-Mueller tube is Argon-Halogen quench filled. The preamplifier includes a foldover protection circuit to maintain full scale readings when radiation levels exceed the detector range.

A check/source assembly containing a 0.05 uCi Cl-36 source is located next to the GM tube in each detector assembly.

Particulate and Iodine Assemblies: Three P & I collecting assemblies are supplied with the High Range Monitor. Each assembly is identical to that described for the Normal Range Monitor with the following additions:

Each collector assembly is located within a shielded sampler to protect personnel from high radiation levels during operation. This sampler consists of a drawer to house the collector assembly and a lead shield.

The shield is a 3 inch 4 π lead design with all wetted surfaces constructed from type 300 stainless steel. The drawer assembly is attached and sealed to the shield so that the particulate filter and iodine cartridge are held in a horizontal position. The sample air flows downward through the shield and into this collecting assembly.

Mounted directly above each collector assembly is a GM detector which measures the radiation build-up level of the collectors. The primary function of this detector is personnel protection. The alarm of this detector is set at the maximum level acceptable for the personnel who will remove the collector assembly for lab analysis. When the detector sensing circuit reaches this high alarm set point, the associated microcomputer transfers the flow to the next particulate and iodine assembly, isolates the alarmed assembly and indicates to the operator the need to replace the collector assembly. If all collector assemblies have alarmed collection continues on the last filter sequenced.

Response

Q321.6 (Cont'd)

The door of the collector assembly is attached to the lead shield by use of a quick release hand operated latch. Once the door has been opened, the collector assembly can be unclamped and removed immediately and placed into the supplied portable three inch lead shield for transporting the collectors to the laboratory for analysis.

The High Range Main Steam Line Monitor description is as follows:

These monitors provide plant operations personnel with a measurement and record of the radioactivity released because of the actuation of the steam generator safety relief valve or the atmospheric steam dump valves during certain phases of plant operations. As designed these monitors conform with the requirements of NUREG-0737 (II.F.1, Att. 1) and RG 1.97 Rev 2 (type E Variables) for monitoring airborne radioactive material released from the plant.

There are four High Range Main Steam Line Monitors, one for each main steam line. Each monitor consists of an ion chamber detector, a microcomputer and associated indication units in the non-seismic portion of the Main Control Room Monitoring System. A 5.5 inch lead shield is provided for reducing the effect of background radiation on the detector. The detector will be mounted in th center of the shield and a slot in the lead shield will allow an unattenuated view of the steam line of the detector. The configuration is such that the detector will be able to detect activity concentration in the main steam through the pipe wall in the range of 10^{-1} µCi/cc to 10^3 µCi/cc. The ion chamber detector assembly contains an internal 0.1 uCi Am-241 "keep-alive" source providing a constant upscale reading to insure detector operation.

Each detector will be viewing a segment of the main steam line upstream of the safety relief valves and the atmospheric steam dump valves. The detector, lead shield and support structure are seismically qualified.

The FSAR will be amended to reflect the response to this question.

TABLE 1.8-2 (Cont'd)

NUREG- 0737 FSAR Item No.	Related NUREG Item No.	Location	Requirements	Remarks
II.E.4.1*	NUREG-0578 2.1.5.a 2.1.5.c NUREG-0694 II.E.4.1	6.2.4 ,	Dedicated Hydrogen Penetrations	H_2 recombiners are located inside the Reactor Building.
II.E.4.2*	NUREG-0578 2.1.4	(6.2.4)	Containment Isolation Dependability	Note 4, see CESSAR-F Appendix B
II.F.1*	NUREG-0578 2.1.8.b, 2.1.9 (ACRS) NUREG-0694 II.F.1	11.5 for attach 1 & 2. ~~(11.5)~~ (7.A) 6.2.5 12.3.4 for attach 3	Accident Monitoring Instrumentation a) Containment Pressure b) Containment Water Level c) Containment Hydrogen Concentration d) Containment Radiation Intensity e) High Range Noble Gas Effluents from PWR Steam Safety and Atmospheric Dump Valves	Note 4, procedures developed prior to fuel load
II.F.2	NUREG-0578 2.1.3.b NUREG-0694 II.F.2	(6.5) (7.A)	Instrumentation for Detection of Inadequate Core Cooling	Note 2 See Item II.F.1 See CESSAR-F Appendix B
II.G.1*	NUREG-0578 2.1.1 NUREG-0694 Part 1	(5.4.7) (7.6)	Emergency Power for Pressurizer Equipment	Note 1 See II.E.3.1
II.K.1		1.8	IE Bulletins	See Table 1.8-3. See CESSAR-F Appendix B
II.K.2.2*			Control of Auxiliary Feedwater Independent of the Integrated Control System	Not Applicable
II.K.2.8*			Auxiliary Feedwater System Upgrading	Not Applicable
II.K.2.9*	NUREG-0645 2.4.6 NUREG-0694 Part 2		Failure Mode Effects Analysis on the Integrated Control System	Not Applicable
II.K.2.10	NUREG-0645 2.4.6 NUREG-0694 II.K.I		Safety Grade Anticipatory Reactor Trip	Not Applicable
II.K.2.13	NUREG-0645 2.4.5	In Review	Thermal Mechanical Report Effect of High Pressure Injection on Vessel Integrity for Small-Break LOCA with no Auxiliary Feedwater	Note 1 (6 months prior). See CESSAR-F Appendix B
II.K.2.14			Lift Frequency of PORVs and Safety Valves	Not Applicable
II.K.2.15	NUREG-0565 2.6.2.1 NUREG-0645 2.4.6 NUREG-0694 Part 2		Effects of Slug Flow on Steam Generator Tubes	Not Applicable

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11.5.2.4.2 Effluent Radiation Monitors

a) Plant Vent Radiation Monitors (Extended Range)

extended range

The plant vent radiation monitors provide plant operations personnel with a measurement and a record of the airborne activity released through the plant vents for both normal operation and post-accident conditions. These monitors sample and monitor radioactive particulates, sample halogens (iodine) and monitor radioactive gases which are in the effluent air. The samples are available for later laboratory analysis. Thus, these monitors are seismically qualified and satisfy th requirements of NUREG-0737 (II.F.1.(1) & (2), and of Reg. Guide 1.97 (Type E) for monitoring of airborne radioactive mat ial released f the plant.

Insert A

extended range

There are four plant vent radiation monitors, one for each plant vent. These airborne monitors are located on the 417.5 ft. level of the Reactor Auxiliary Building near the vertical riser which contributes to each plant vent. The sample for each monitor is taken from the plant vent stack downstream of the point at which the last tributary joins it. At the sampling point the air first flows through an air straightener to remove vorticity from the airflow and then a multipoint isokinetic sample (per ANSI 13.1) is taken and a multipoint flow measurement is made. The flow measurement is used both for controlling the isokinetic sampling and for integrating the release of radioactive material. The sample line is heat traced and routed with a minimum number of bends and horizontal runs to preserve the quality of the sample. After the sample passes through the monitor it is returned to the plant vent. ~~Physically each of these monitors is a two-stage airborne monitor as described in Subsection 11.5.2.3.3.2, which uses a fixed particulate filter, two parallel redundant air pumps and has a temperature control system to prevent condensation within the monitor and its sample lines. The monitors are seismic, Class IE qualified devices.~~ 2

INSERT B →

The measured activity levels for both the particulate and gas channels are transmitted to the Main Control Room. ~~where they are displayed on modules and recorded by strip chart recorders mounted in the seismic Class IE panels.~~ The information is transmitted ~~through appropriate buffering~~ to the Radiation Monitoring System computer for incorporation into displays, records, and the system's database. If the activity exceeds pre-established setpoints an annunciation is made ~~on the main control panel and~~ through the Radiation Monitoring System CRTs and event typer.

The receipt of these alarms will alert the operator to the presence of unusual levels of contamination so that additional surveys, sampling and equipment isolation can be effected in order to locate and eliminate the source of the contamination. The records of the total quantity of radioactive material released is used in writing the reports required by Regulatory Guide 1.21. The alarm setpoints are selected to prevent activity concentrations at the plant boundary or beyond from exceeding 10CFR20 limits and to support the limits set in the plant technical specification. The setpoints may be adjusted continuously over the entire range of the monitor. The system will continue to operate following postulated accidents and will be utilized to provide the operator with information regarding radioactive releases during the post-accident period.

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Q321.6

INSERT A

... in conformance with Item II.F.1, Attachments 1 and 2 of NUREG-0737. As designed by Kaman Sciences Corporation (KSC)...

Q321.6

INSERT B

The extended range effluent monitor is a noble gas monitor that detects and measures the gross beta/gamma activity level °F isotopes present in gaseous form in the effluent release vents. Designed to satisfy current regulatory requirements, this monitor uses three detectors to cover the gaseous activity range from 10^{-7} µCi/cc to 10^{5} µCi/cc. Also included is a collection system for both particulates and halogens to allow collection at levels at or below 10^{2} µCi/cc.

The extended range Plant Vent Radiation Monitor is actually two monitors; a normal range monitor and a high range monitor. Each of these two monitors is mounted on a separate skid. Each of the skids has it's own microprocessor and the two are interconnected to provide appropriate "handover" signals to each other as the radiation rate increases in an accident condition. The high range monitor is activated by a "handover" signal from the normal range monitor when the activity increases above a pre-set level. For additional reliability, the high range monitor will automatically turn on if power is lost at the normal range monitor, or if the instrument cables are severed.

In order to maintain a reasonable time to events occurring in the steam being sampled, a flow rate of several SCFM must be maintained through the monitor. Trying to collect particulates not practical, however. To overcome this problem and yet provide a reasonable response time, the following scheme is employed. An isokinetic tap is provided on the low range unit. The pumping system on th low range unit operates continuously at a high flow rate to minimize the response time. The pumping system on the high range unit draws a sample from the tap at a much lower flow rate in order to make collection feasible. Tubing length between the two skids is limited in order to minimize transit delays and plateout.

(i) Normal Range Monitor (KSC Model KMG-HRN).

The normal range monitor is designed to monitor effluents during normal operation of the plant.

INSERT B (CONT'D)

(i) Normal Range Monitor (KSC Model KMG-HRN) (Cont'd)

The noble gas sampler assembly consists of a gas sample chamber and a lead shield. The chamger is cylindrical in shape and has a volume of 2.2 liters. The lead shield is configured in 4 π geometry affording 4 inches of shielding thickness around the chamber. A beta scintillation detector is mounted inside the sample chamber. The detector is suitable for use down to a low energy level of 80 KeV and covers the range from 1×10^{-7} μCi/cc to 3×10^{-1} μCi/cc for Xe-133.

Two particulate and iodine collectors are mounted in parallel in the sample input line upstream of the gas sampler. The particulate collector is a paper filter disk with a collection efficiency of 99% for 0.3 micron particles. The iodine collector is a charcoal cartridge with a collection efficiency (for methyl iodides) of not less than 95% at a flow rate of 4 SCFM. These collectors are used only during the normal monitor operation and are isolated and bypassed during accident monitoring. Both collectors can be removed for laboratory analysis.

(ii) High Range Monitor (KSC Model KMG-HRH)

The accident range monitor consists of three particulate and iodine lead shielded collectors and the mid and high range gas sampler assembly.

The noble gas sampler assembly (Model KMG-HR) consists of a sample chamber, an attenuator-collimator and a lead shield.

The sample chamber is constructed of type 300 stainless steel with all wetted surfaces passivated and polished. The chamber is cylindrical in shape and has a volume of 0.8 liters. One end of the cylinder is held in place by a snap-ring enabling quick disassembly for decontamination and cleaning.

A 6 inch 4 π lead shield surrounds the sample chamber. The mid range GM detector is located within the sample chamber and is inside of a stainless steel protective well. This detector covers the following range:

$$5 \times 10^{-2}\ \mu\text{Ci/cc to } 1 \times 10^{2}\ \mu\text{Ci/cc for Xe-133}$$

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INSERT B (CONT'D)

(ii) High Range Monitor (KSC Model KMG-HRH) (Cont'd)

The high range GM detector is mounted to monitor the inlet/outlet tubing of the sample chamber with the necessary attenuation and collimation to cover the following range:

1×10^1 uCi/cc to 1×10^5 uCi/cc for Xe-133

Each of the two GM detector assemblies (Model KDGM) consists of a Geiger-Mueller tube and associated preamplifier assembly. The Geiger-Mueller tube is Argon-Halogen quench filled. The preamplifier includes a foldover protection circuit to maintain full scale readings when radiation levels exceed the detector range.

A check/source assembly containing a 0.05 uCi Cl-36 source is located next to the GM tube in each detector assembly.

Particulate and Iodine Assemblies: Three P & I collecting assemblies are supplied with the High Range Monitor. Each assembly is identical to that described for the Normal Range Monitor with the following additions:

Each collector assembly is located within a shielded sampler to protect personnel from high radiation levels during operation. This sampler consists of a drawer to house the collector assembly and a lead shield.

The shield is a 3 inch 4π lead design with all wetted surfaces constructed from type 300 stainless steel. The drawer assembly is attached and sealed to the shield so that the particulate filter and iodine cartridge are held in a horizontal position. The sample air flows downward through the shield and into this collecting assembly.

Mounted directly above each collector assembly is a GM detector which measures the radiation build-up level of the collectors. The primary functon of this detector is personnel protection. The alarm of this detector is set at the maximum level acceptable for the personnel who will remove the collector assembly for lab analysis. When the detector sensing circuit reaches this high alarm set point, the associated microcomputer transfers the flow to the next particulate and iodine assembly, isolates the alarmed assembly and indicates to the operator the need to replace the collector assembly. If all collector assemblies have alarmed collection continues on the last filter sequenced.

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INSERT B (CONT'D)

The door of the collector assembly is attached to the lead shield by use of a quick release hand operated latch. Once the door has been opened, the collector assembly can be unclamped and removed immediately and placed into the supplied portable three inch lead shield for transporting the collectors to the laboratory for analysis.

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The receipt of an alarm will alert operators to analyze additional water and other samples to determine the reason for the alarm. The groundwater is not expected to contain any radioactive contamination therefore setpoints for this radiation monitor are placed just above and as statistically close as practicable to the measured natural background level. The setpoints maybe adjusted over the entire five decade range of this monitor. The design of this monitor was selected to give a very high level of sensitivity.

Insert C

11.5.2.5 Noncontinuous Sampling for Radioactivity

To augment the information provided by the continuous process and effluent monitors, samples are taken at specified intervals at selected locations in the process and effluent streams.

The samples are then taken to the radiochemistry laboratory for analysis. Although a number of the analyses are for other than radioactivity content, each sample can be analyzed for its isotope content or gross activity by use of instrumentation available in the counting room. This instrumentation consists of proportional counters, liquid scintillation detectors and Ge(Li) semiconductor detector and associated data analysis computer.

The sensitivity of the liquid scintillation spectrometer and Ge(Li) semiconductor-detector spectrometer are sufficient to enable detection of the isotopes in the samples within the limits specified by Regulatory Guide 1.21.

There are three kinds of samples taken at the plant: samples from the Process Sample System (Subsection 9.3.2), local liquid grab samples, and gas analyzer grab samples. In addition grab samples taken directly from all process and effluent radiation monitors and the particulate and iodine filters in the gaseous monitors may be removed for laboratory analysis. The location and other data for the specific sampling points are listed in Table 9.3.2-1 for primary samples, and secondary samples, and Tables 11.5-2 and 11.5-3 for local and gas analyzer samples respectively.

Sample point locations are based on one or more of the following requirements:

a) to check the performance of process equipment,

b) to alert the operator to any abnormal condition such as leakage, and/or

c) to insure effluent releases are below applicable limits.

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INSERT C

The High Range Main Steam Line Monitor description is as follows:

These monitors provide plant operations personnel with a measurement and record of the radioactivity released because of the actuation of the steam generator safety relief valve or the atmospheric steam dump valves during certain phases of plant operations. As designed these monitors conform with the requirements of NUREG-0737 (II.F.1, Att. 1) and RG 1.97 Rev 2 (type E Variables) for monitoring airborne radioactive material released from the plant.

There are four High Range Main Steam Line Monitors, one for each main steam line. Each monitor consists of an ion chamber detector, a microcomputer and associated indication units in the non-seismic portion of the Main Control Room Monitoring System. A 5.5 inch lead shield is provided for reducing the effect of background radiation on the detector. The detector will be mounted in the center of the shield and a slot in the lead shield will allow an unattenuated view of the steam line of the detector. The configuration is such that the detector will be able to detect activity concentration in the main steam through the pipe wall in the range of 10^{-1} μCi/cc to 10^{3} μCi/cc. The ion chamber detector assembly contains an internal 0.1 μCi Am-241 "keep-alive" source providing a constant upscale reading to insure detector operation.

Each detector will be viewing a segment of the main steam line upstream of the safety relief valves and the atmospheric steam dump valves. The detector, lead shield and support structure are seismically qualified.

TABLE 11.5-1 (Cont'd)

Name (Instrument Tag Number)	Q'ty	Design Background (mR/hr Co-60)	Sampler Type	Activity Measured	Sensitivity @ Background	Range μCi/cc	Typical Alarm Set-points μCi/cc	Automatic Actions Initiated	Location	Duty
Steam Generator Blowdown Line Radiation Monitor (RE-BD-0125A; RE-BD-0125B)	2	2.5	Ambient	Gross γ	N.A.	$1x10^{-1}$ to $1x10^{4}$	5 10	Alarm Only	Lines 2BD4-113SN 2BD4-112SN	Continuous
Refueling Pool Ambient Radiation Monitor (RE-HV-6701-AS; RE-HV-6702-AS) (RE-HV-6701-BS; RE-HV-6702-BS)*	4	2.5	Ambient	Gross γ	N.A.	$1x10^{-1}$ to $1x10^{4}$	5 10	Containment Purge & Selected Penetration Isolation	Walls of Refueling Pool	Continuous
Spent Fuel Pool Ambient Radiation Monitor (RE-HV-5071-AS; RE-HV-5072-AS) (RE-HV-5071-BS; RE-HV-5072-BS)	4	2.5	Ambient	Gross γ	N.A.	$1x10^{-1}$ to $1x10^{4}$	5 10	FHB HVAC System Isolation	Walls of Fuel Handling Building	Continuous
Effluent Radiation Monitors										
Plant Vent Radiation Monitors - Extended Range										
~~(RE-HV-4913A & RE-HV-4914A) (RE-HV-4913B & RE-HV-4914B) (RE-HV-5043A & RE-HV-5044A) (RE-HV-5043B & RE-HV-5044B)*~~ REPLACE WITH: (RE-HV-4913B1/B2 & RE-HV-4914B1/B2) (RE-HV-4913A1/A2 & RE-HV-4914A1/A2) (RE-HV-5043A1/A2 & RE-HV-5044A1/A2) (RE-HV-5043B1/B2 & RE-HV-5044B1/B2)	4	2.5	Two Stage Airborne	Gross β Particulate & Gas	$1x10^{-9}$ μCi/cc Sr-90 @ 1 mR/hr Co-60(2) $1x10^{-6}$ μCi/cc Kr-85 @ 1 mR/hr Co-60(3)	$1x10^{-10}$ to $1x10^{-5}$ ~~$1x10^{-7}$ to $1x10^{-2}$~~ Normal Range: $1x10^{-7}$ to $1x10^{-1}$ Accident Range: $1x10^{-2}$ to $1x10^{5}$	$3x10^{-10}$ $3x10^{-9}$ ~~$5x10^{-7}$~~ ~~$5x10^{-6}$~~ Normal Range $1x10^{-2}$ to $1x10^{-1}$ Accident Range $1x10^{1}$ to $1x10^{3}$	Alarm Only	HVAC Vent Stacks No. 3 No. 2 No. 4 No. 1	Continuous

| 2

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TABLE 11.5-1 (Cont'd)

Name (Instrument Tag Number)	Q'ty	Design Background (mR/hr Co-60)	Sampler Type	Activity Measured	Sensitivity @ Background	Range µCi/cc	Typical Alarm Set-points µCi/cc	Automatic Actions Initiated	Location	Duty
Sump and Secondary High Purity Discharge Radiation Monitor (RE-SD-0001)	1	2.5	Liquid	Gross γ	$1x10^{-6}$ µCi/cc Cs-137 @ 1 mR/hr Co-60(1)	$5x10^{-7}$ to $5x10^{-2}$	$5x10^{-6}$ $5x10^{-5}$	Alarm & Termination of Discharge	Line 6SD3-098	Batch
Discharge to Neutralization Pond Radiation Monitor (RE-WM-6106)	1	2.5	Liquid	Gross γ	$1x10^{-6}$ µCi/cc Cs-137 @ 1 mR/hr Co-60(1)	$5x10^{-7}$ to $5x10^{-3}$	$5x10^{-5}$ $5x10^{-4}$	Alarm & Termination of Discharge	Line 6LS 1 1/2-433R	Batch
Groundwater Drain Radiation Monitor (RE-RM-0007)	1	0.01	Ambient	Gross γ	Approximately 10^{-5} µCi/cc Cs-137 @ ambient background(1), (4)	$5x10^{-7}$ to $5x10^{-2}$	Above Ambient Background	Alarm Only	Sump in Groundwater Tunnel	Continuous

(1) Sensitivity is defined as the ability to detect the stated concentration of radioactive material, in µCi/cc as an increase in the counting rate equal to two standard deviations of the counting rate of the monitor, when it has the specified dose rate of gamma radiation from the specified isotope incident on the outside of its shielding during an integrated counting period of one minute.

(2) Sensitivity is defined as the ability to detect the stated concentration of radioactive material in µCi/cc contained in air which is passing through a filter at two scfm for a period of 10 minutes as an increase in the counting rate equal to two standard deviations of the counting rate, of the monitor, when it has the specified dose rate of gamma radiation from the specified isotope incident on the outside of its shielding during an integrated counting period of one half minute.

(3) Sensitivity is defined as the ability to detect the stated concentration of radioactive material, in µCi/cc as an increase in the counting rate equal to two standard deviations of the counting rate, of the monitor, when it has the specified dose rate of gamma radiation from the specified isotope incident on the outside of its shielding during an integrated counting period of one half minute.

(4) Vendor sensitivity data is not available at this time.

(5) Efficiency: 6.6×10^{-9} A/R/hr

*Class IE

High Range Main Steam Line Monitors (RE-MS-1000A&B) (RE-MS-10001A&1B)	4	5.0	Ambient	Gross γ	Note 5	$1x10^{-1}$ to $1x10^{3}$	$1x10^{1}$ to $1x10^{2}$	Alarm Only	MS line upstream of steam relief & atmo. dump valves in main steam tunnel	continuous

Q321.6

Question No.

410.16 (3.5.1.1) Discuss the protection afforded spent fuel from internally generated missiles.

Response

Spent fuel assemblies will be placed within seismic Category I storage racks, located in the spent fuel pool of the Fuel Handling Building. The location of the spent fuel storage facilities within the station complex is shown on FSAR figures 9.1.2-2a and 9.1.2-2b. The spent fuel pool is a stainless steel lined, concrete walled pool that is an integral part of the Fuel Handling Building structure designed to seismic Category I requirements and which complies with Regulatory Guide 1.13, Rev. 1. (See FSAR Section 9.1.2 for further discussion).

The potential sources of missiles which were evaluated in the Fuel Handling Building are considered to be generated from failure of either a pressurized component or a rotating component as described in FSAR Subsection 3.5.1.1. There are no high energy systems located within the Fuel Handling Building. Therefore, missiles such as valve stems, flange bolts, thermowells etc. will not be generated. The only rotating pieces of equipment in the Fuel Handling Building are the component cooling water pumps (EL 335.0), fuel pool cooling pumps (EL 362.5) and the fuel pool clean-up pumps (EL 362.5). All of these pumps and their motors are located on elevations below the spent fuel pool and are separated by seismic Category I barriers which prevent any missiles from penetrating the spent fuel pool.

See Subsection 15.7.5 for a description of Spent Fuel Cask Drop accident.

The Supply System has committed to perform an evaluation of the WNP-3 design to determine the adequacy of the heavy and light load handling systems and to assure that the effects of postulated accidents related to these systems are appropriately mitigated.

Our resonse to this question will be updated when this information becomes available.

Question No.

410.17 (3.5.1.1) Provide the results of an analysis which shows that turbine driven pumps will not become a source of missiles or that missiles from the turbine cannot damage safety-related equipment.

Response

There are two types of turbine driven pumps incorporated in the WNP-3 design: Steam Generator Feedwater Pumps and Auxiliary Feedwater Pumps.

The SG Feedwater Pumps are located in the turbine building, outside containment, and are classified as non-safety components. The turbine drives incorporate redundant overspeed protection devices and both the turbine and pump casings are designed of sufficient strength to prevent the release of missiles generated by failure of the rotor or impeller. In the unlikely event that a missile penetrated the casing, the SG Feedwater Pumps have been oriented such that the path of the missile would be away from all safety-related components.

The Auxiliary Feedwater Pumps are located outside containment and both the turbine drive and pumps are classified as safety-related components. The Auxiliary Feedwater Pumps incorporate design provisions to mitigate the generation and release of missiles. These include redundant turbine overspeed protection, channelling of turbine wheel fragments to absorb energy without rupturing the casing, and turbine and pump casing strengths sufficient to prevent the release of missiles due to rotor or impeller failure. Each safety train of the Auxiliary Feedwater Pumps is located in a separate concrete cubicle containing a motor driven and turbine driven pump. The plant design incorporates physical separation of safety train A and B components to ensure safe shutdown of the plant assuming a single failure event.

Question No.

410.18 (3.5.1.1) Explain why consideration was not given to the secondary effects of postulated missiles such a ricochet or missiles penetrating reinforced concrete. (See FSAR Subsection 3.5.1.1.2.)

Response All safety related systems outside the containment required for safe shutdown have redundancy and are physically separated (refer to FSAR Section 9.5.1). Components of safety related systems are located inside seismic Category I structures where concrete floors and internal compartment walls are used as missile barriers so that a single missile is incapable of negating the redundant function arrangement. Therefore, secondary effects of postulated missiles are not considered. For the arrangement of floors and internal walls in Category I structures outside containment, see Figures 1.2-9 through 1.2-17.

Also, concrete barriers used as missile protection are designed to prevent perforation from postulated missiles. These barriers satisfy the minimum thickness requirements, including spalling and scabbing effects, as described in FSAR Subsection 3.5.3.1.1.

Question No.

410.19 (3.5.1.2) With regards to internally generated missiles (inside containment) verify that a seismic event will not result in gravity missiles which could cause damage to essential systems required to assure a safe shutdown or result in unacceptable releases of radioactivity.

Response Structures, systems and components located inside containment are either designed as seismic Category I or are designed for Category I seismic loads. (See FSAR Section 3.2.1 and Table 3.2-1). Therefore, a seismic event will not generate gravity missiles which will affect the safe shutdown capability of the plant or result in unacceptable releases of radioactivity.

Question No.

410.24 (3.5.1.1 & 3.5.1.2) Provide a discussion of the methodology used as the basis for determining that the safety-related structures, systems, and components are adequately protected against internally generated missiles.

Response

The methodology employed for determining that safety-related structures, systems and components are adequately protected against internally generated missiles inside and outside of the containment is based on

i) the selection of potential internally generated missiles and,

ii) the verification that adequate missile protection exists or is necessary for safety-related structures, systems and components at WNP-3.

The selection of potential internally generated missiles was done by examination of sources of energy such as:

a) contained fluid energy - associated with equipment and components of high energy systems as stated in FSAR Subsection 3.5.1.1.1 (high energy system as defined in BTP-APCSB-3-1).

b) rotational energy - associated with rotating equipment such as turbines, fan blades, pumps and motors,

and the determination of whether or not that energy within the system can be converted into kinetic energy (associated with a missile) of sufficient magnitude to damage safety-related equipment.

Furthermore, by utilizing the general and specific design conditions delineated in FSAR Subsection 3.5.1.1, some potential missiles were disqualified.

For those missiles that were not initially disqualified, design of shields and/or design modifications such as changing valve orientation, adding missile gratings or duct reinforcement were instituted to preclude the possibility of missiles damaging safety-related structures, systems and components.

Question No.

410.25 (3.6.1) Provide typical 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.

Response In response to this question, the Emergency Core Cooling System (ECCS) areas were chosen as typical safety related areas to be discussed. Five sets of the following drawings are provided to illustrate pipe rupture analysis and protection in the ECCS areas of the Reactor Auxiliary Building:

LIST OF DRAWINGS

Item No.	Type of Drawing	Drawing Number
(1)	General Arrangement	G-1010
(2)	General Arrangement	G-1021
(3)	Inst & Control	G-6322
(4)	Inst & Control	G-6323
(5)	Inst & Control	G-6324
(6)	Electrical	G-546015
(7)	Electrical	G-546016
(8)	Electrical	G-546019
(9)	Break & Rupture Rest Location (AS/C)	M-705 Sheet 1
(10)	Break & Rupture Rest Location (CVCS)	M-707
(11)	Jet Impingement (CVCS)	M-720 Sheet 1
(12)	Jet Impingement (AS/C)	M-721 Sheet 1
(13)	Jet Barriers	G-3453
(14)	Jet Barriers	G-3459

The ECCS areas A & B are located at elevation 335.00 ft outside containment between column C and N and Columns 4W and 8 (Ref: Drawing Nos. 1 & 2). Safety related equipment and components

Question No.

410.25 (Cont'd)

are located in these rooms and in the adjacent corridors. The only high energy piping in the area is the CVCS charging and letdown lines and Auxiliary Steam/Condensate lines. For the routing and postulated break locations of these lines see the Break & Rupture Restraint Location Drawings (Ref: Nos 9 & 10) above.

The attached table summarizes the analysis and protection from high energy line breaks. Please note that the CVCS lines are enclosed within pipe chases at elevations 357.00 and 347.00 ft. The Auxiliary Steam/Condensate lines are located in the corridors outside the ECCS Rooms.

Moderate energy piping and rupture locations are not shown because the analysis for moderate energy cracks has conservatively postulated cracks in all moderate energy lines at any location. This analysis and protection is discussed in FSAR Subsection 3.6A.3.4.2.

Q410.25

HIGH ENERGY LINE BREAK

ANALYSIS AND PROTECTION

RAB elevation 335.00 ft.

I. ECCS Area "A"

High Energy Lines - None

II. ECCS Area "B"

(A) High Energy Lines - CVCS Charging & Letdown

(B) Essential Equipment - HPSI, LPSI Pumps, Shutdown Cooling Heat Exchanger (CVCS break)

(C) Protection

Pipe Whip - Separation and Restraints
(Ref: FSAR Subsection 3.6A.2.1.1)

Jet Impingement - Separation and Barriers
(Ref: FSAR Subsection 3.6A.2.2.1

Environmental Effects - Isolation of line and qualification of Equipment
(Ref: FSAR Subsection 3.6A.2.3.2 and NRC Question 410.26)

III. Corridors Outside ECCS Areas

(A) High Energy Lines - Aux Steam/Condensate

(B) Essential Equipment - Various Instrumentation Racks and Electrical Boxes

(C) Protection

Pipe Whip - Separation and Restraints
(Ref: FSAR Subsection 3.6A.2.1.5)

Jet Impingement - Separation and Barriers
(Ref: FSAR Subsection 3.6A.2.2.3)

Environmental Effects - Isolation of line and qualification of Equipment
(Ref: FSAR Subsection 3.6A.2.3.2 and NRC Question 410.26)

Question No.

410.29 (5.2.5) Provide the following additional information concerning leakage from the reactor coolant pressure boundary:

(a) Discuss 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.

(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 an accuracy of one gpm or better in accordance with the guidelines of Regulatory Guide 1.45.

Response

a) Intersystem leakage of primary coolant into the Shutdown Cooling System is not monitored since intersystem leakage path does not exist in the shutdown cooling lines. Refer to CESSAR-F Figure 6.3.2-1B. In the event seat leakage takes place past the two isolation valves SI-651 and SI-653 (SI-652 and SI-654 on SDC Loop 2), the leakage will pressurize the shutdown cooling lines and lift relief valves SI-179 and SI-189. (Note: relief valves SI-469 and SI-169 located between the two isolation valves are thermal relief valves and will not open for overpressurization protection.) The discharge from relief valves SI-179 and 189 is directed to the SIS recirculation sump and monitored as an unidentified leakage source. The maximum volume of this unidentified leakage will be less than .2 gallons/day. FSAR Subsection 5.2.5.1.5 will be revised to delete any reference to intersystem leakage into the Shutdown Cooling System.

b) The means of detection of leakage of primary coolant through the letdown heat exchanger, reactor coolant pump seal heat exchanger and thermal barriers into the Component Cooling Water System are as follows:

1) Component Cooling Water System radiation - heat exchanger leaks will produce inleakage of reactor coolant and fission products into the cooling water. Such inleakage will increase the radioactivity content of the cooling water. The increase will be detected by the Component Cooling Water System radiation monitors (RE-CC-7020AS and RE-CC-7020BS) located in the recirculation lines across the component cooling water pumps of each train. These monitors are described in Subsection 11.5.2.4.1(a).

Response

410.29 (Cont'd)

2) Component cooling surge tank level - leakage of reactor coolant increases the inventory in the Component Cooling Water System, causing an increase in the surge tank level. Level switches LS-CC-7013AS and LS-CC-7013BS provide a high level alarm in the Main Control Room.

FSAR Subsection 5.2.5.1.4 will be updated accordingly.

c) The containment atmosphere monitor has been designed to accurately measure the gaseous and particulate activity in the containment atmosphere. (See Subsection 11.5.2.4.1.g.) Its response to a one gpm reactor coolant leak depends on numerous plant factors such as coolant activity and particulate behavior that may vary widely with time. This variability is inherent in the method due to the indirect relationship between the measured variable (radiation) and leak rate.

Regulatory Guide 1.45 does not require an accuracy of one gpm for the containment monitor, (this requirement applies to the flow measurement devices) but specifies a detector sensitivity and response time adequate to detect a one gpm leak in less than one hour. Under realistic assumptions of failed fuel, the containment atmosphere monitor could detect a one gpm leak in less than one hour. For example:

Assuming reactor coolant concentration equivalent to 0.1% failed fuel, a prior coolant leak for 30 days of 0.1 gpm, Containment Vent System in operation, and a 2.5 mR/hr background at the monitor, the gaseous monitor will detect a one gpm leak in 22.5 minutes.

Assuming 0.1% failed fuel, a prior coolant leak for 30 days of 0.1 gpm, Containment Vent System in operation, Airborne Radioactive Removal System not in operation, an airborne particulate production equivalent to 100% of noble gas daughters and 1.25% of released iodines, neglecting settling or resuspension, the particulate monitor will detect a one gpm leak in less than 11 minutes.

Both sides of this sheet are affected
(ie 5.2-11 & 5.2-12)

Leakage from the Main Steam, Feedwater, and Component Cooling Water Systems and other nonradioactive sources results in increased quantities of condensate without an associated increase in background radioactivity. RCPB leakage is identifiable by a simultaneous increase in condensate and radioactivity.

b) Airborne Particulate Radioactivity Monitoring

The containment atmosphere is monitored for radioactive particulates by the Containment Atmosphere/Containment Purge Airborne Radiation Monitors described in Subsection 11.5.2.4.1(g) and Table 11.5-1. These monitors are a pair of identical and redundant units.

The particulate channel in each monitor is capable of detecting the airborne radioactive particulates resulting from an increase of one gpm in the leakage rate from the primary coolant pressure bounday into the containment atmosphere within one hour. In addition, the particulate filter tape and the downstream iodine filters may be removed for laboratory analysis.

The airborne radioactive particulate monitoring equipment used for leakage detection has been designed to remain functional following an SSE. The equipment seismic capability is consistent with guidelines of Regulatory Guide 1.45.

c) Airborne Gaseous Radioactivity Monitoring

The containment atmosphere is monitored for radioactive gases by the Containment Atmosphere/Containment Purge Airborne Radiation Monitors described in Subsection 11.5.2.4.1(g) and Table 11.5-1. These monitors are a pair of identical and redundant units.

The gaseous channel in each monitor is capable of detecting the airborne radioactive gases resulting from an increase of one gpm in the leakage rate from the primary coolant pressure boundary into the containment atmosphere within one hour.

The airborne radioactive gas monitoring equipment used for leakage detection has been designed to remain functional following an SSE.

d) Reactor Coolant Inventory Monitoring

Abnormal leakage from the Reactor Coolant System can be detected through measurement of the net amount of makeup flow to the system. (Refer to CESSAR-F Subsections 5.2.5.1.1 and 9.3.4 for details).

5.2.5.1.3 Leakage Through Steam Generator Tubes or Tubesheet

Refer to CESSAR-F Subsection 5.2.5.1.3.

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5.2.5.1.4 Leakage to Auxiliary Systems

Subsection 11.5.2.4 describes the design basis for process monitors used in all potentially contaminated auxiliary systems and their sensitivity.

5.2.5.1.5 Intersystem Leakage

Intersystem leakage typically is not detected by monitoring of the normal "identified" or "unidentified" leakages.

Leakage from the RCPB may occur into the [redacted] Safety Injection System. [redacted] 2

[redacted] Leakage into the Safety Injection System can be identified by high pressure reading and alarm. Refer to CESSAR-F Figure 6.3-1 for the system instrumentation provided.

Intersystem leakage between the RCPB and the CVCS is not monitored since the CVCS is in operation when the RCS is pressurized, and is thus processing fluid; however, the CVCS can be used to identify any leakage from the RCS by observing makeup flow rates to the volume control tank for the purposes of identifying gross leakage over an extended period of plant operation. Leakage can also be identified through monitoring of the level changes within the volume control tank.

5.2.5.2 Control Room Leakage Instrumentation

5.2.5.2.1 Primary Indicators of Reactor Coolant Leakage

The primary instrumentation indications of reactor coolant leakage to the containment environs are:

a) RCPB - Identified Leakage Flow Indicator (0-20 gpm) and Alarm (10 gpm)

b) RCPB - Unidentified Leakage Flow Indicator (0-5 gpm) and Alarm (1 gpm or Reactor Cavity Sump Pump running) 2

c) Containment airborne radioactivity monitor indication (particulate and gaseous)

d) High containment particulate radioactivity increase alarm

e) High containment gaseous radioactivity increase alarm 2

5.2.5.2.2 Other Indicators of Reactor Coolant Leakage

Other Control Room instruments that would indicate gross reactor coolant leakage are:

a) Reactor drain tank level 2

Q410.29

b) Pressurizer pressure indicators

Question No. 410.29

Insert 1

The means of detection of leakage of primary coolant through the letdown heat exchanger, reactor coolant pump seal heat exchanger and thermal barriers into the Components Cooling Water System are as follows:

a) Component Cooling Water System radiation - heat exchanger leaks will produce in-leakage of reactor coolant and fission products into the cooling water. Such in-leakage will increase the radioactivity content of the cooling water. The increase will be detected by the Component Cooling Water System radiation monitors (RE-CC-7020AS & RE-CC-7020BS) located in the recirculation line across the component cooling water pumps of each train. These monitors are described in subsection 11.5.2.4.1(a).

b) Component cooling surge tank level - leakage of reactor coolant increases the inventory in the component cooling water system, causing an increase in the surge tank level. Level switches LS-CC-7013AS and LS-CC-7013BS provide a high level alarm in the main control room.

Question

410.30 (9.1.1) Verify that the vault housing the new fuel storage racks is not located in the vicinity of any moderate or high energey lines or rotating machinery to insure physical protection for the new fuel from internally generated missiles and the effects of pipe breaks.

Response New fuel storage racks are located within reinforced concrete vaults which are an integral part of the Fuel Handling Building structure that has been designed to seismic Category I requirements and complies with Regulatory Guide 1.13, Rev. 1. The location of the new fuel storage area can be found in FSAR figures 9.1.2-2a and 9.1.2-26.

A survey of the Fuel Handling Building indicates within the vicinity of the new fuel storage area no moderate or high energy lines exist. (No high energy lines exist within the Fuel Handling Building). Rotating machinery capable of generating a missile is located on lower elevations and seismic Category I barriers are provided. Some of the fuel handling devices employ hoist and drive motors. These rotating devices are not considered to be capable of generating creditable high energy missiles.

Question No.

410.32 (9.1.2) Verify the spent fuel pool is not located in the vicinity of any high energy lines or rotating machinery to ensure physical protection for the fuel from internally generated missiles and the effects of pipe breaks.

Response Spent fuel assemblies will be placed within seismic Category I storage racks, located in the spent fuel pool of the Fuel Handling Building. The location of the spent fuel storage facilities within the station complex is shown on FSAR figures 9.1.2-2a and 9.1.2-2b. The spent fuel pool is a stainless steel lined, concrete walled pool that is an integral part of the Fuel Handling Building structure designed to seismic Category I requirements and which complies with Regulatory Guide 1.13, Rev. 1. (See FSAR Section 9.1.2 for further discussion).

The potential sources of missiles which were evaluated in the Fuel Handling Building are considered to be generated from failure of either a pressurized component or a rotating component. However, there are no high energy systems located within the Fuel Handling Building. Therefore, missiles such as valve stems, flange bolts, thermowells etc. will not be generated. Rotating pieces of equipment in the Fuel Handling Building include the component cooling water pumps (EL 335.0), fuel pool cooling pumps (EL 362.5) and the fuel pool clean-up pumps (EL 362.5). All of these pumps and their motors are located on elevations below the spent fuel pool and are separated by seismic Category I barriers which prevent any missiles from penetrating the spent fuel pool. Additionally, hoist and drive motors are provided with some of the fuel handling equipment located in the Fuel Handling Building. These rotating devices are not considered to be capable of generating creditable high energy missiles.

Question No.

410.35 (9.2.5) In accordance with Regulatory Guide 1.27, a continuous capability to maintain the plant in a safe shutdown condition for at least 30 days is recommended for the ultimate heat sink. The FSAR refers to an analysis of the 30-day period following a design basis accident, but the analysis is inconclusive due to the following missing information:

(a) Table 9.2.5-5 (total heat load from Component Cooling Water System) provides the data up to 25.9722 hours only, not for the 30-day period.

(b) Figures 9.2.5-2a through 9.2.5-2d have not been supplied yet.

(c) Table 9.2.5-3 indicates that certain data will be provided later.

Response The Ultimate Heat Sink (UHS) which is a dry cooling tower operates in conjunction with the Component Cooling Water System (CCWS). The CCWS is a closed loop cooling water system requiring no makeup. Redundant UHS's and CCWS trains have been provided as discussed in FSAR Subsection 9.2.2.

Each UHS is sized to reject 180×10^6 BTU/HR compared to a maximum projected design basis heat rejection requirement of 158.43×10^6 BTU/HR which occurs approximately four hours after initiation of the design basis event. The UHS heat rejection requirement steadily decreases from this maximum value as verified by the analysis for the first 25.9722 hours of the event. This decrease continues throughout the postulated 30 day period as referenced in Subsection 9.2.5. Details of the analysis are provided in Subsections 6.2.1 and 5.4.7.

The UHS in conjunction with the CCWS is designed to provide heat rejection capability exceeding the maximum calculated requirement per the analysis and to do this on a continuous basis for an indefinite period of time beyond the 30 day requirement following the accident event. On this basis, it is considered that Table 9.2.5-5 need not be revised to include data beyond 25.9722 hours. Subsection 9.2.5.3 will be amended to reflect the above information.

FSAR Figures 9.2.5-2a through 9.2.5-2c and Table 9.2.5-3 have been provided in FSAR Amendment 3 and are attached to this response for your use.

During normal operation the UHS in conjunction with the CCWS heat exchanger, can reject the maximum normal heat loads while maintaining CCWS temperature at or below 95F. Table 9.2.5-1 presents expected tower performance requirements during normal conditions. Parametric performance expectations for a range of ambient temperatures with and without heat rejection to the SWS under normal and emergency conditions is presented in Table 9.2.5-2. During emergency operation the UHS provides sufficient cooling to safety-related heat loads identified in Subsection 9.2.2. In the event of the loss of one train for any reason, the redundant train can reject the maximum instantaneous heat load. Non-essential heat loads can be manually aligned as reactor decay heat affords spare UHS capacity. The appropriate controls as discussed in Section 7.3 permit the operator to monitor and select these heat load alignments.

9.2.5.3 Safety Evaluation

SEE Insert A

The UHS, with one tower operating alone is designed to meet maximum heat load following an accident. Its long term heat rejection capacity is sufficient to mitigate a postulated LOCA and return the containment pressure and temperature to ambient conditions.

The results of the ~~an~~ analysis of the ~~30-day~~ period following a design basis accident are found in Tables 9.2.5-4 and 9.2.5-5 and Figures 9.2.5-2a through 9.2.5-2c. This analysis has determined the total heat rejected, the sensible heat rejected, the station auxiliary system heat rejected, and the decay heat release from the reactor. Details of this analysis are provided in Subsections 6.2.1 and 5.4.7. 3

As per Branch Technical Position ASB-9-2, the decay heat curves for fission products and for heavy elements were obtained using the assumptions and uncertainties set forth in the October 1973 draft proposed ANS standard, "Decay Energy Release Rates Following A Shutdown Of Uranium-Fueled Thermal Reactors" (ANS-5), to establish the heat input due to decay of radioactive material. An equilibrium fuel cycle and an increase in the calculated heat inputs were assumed as follows:

a) For the time interval 0 to 10^3 seconds, 20 percent was added to the heat released by the fission products to account for uncertainties in their nuclear properties.

b) For the time interval 10^3 to 10^7 seconds, 10 percent was added to the heat released by the fission products to account for uncertainties in their nuclear properties.

c) For the time interval 0 to 10^7 seconds, the heat released by the heavy elements was calculated (using the best estimate of the production rate for each unit) and 10 percent was added to account for uncertainties in their nuclear properties.

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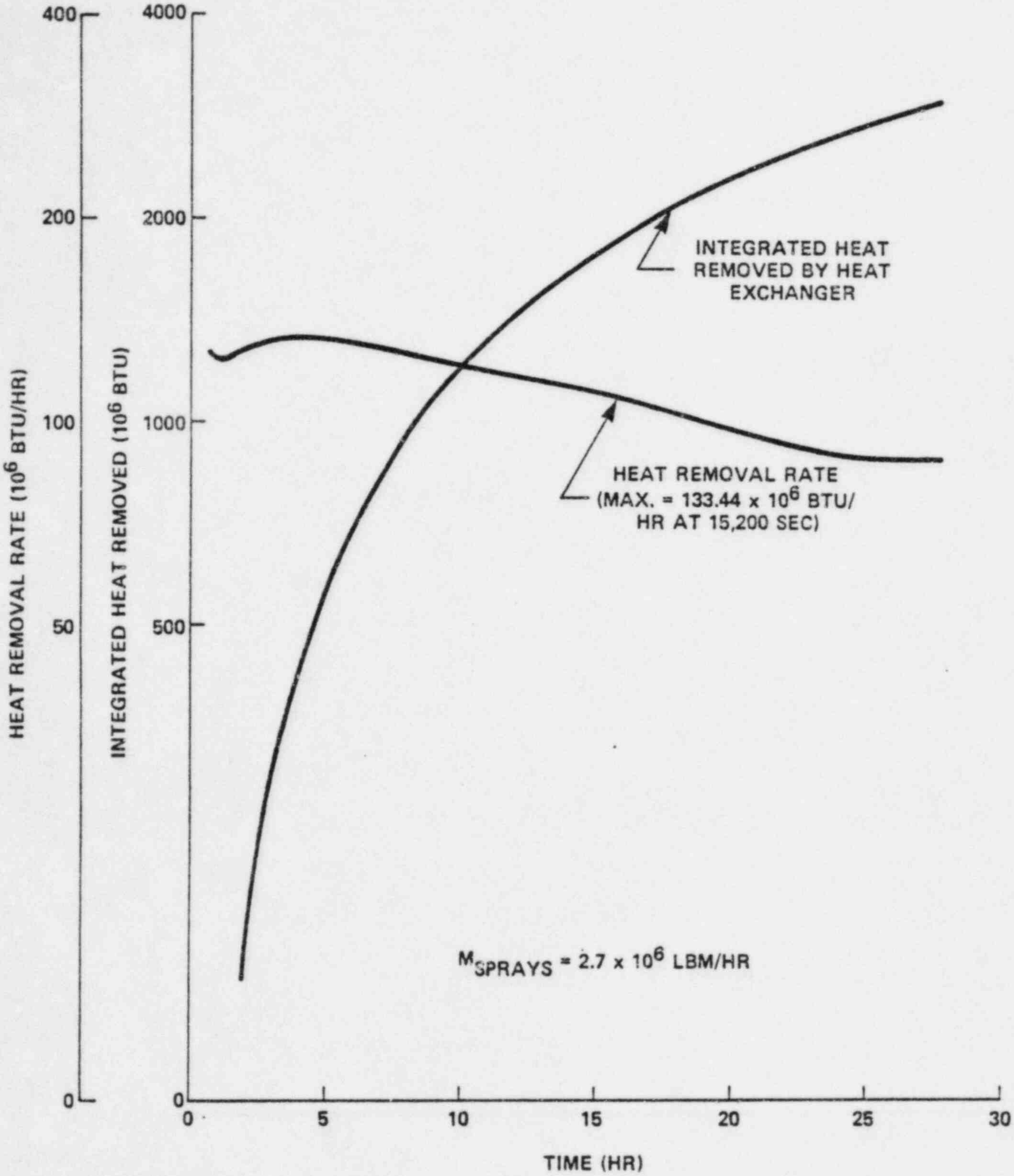
INSERT A

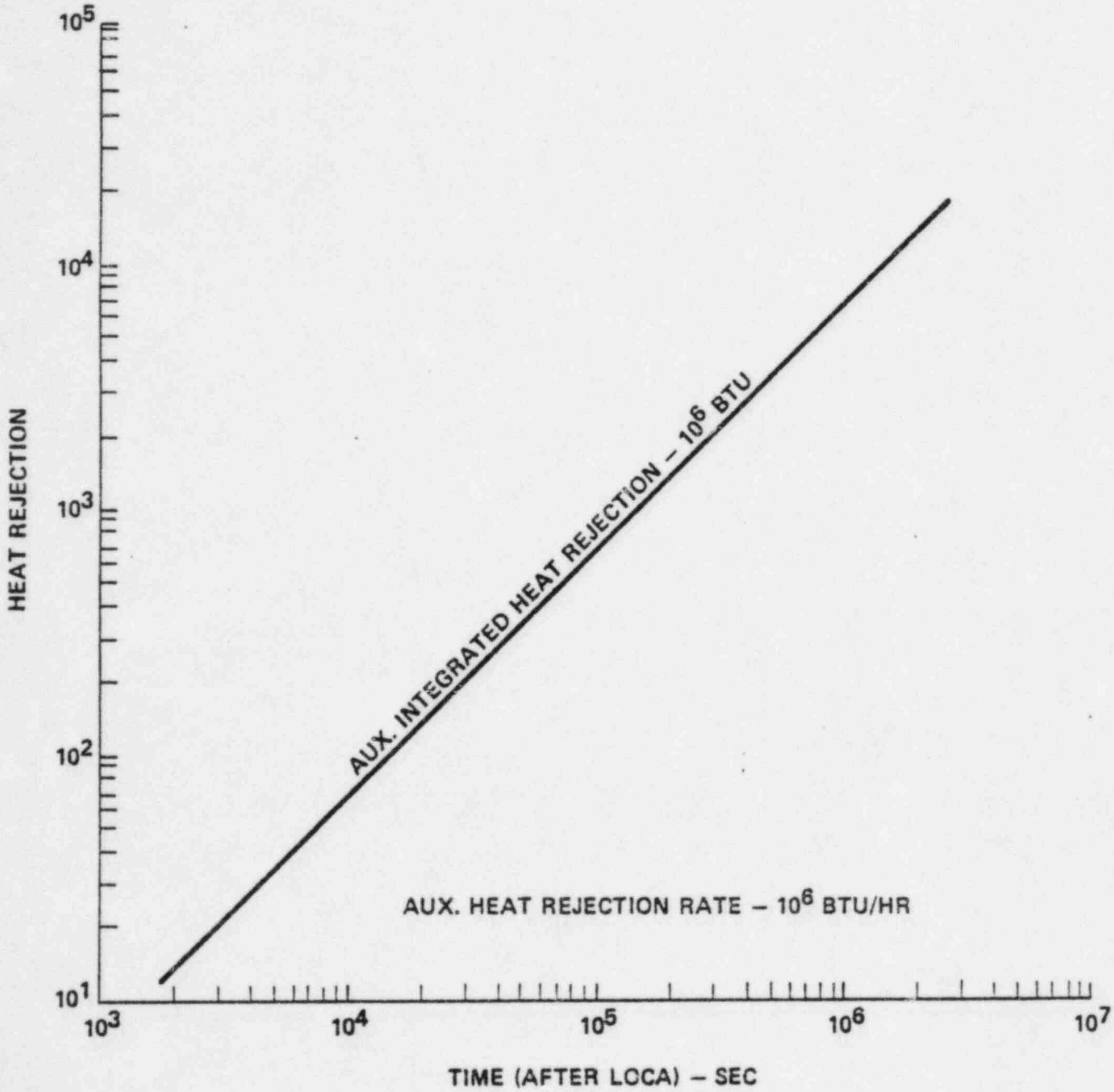
The UHS, with one tower operating alone, is designed to reject the maximum design basis heat load following an accident. Based on an analysis of the period following a design basis accident, the maximum heat rejection rate to the Component Cooling Water System occurs approximately 4 hours after initiation of the event. From this maximum, the heat rejection requirement steadily decreases until safe shutdown of the reactor is achieved. Since the CCWS is a closed water system requiring no makeup water, the UHS has the capability to provide the maximum heat rejection required to mitigate a postulated LOCA and return the containment pressure and temperature to ambient conditions well beyond the 30 day requirement.



410.35

AMENDMENT NO. 3 (4/83)

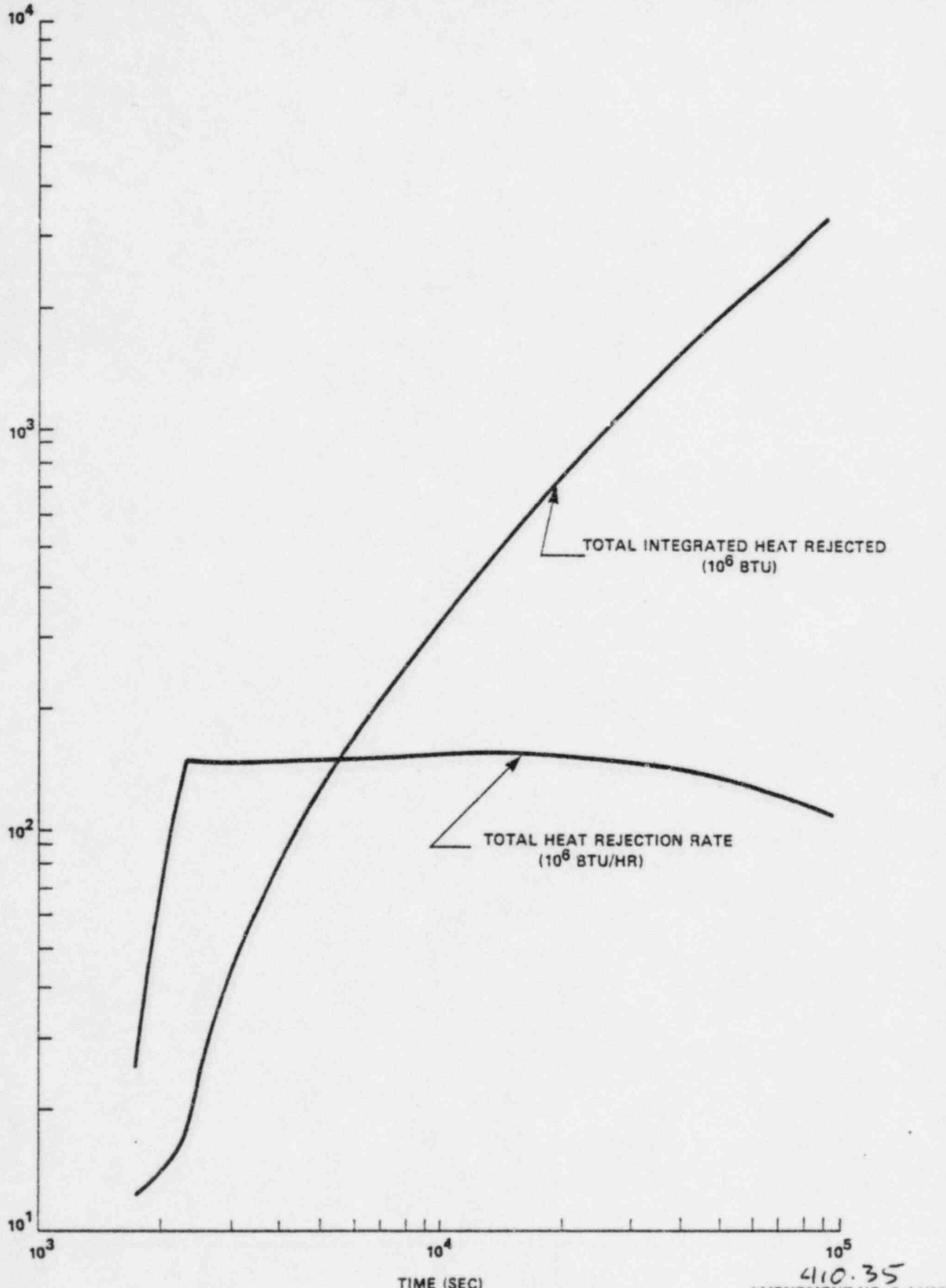
WASHINGTON PUBLIC POWER SUPPLY SYSTEM Nuclear Projects 3 & 5 FINAL SAFETY ANALYSIS REPORT	UNFOULED SHUTDOWN HEAT EXCHANGER HEAT REMOVAL (U = 392 BTU/HR - FT^2 ^oF) DESLS WITH MAX SI	FIGURE 9.2.5-2a



410.35

AMENDMENT NO. 3 (4/83)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM Nuclear Projects 3 & 5 FINAL SAFETY ANALYSIS REPORT	HEAT REJECTION DUE TO STATION AUXILIARY SYSTEMS*	FIGURE 9.2.5-2b



410.35

AMENDMENT NO. 3 (4/83)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM Nuclear Projects 3 & 5 FINAL SAFETY ANALYSIS REPORT	TOTAL HEAT LOAD FOR COMPONENT COOLING WATER SYSTEM	FIGURE 9.2.5-2c

TABLE 9.2.5-3

UHS COMPONENT DESIGN DATA

Component Description

1) Number of Cells:	Ten(10) per Tower	3
2) Type of Tube Bundle: Multipass, Multiparallel pass, Baffled water box on each end, Number of Bundles	Forty(40) per Tower	
3) Weight per bundle (dry) lbs.	26,400	3
4) Bundle length ft.	45' - 7"	
5) Bundle width ft.	7' - 5 1/2"	
6) Nominal Nozzle size inches	4	
7) Fan type - Axial flow, propeller type with provision for manual blade pitch adjustment. Horizontally mounted on fan deck. Electric fan, motor driven through a reduction gearbox with one motor/gearbox per fan. Number of fans	20	3, 3
8) Heat retention doors. Electrically operated. Number of doors	40	3
9) Total train design heat rejection rate, 10^6 Btu/hr	180	
10) Total water quantity cooled, gpm	11,000	
11) Ambient design dry bulb temperature, F	101.5	
12) Inlet Water Temperature, F	153	
13) Outlet, F	120	
14) Approach, F	18.5	
15) Cooling Range, F	33	

410.35

TABLE 9.2.5-3 (Cont'd)

Component Description		
16) Maximum allowable tube side pressure drop, psi (tube bundle inlet flange to outlet flange - 100% tubes)	8	3
17) Tube side design pressure, temperature psig/F	150/200	3
18) Maximum allowable connected fan horsepower, hp	2,000	
19) Design allowance for plugged tubes	5%	

Q410.35

Question No.

410.36 (9.3.1) Concerning the compressed air system, provide the following information:

(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 shutdown.

(c) Identify the testing requirements and frequency of tests for the accumulators and check valves provided within the compressed air system.

(d) Discuss how the safety related portions of the system meet the requirements of GDC 2 and 4 regarding protection against natural phenomena, missiles and environmental effects.

(e) Verify that failure of this non-safety related system does not affect the safety system functions.

Response (a) The air quality limits which will not be exceeded are in accordance with the recommendations of ISA S7.3, dated 1975 and consist of the following:

Max Dew Point	-	40°F @ 75 PSIG
Filtration	-	100% Removal of all particulates 3 microns and larger.
Oil Content	-	Negligible (compressors are 2-stage, reciprocating, oil free with carbon filled Teflon piston rings).
Contaminants	-	The instrument air system is designed to preclude the ingress of corrosive contaminants and hazardous gases, flammable or toxic.

Response

410.36 (Cont'd)

FSAR Table 9.3.1-1, "After Filters" will be amended to state "100% removal of all particulates 3 microns and larger".

(b) Safety related systems and components (i.e., air operated containment isolation valves) which utilize instrument air and whose function is to mitigate an accident or safely shutdown the plant are designed such that no single active failure will prevent the safety related system from performing it's intended function as indicated by the applicable failure modes and effects analyses for safety related systems.

(c) Compressed Air System components will be tested in accordance with the Revised Code of Washington and Washington Administrative Code.

(d) The only portions of the compressed air system that are safety related are the containment penetrations and associated piping and isolation valves. The compressed air system's containment penetrations are located within a seismic Category I structure which is designed to protect the containment isolation system against natural phenomena such as earthquakes, tornadoes, tornado generated missiles, etc. The compressed air system containment penetrations associated piping and isolation valves are designed to ASME Section III, Class 2, seismic Category I requirements and LOCA transient and environmental conditions.

(e) Operation of the compressed air system is not required for the initiation of any ESF systems, safe-shutdown system or any other safety related system. All safety related system valves using compressed air are designed to assume the positions required for a safe shutdown if the compressed air supply is lost as described in FSAR Section 9.3.1.

TABLE 9.3.1-1 (Cont'd)

Air Receiver	
Type	Vertical vessel with integral drain to remove condensed moisture
Quantity	1
Design Pressure	125 psig
Design Temperature	125F
Code	ASME Section VIII
Prefilters	
Type	Cartridge
Quantity	1
Filtration	100% removal of all entrained particulate 10 microns in size and larger
Air Drying Towers	
Type	Desiccant regenerative drying tower
Quantity	1
Design Pressure	125 psig
Max Dew Point	-40 F @ 75 psig
After Filters	
Type	Cartridge
Quantity	1 Unit
Filtration	100% removal of all particulates ~~over 5 microns~~ 3 microns and larger
2 - Service Air System	
Air Compressor	
Type	Two stage, reciprocating oil-free compressor, with carbon filled Teflon piston rings
Quantity	1
Capacity	581 ± 3% SCFM @ 60°F and 14.7 psia 1

Q410.36
SCN 461

Question No.

410.38 (9.4) Some of the licensees have provided measures for detecting and correcting dust accumulation on safety related equipment in order to assure their availability on demand. Verify that dust accumulation doesn't pose a problem in this plant.

Response Dust problem within the plant buildings housing the safety related systems is negligible due to design considerations and administrative procedures.

A dust laden atmosphere is not a prevailing site characteristic because of the topographical and climatic conditions.

Concrete walls in areas housing safety related equipment are generally treated with a special non-porous coating to preclude dust collection and generation.

The Reactor Auxiliary Building Main Ventilation System is provided with evaporative air cooling sprays and filters which separate large particulate matter from the outside air before it is supplied to most safety related equipment areas in the Reactor Auxiliary Building. The remaining safety related equipment areas are served by independent ventilation systems which include particulate air filters having 55 percent maximum efficiency except for the Diesel Generator Areas Ventilation System.

The Diesel Generator Areas Ventilation System and provisions in the design which inhibit dust accumulation are discussed in the response to Question 430.55.

Question No.

410.43 (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 during emergency conditions.

Response

The Control Room Area Ventilation System and the Electrical Equipment and Battery Rooms Ventilation System are independent safety-related systems which provide continuous ventilation and cooling to the Control Room and ESF switchgear rooms, respectively for all modes of operation including normal and emergency conditions. Each safety system is provided with redundant seismic Category I air handling units located in separate HVAC equipment rooms.

Each HVAC equipment room is ventilated and cooled during all modes of operation from a common distribution ductwork connected to the equipment train air handling units for each system. The single failure of one of the two system air handling units cannot result in complete loss of ventilation and cooling to both of the HVAC equipment rooms. The standby air handling unit is available to assure ventilation and cooling to both trains through the common distribution ductwork.

The HVAC equipment rooms are ventilated and cooled to maintain the proper environment in the rooms for each system's air handling units regardless of a single component failure which can cause one train of ventilation equipment to be temporarily shut down.

For further discussion refer to FSAR Subsections 9.4.1.2.3 and 9.4.5.1.2.3, respectively.

Question No.

410.45 (9.4.3) Describe the means provided for isolating the Radwaste Building Ventilation System following a design basis event (such as SSE) in order to prevent the release of potentially radioactive airborn contaminants through building openings.

Response As described in Section 15.7 of the FSAR, radioactive releases resulting from the failure of components and systems located in the Reactor Auxiliary Building have been assumed to reach the environment unfiltered (without isolation of the structure). The analysis provided in Section 15.7 show that the off-site doses resulting from the unfiltered releases are well within the limits of 10CFR100. As such, a design basis event (such as an SSE) which may cause the failure of systems and components containing radioactive liquids or gases does not require isolation of the Reactor Auxiliary Building in order to contain the released sources.

Question No.

410.47 (10.3) Identify Main Steam Isolation Valves (MSIV's) on Figure 10.3-1. 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.

Response Each of the four main steam lines is equipped with a quick acting automatically operated Main Steam Isolation Valve (MSIV). These valves have an actuation time of five seconds from receipt of a Main Steam Isolation Actuation Signal (MSIS) and are designed to be capable of maintaining tight shutoff at the maximum design main steam line temperature and differential pressure in both directions. This is to prevent uncontrolled blowdown from more than one steam generator in the event of a break in the main steam line inside or outside the containment beyond the Break Exclusion Region (BEX), assuming a single active failure.

FSAR Figure 10.3-1 will be amended to identify the Main Steam Isolation Valves and FSAR Subsection 10.3.2.2.2 will be amended to reflect the above response.

different auxiliary feed pump turbine. Corresponding branch lines from the two steam generators are joined together before entering each auxiliary feed turbine, so as to provide a redundant supply of motive steam in case of depressurization of one steam generator due to steam or feedwater pipe rupture.

10.3.2.2.2 Main Steam Isolation Valves

Each of the four main steam lines is equipped with a quick acting automatically operated Main Steam Isolation Valve (MSIV). These valves are located downstream of the safety relief valves and the atmospheric dump valves, close to the Reactor Building wall. The design of the MSIVs conforms to the CE interface requirements described in CESSAR-F Subsections 5.1.4.E.2, 5.1.4.F.3, 5.1.4.F.4, 5.1.4.F.5, 5.1.4.G.10, 5.1.4.G.11, 5.1.4.H.3, 5.1.4.I.1 through I.4, 5.1.4.I.8, 5.1.4.J.1, 5.1.4.J.2, 5.1.4.M.7 and 5.1.4.M.8. 2

at the maximum design main steam line temperature and differential pressure in both

designed to be

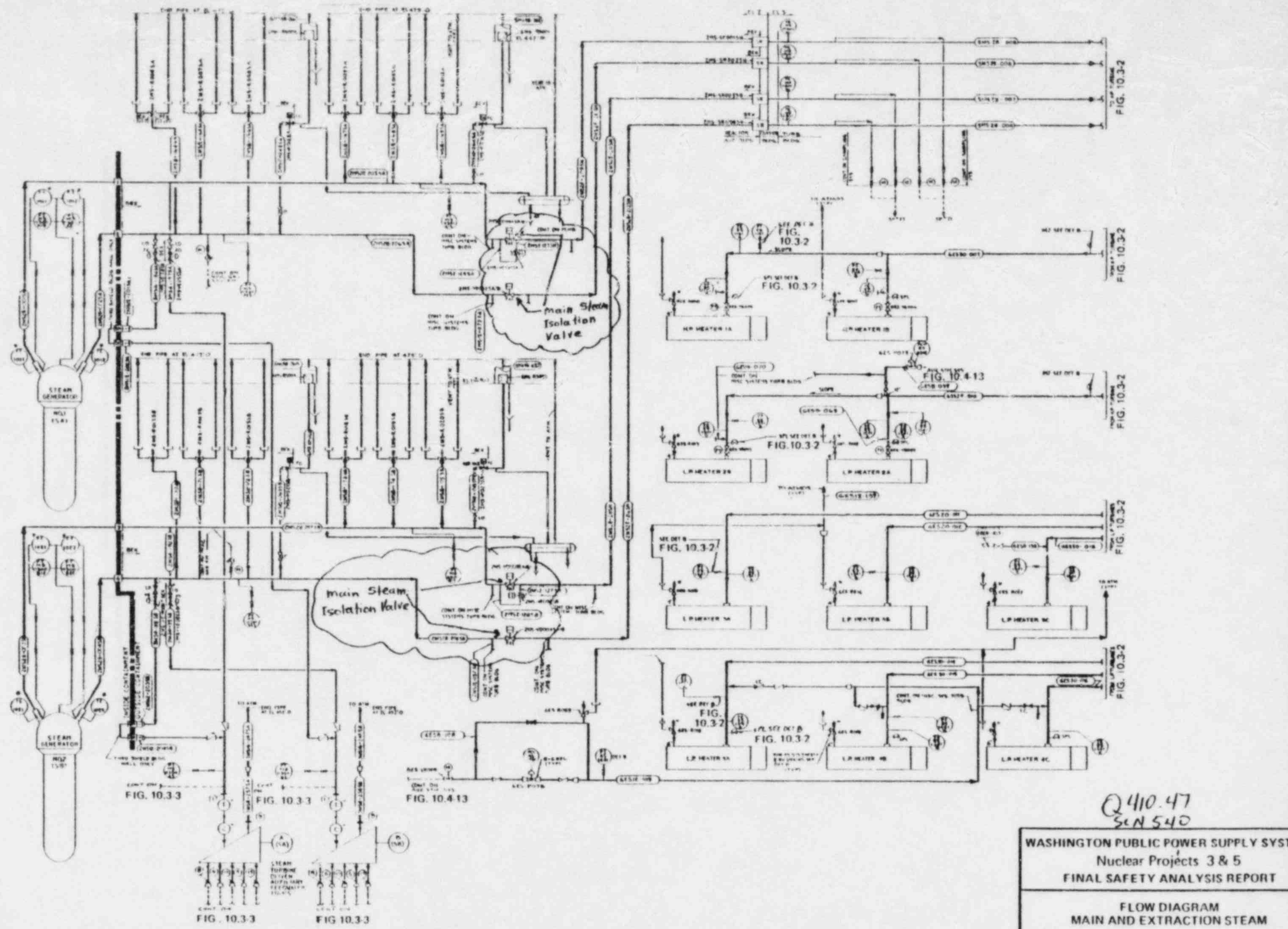
Each valve has an actuation time of five seconds or less from receipt of Main Steam Isolation Valve Actuation Signal (MSIS) and is capable of maintaining tight shutoff ~~under full mainstream line pressure and temperature from either~~ directions. This is to prevent uncontrolled blowdown from more than one steam generator in the event of a break in the main steam line inside or outside containment beyond the Break Exclusion Region (BEX), assuming a single active failure.

The MSIVs are double-disc-type gate valves, designed and manufactured in accordance with ASME Section III, Class 2 requirements. MSIV closure on MSIS is assured, and spurious closures, due to a single failure, are avoided by the design of the two independent hydraulic circuits, each connecting one hydraulic accumulator to the operator's cylinder. The hydraulic accumulator is pressurized by nitrogen (N_2). Upon operation of the MSIV or leakage, hydraulic fluid is drawn from the accumulator and nitrogen pressure decreases, initiating the air operated hydraulic fluid pump. The air operated pump will then deliver hydraulic fluid to the accumulator to maintain the normal hydraulic fluid pressure. Each hydraulic accumulator has a built in capacity of holding the valve open for eight hours, and permits one open and close cycle without need for recharging. Redundant air receivers are provided to operate the pilot solenoid valves which are used to connect the hydraulic fluid lines for the operation of the MSIV actuators. Air for the air operated hydraulic pump and the air receivers are provided from the plant Instrument Air System (Subsection 9.3.1).

Loss of ac power does not result in automatic valve closure. One 120V ac and one 125V dc power supply is provided for each operator, either of which is capable of closing the valve. The fail as-is position for the MSIVs was selected in order to prevent possible plant trips due to spurious valve closures. The actuator still retains the ability to close both valves upon any single failure.

A main steam isolation valve bypass line is provided on each steam generator. 2
These lines are used for warmup of the steam lines downstream of the isolation valves, and pressure equalization prior to admitting steam to the turbine.

Q 410.47
SCN 540



WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Nuclear Projects 3 & 5
FINAL SAFETY ANALYSIS REPORT

FLOW DIAGRAM
MAIN AND EXTRACTION STEAM

FIGURE 10.3-1

Question No.

410.50 (10.4.7) FSAR Subsection 10.4.7.3.2(b) discusses compliance with CE interface requirements of CESSAR-F Subsection 5.4.4.I.10. This subsection requires maintaining a leak rate of less than 1000 cc/hr under certain main feedwater line break conditions. The FSAR does not cover the above interface requirements. Clarify the discrepancy.

Response

The maximum leak rate through the downcomer and economizer feedwater line isolation valves does not exceed 1,000 cc/hr. Hence, CESSAR-F interface requirement 5.1.4.I.10 is met by the WNP-3 design.

FSAR Subsection 10.4.7.3.2 will be amended to reflect the response to this question.

and with one low pressure heater string out of service (which imposes a higher head) to maintain the 100 percent load feedwater flow. It is equipped with a lube oil system providing lubrication for both the turbine and the pump and with lube oil coolers serviced by the Service Water System.

10.4.7.3.1.4 Motor Driven Feedwater Pump (MDFP)

The MDF pump is provided with a forced feed, water cooled, lubrication system. The main oil pump is driven by the shaft and mounted on the thrust end bearing housing. This pump supplies lube oil for both the pump and motor and is serviced by the Service Water System Subsection 9.2.1.

An auxiliary oil pump driven by an electric motor is provided to supply oil during starting and stopping periods. The auxiliary oil pump starts automatically and cuts off and remain on standby when full flow from the shaft driven pump is reached.

10.4.7.3.2 Valves

a) Feedwater Economizer Control Valves

The economizer control valve is an 18 inch, ANSI Class 1500 angle valve equipped with a spring loaded, air piston operator. The valve fails in the closed position to avoid overfilling the steam generator and possibly damaging the turbine blades. The valve is rated for a maximum flow of 25,200 gpm at 450F and can control flow down to 1800 gpm at 200F. ~~and conforms to CE interface requirements as described in CESSAR-F Subsection 5.1.4.I.10.~~

b) Feedwater Downcomer Control Valves

The downcomer control valve is 8 inch, ANSI Class 1500, angle valve equipped with a spring loaded diaphragm operator. The valve fails in the closed position for the same reasons as the economizer valve. The valve is rated for a maximum flow of 3500 gpm at 200F and 2100 gpm at 450F with a minimum flow of 60 gpm at 40F. ~~and conforms to CE interface requirements as described in CESSAR-F Subsection 5.1.4.I.10.~~

c) Feedwater Isolation Valves

These valves are ASME-Class 2, Class 900. The valves are designed to close within 5 seconds after receipt of Main Steam Isolation Signal (MSIS) and the design conforms to CE interface requirements as described in CESSAR-F Subsections 5.1.4.E.3, 5.1.4.F.8, 5.1.4.H.3, 5.1.4.I.9, 5.1.4.M.16, ~~and~~ 5.1.4.M.17 and 5.1.4.I.10 with respect to maximum leak rate not exceeding 1000 cc/hr.

There are two valves on each line supplied with redundant electric power from their respective safety-related buses, SA and SB. | 2

d) Prestart Cleanup Pressure Control Valve

This valve controls and limits the pressure of the cleanup water returned to the electromagnetic filter.

Q410.50
SCN 493

Question No.

410.52 (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 approximately 15% of full power by using Feedwater through the downcomer nozzle at the lowest feedwaer 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 Refer to CESSAR-F Subsection 14.2.12.2.14 for a description of the feedwater water hammer test to be run at WNP-3.

Question No.

430.3 (SRP 9.5.3) Identify the vital areas and hazardous areas where emergency lighting is needed for safe shutdown of the reactor and the evacuation of personnel in the event of an accident. Tabulate the lighting system provided in your design to accommodate those areas so identified.

Response

Vital and hazardous areas, where emergency lighting is needed are shown in the attached Table A with their respective illumination levels (fc). In addition, the self-contained storage battery assemblies are strategically located so that in the event of an accident personnel can evacuate safely, and operation of the required vital and safety-related equipment can be performed. The exact orientation for the battery pack heads shall be determined in the field to obtain optimum illumination for evacuation, as well as vital and safety-related equipment operation.

TABLE "A"

Illumination Levels in Vital, Safety Related, and Hazardous Areas Needed For Safe Shutdown and Evacuation

Vital/Hazardous Area	Illumination Level (fc) Normal/Emergency System (Per train)	DC Emergency System	Remarks
1. Control Room Louvered (Main Control Board)	38.5	10	
Control Room Acoustic	12.5	11	
2. Remote Shutdown Room	19	13	
3. Technical Support Center	55	N/A	
4. Boric Acid Make-Up Operating Area	10	*	
5. Diesel Generator Rooms	4	*	Normal/Emergency Lighting Fed by Security Diesel
6. Security Center (CAS)	45	*	
7. Aux Feedwater Turb. Panel Area	2.3	*	

* Self-contained storage battery lighting fixtures.

Question No.

430.4 (SRP 9.5.3) For the areas identified in the above request, 430.1, provide a tabulation of the illumination levels that will be maintained during emergency conditions. Demonstrate that illumination levels in the control room will conform to the requirements of NUREG/CR-0700, assuming a single active failure of a diesel generator. Show that illumination levels in other vital areas meet the recommendations of the Illumination Engineering Society (IES) handbook.

Response

The Normal/Emergency Lighting System illumination levels shown in the attached Table A are in accordance with NUREG/CR-0700 guidelines and the Illumination Engineering Society recommendations for emergency conditions. The Normal/Emergency Lighting System extends throughout the plant to provide the necessary lighting essential to the safe and orderly operation and/or shutdown of the plant during loss of normal ac power. During a loss of offsite power, the Normal/Emergency Lighting System receives its power from the standby diesel generators.

The DC Emergency Lighting System is designed to provide illumination only during loss of the normal/emergency lighting source. The DC Lighting System for the Control Room and remote shutdown room utilizes the safety-related 125V dc system batteries as a source of power.

In other areas where safety-related functions are performed such as the essential switchgear rooms, ECCS pump area and access/egress routes to and from these areas, self-contained storage battery lighting fixtures designed to provide illumination for a minimum of eight hours are utilized.

TABLE "A"

Illumination Levels in Vital, Safety Related, and Hazardous Areas Needed For Safe Shutdown and Evacuation

Vital/Hazardous Area	Illumination Level (fc) Normal/Emergency System (Per train)	DC Emergency System	Remarks
1. Control Room Louvered (Main Control Board)	38.5	10	
Control Room Acoustic	12.5	11	
2. Remote Shutdown Room	19	13	
3. Technical Support Center	55	N/A	
4. Boric Acid Make-Up Operating Area	10	*	
5. Diesel Generator Rooms	4	*	Normal/Emergency Lighting Fed by Security Diesel
6. Security Center (CAS)	45	*	
7. Aux Feedwater Turb. Panel Area	2.3	*	

* Self-contained storage battery lighting fixtures.

Question No.

430.5 (SRP 9.5.3) In Section 9.5.3 of the FSAR, you describe the Normal/Emergency (N/E) lighting transformers as being "seismically supported," and "meets the requirements of Class IE." These descriptions are unclear. Provide a clarification.

Response

As described in Subsection 8.3.1.2.8.15e), Normal/Emergency Lighting Systems receiving power from the Class 1E MCC's are fed through lighting transformers which are purchased to Class 1E requirements and are seismically supported. Each feeder is protected by a circuit breaker and a fuse connected in series. These items are also purchased to Class 1E requirements and are seismically supported and located in the corresponding MCC. All lighting transformers are designed and constructed to have an internal impedance to preclude any unacceptable disturbance in the Class 1E 480 Volt system due to a fault in the lighting circuits.

Question No.

430.6 (SRP 9.5.3) In Section 9.5.3 of the FSAR, you state that the lighting fixtures in safety related areas for both the normal and normal/emergency lighting systems are not seismically supported. This is not acceptable. We require lighting system components and fixtures in safety related areas to be seismically supported, or provide the results of an analysis that shows that failure of these components and/or fixtures will not impair the safety function of equipment.

Response

As described in our response to Question 430.7, the lighting system as a whole is designed as a non-class 1E system.

Lighting fixtures and components, in general, are not seismically supported. Lighting fixtures in the control room and remote shutdown room are in addition to their supporting structures, further restrained by high tensile strength cables to preclude the falling of these fixtures should they be dislodged from their mounting location during a seismic event.

Upon completion of installation of all equipment in safety related areas, a survey will be conducted to ascertain that the failure of any lighting system component does not cause unacceptable interaction wth safety related equipment or impair their safety function. Additional seismic restraints will be provided where unacceptable interaction is deemed possible.

FSAR Subsection 9.5.3 will be amended to reflect the response to this question.

9.5.3.2 System Description

9.5.3.2.1 Normal Lighting System

The normal ac lighting system is continuously energized from plant non-safety-related 480V Motor Control Centers (MCC's). Dry type distribution transformers, fed from these MCC's rated 480-480Y/277V or 480-208Y/120V (3 phase, 4 wire) supply local area lighting panels.

The Normal Lighting System is arranged so that each lighting transformer and an associated lighting panel are located near the center of the lighting loads they serve. Each lighting panel is supplied by one lighting transformer. Areas remote from the center of the lighting loads served are supplied by a local lighting transformer and panel for that area. Cables for the Normal Lighting System are routed in conduits and trays separate from both the Normal/Emergency Lighting System and the DC Emergency Lighting System. 1

The normal ac lighting system fixtures are not seismically supported. However, these fixtures are of light weight design (maximum 50 lbs) and located such that a falling fixture (in a seismic event) will not damage safety-related equipment.

Normal lighting is provided in all plant areas.

9.5.3.2.2 Normal/Emergency AC Lighting System

The Normal/Emergency Lighting System is continuously energized from safety-related 480 volt motor control centers through 3 phase, 4 wire 480-480Y/277V and 480-208Y/120V dry type distribution transformers. These transformers feed N/E lighting panels. 1

The Normal Emergency Lighting System consists of two completely redundant and physically separate trains (A and B). Either train of lighting is capable of providing the necessary lighting during the safe and orderly operation and/or shutdown of the plant following the loss of offsite power. Upon normal offsite power failure, each train is re-energized from its associated standby diesel generator.

Cables for each train of the Normal/Emergency Lighting System are routed in conduits and trays separate from the Normal Lighting System, the DC Emergency Lighting System, and the other train of Normal/Emergency.

The Normal/Emergency Lighting System supplements normal plant lighting in all of the plant areas including the control rooms, remote shutdown rooms, access/egress routes and areas containing safety-related equipment such as the essential switchgear rooms and shutdown cooling area.

Normal/Emergency Lighting System fixtures are located at strategic points in order to provide illumination for personnel safety, emergency operation and emergency maintenance during loss of normal power except for the first ten seconds following a loss of offsite power during which dc emergency lighting is used. All N/E Lighting System equipment up to and including the N/E lighting transformers are seismically supported. These lighting fixtures are ~~not seismically supported but are of light weight design (maximum 50 lbs) and~~ 1

CLASSIE AND

Q430.6

~~located such that a falling fixture (in a seismic event) will not damage safety-related equipment.~~

INSERT A

The redundant system design feature of the Normal/Emergency Lighting System precludes the total loss of adequate illumination in all operating plant areas required to support site activity during loss of offsite power.

9.5.3.2.3 DC Emergency Lighting System

DC emergency lighting is provided in areas where safety-related functions are performed; including access routes to these areas; such as but not limited to the control rooms, essential switchgear rooms, safety injection pump areas, emergency cooling equipment and standby ac sources. Emergency dc lighting is also provided for egress. The DC Emergency Lighting System provides adequate illumination required for safe plant shutdown, evacuation and emergency operation.

The DC Emergency Lighting System consists of two completely separate and redundant systems (A and B). This system is automatically energized upon loss of the respective normal/emergency ac source and is automatically de-energized upon restoration of normal/emergency lighting. Power for system operation is supplied from the 125V dc safety-related batteries for the control rooms and remote shutdown rooms only. For all other areas, the DC Emergency Lighting System is supplemented by self-contained storage battery lighting fixture assemblies. These assemblies consist of two lighting heads, storage battery, charger unit and control device. The units are arranged in two functionally redundant separate trains (A and B). The battery for each unit in a train is kept charged via the associated normal/emergency lighting train. Each unit is automatically energized upon failure of its respective normal/emergency power source. Although the dc battery power supply is de-energized automatically upon restoration of its normal/emergency power source, the battery is designed to provide illumination for a minimum of eight hours without recharging.

The operation of the dc emergency lighting supplied by the station 125V batteries, is annunciated in the Main Control Room.

DC Emergency Lighting System fixtures (i.e., the incandescent lamp holders and associated reflectors) are supported by high tensile strength cables. Battery packs in the RAB and FHB are seismically supported, and replacement lamps are safely stored in such a way as to ensure that they are available during and after plant transients.

9.5.3.3 Failure Analysis

In the event that normal ac power is lost, the Normal/Emergency Lighting System provides adequate illumination necessary to support plant safe shutdown and emergency operations in the safety-related areas (i.e., control rooms, diesel generator rooms, essential switchgear rooms, etc.) Power for the normal/emergency lighting in these areas is supplied from redundant Class IE safety-related buses. N/E lighting system meets the requirements of Class IE from MCC's up to and including lighting transformers. These redundant systems are physically and electrically separated. Consequently a failure or loss of one of the Class IE systems will not result in the ultimate failure of the remaining system. 1

Q430.6

Question No. 430.6

Insert A

Not seismically supported except in the control room and remote shutdown room where fixtures are further restrained by high tensile strength cables. Upon completion of installation of all equipment in safety related areas, a survey will be conducted to ascertain that the failure of any lighting system component does not cause unacceptable interaction with the safety function of safety related equipment. Additional seismic restraints will be provided where unacceptable interaction is deemed possible.

Question No.

430.7 (SRP 9.5.3) Your FSAR does not cover lighting panels for the normal/emergency ac and emergency dc lighting systems. Expand your FSAR to include a discussion of these panels, including location and classification (seismic, quality group, etc). Show that adequate lighting will be maintained in all safety related areas, as well as in access routes, following a design basis seismic event.

Response

Normal/Emergency lighting panels and lighting fixtures are located at strategic points throughout the plant to provide continuous illumination for personnel safety, emergency operation and emergency maintenance during loss of normal power. DC emergency lighting is automatically energized for the first ten seconds following a loss of off-site power.

The Normal/Emergency lighting system consists of two completely redundant and physically separate trains. Either train is capable of providing the necessary illumination in the event of loss of off-site power.

Due to the unavailability of seismically qualified lighting fixtures, the lighting system is designed as a non class 1E system and is not seismically supported, except the N/E lighting transformers which are designed to meet class 1E requirements and are seismically supported.

Normal/Emergency lighting panels are designated as non class 1E and are not seismically supported. These panels, however, are flush-mounted to the wall or otherwise mounted to prevent interaction with the safety function of safety related equipment during a seismic event.

Question No.

430.8 (SRP 9.5.4) Refer to FSAR Fig. 9.5.4-1 and Fig. 1.2-13a. On Fig. 9.5.4-1, the level of fuel oil in a full storage tank is shown to be around elevation 420'-0. On Fig. 1.2-13a, the elevation of the day tank is shown to be around 409'-0. Consequently, when the storage tanks are full, there is a positive head differential between the storage and day tanks of 8'-10'. Under these conditions, a failure of a transfer pump discharge solenoid valve would result in fuel oil overflowing the day tank (Table 9.5.4-3) and entering oil sump 8A or 9A. The FSAR does not provide sufficient information on adequately evaluating the consequences of this event. Therefore, provide the following information:

(1) A detailed description of the fuel oil overflow sump system, including but not limited to, seismic and quality group classifications of oil sumps is discharged, and

(2) Results of your analysis that show that overflow of the day tank will not create a fire hazard in the diesel generator room or at any other safety related area, or revise your design such that an overflow of the day tank(s) is not a credible event.

Response

1) The oil drainage system for the diesel generator fuel oil day tank is designed for a 1,100 gal. maximum oil spill resulting from a day tank failure. This is achieved by surrounding the day tank with a seismic Category I curb one foot high to contain the spill, in lieu of a sump.

The curbed area is further protected by a 6 in. diameter seismically supported overflow line. The overflow is designed to convey the contents of the day tank plus sprinkler system discharge by gravity to the fire water retention basin. The overflow lines have no isolation valves and bypass all oil sumps (8, 8A, 9 and 9A) provided for standard spills and drips. A failure or malfunction in a portion of the piping system will not result in adverse effects on essential systems or components necessary to mitigate an accident or safely shut down the plant.

2) A failure of the diesel fuel oil transfer pump solenoid valve when the diesel fuel oil storage tank is full will result in a maximum day tank overflow of 350 gallons. This quantity is considered extremely conservative based upon the following assumptions:

Response

430.8 (Cont'd)

a) The overflow rate of 11 gpm was calculated based on gravity flow with the maximum static head difference between the diesel storage and day tank, and minimum frictional losses without considering the frictional losses across the positive displacement fuel oil transfer pump. However, the positive displacement transfer pump will effectively limit the gravity flow due to minimal static head produced by the diesel fuel oil transfer system.

b) Operator action to manually close the day tank fill line isolation valve, within the affected diesel generator cubical, is assumed to occur 30 minutes after the day tank high level alarm is received in the Main Control Room via the common trouble alarm.

c) No consideration was given for the available free board in the day tank between the high level alarm setpoint and the tank overflow.

FSAR Appendix 9.5A-4, "Fire Hazard Analysis Fire Areas: DGA and DGB," verifies that the additional combustible loading due to the 350 gallons of the fuel has no significant impact on the overall combustible loading of either fire area.

As discussed in Appendix 9.5A-4, the occurrence of a single fire during a loss of offsite power, which might render one emergency diesel generator inoperative, would in no way jeopardize the safe shutdown of the plant due to the availability of a redundant emergency diesel and associated auxiliary systems, nor would the damage from such a fire extend beyond the fire area boundary.

Question No.

430.9 (9.5.4) In the remarks column of Table 9.5.4-3, you state that a failed (open) transfer pump solenoid valve can be isolated using a manual bypass valve. It is not clear from the piping arrangment shown on Figure 9.5.4-1 just how this isolation can be accomplished. Revise your FSAR to provide clarification of how a failed solenoid valve can be isolated, and what operator action is required to ensure the isolation.

Response Failure of the fuel oil transfer pump discharge solenoid valve (fail open) when the diesel generator is not operating, does not jeopardize the functional operability of the system, since the fuel oil path from the transfer pump to the day tank is not blocked.

If the solenoid valve fails in the closed position when the system is required to operate, the fuel oil flow to the day tank will be temporarily interrupted. However, the normally closed, hand operated bypass globe valve can be opened to allow the resumption of the fuel oil supply to the day tank. The day tank low level alarm and local indicators on the Diesel Generator Control Panel are used to detect a tank low level resulting from the above scenario. These alarms are retransmitted to the main control room and appear as a "Diesel Generator Trouble" alarm on CB-1 in the control room. An operator can be dispatched to the Diesel Generator Panel to determine the specific trouble. Since day tank is sized for two and one quarter hours of fuel supply (see Subsection 9.5.4.2.3), it allows sufficient time for operator action.

FSAR Table 9.5.4-3 will be amended to reflect the response to this question.

TABLE 9.5.4-3

DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER SYSTEM
FAILURE MODE AND EFFECTS ANALYSIS

Equipment	Failure Mode	Probable Cause	Method of Detection	Effect on System	Remarks
1. Diesel oil storage tanks A-SA or B-SB	a) Leakage	a) Manufacturing defect	Low level alarm ~~in~~ on respective diesel generator control board	Loss of one oil tank	Redundant storage tank with seven day supply available, to meet the safe shutdown of the plant assuming a loss of coolant accident concurrent with loss of offsite power
	b) Erroneous low level alarm	Electrical or mechanical malfunction	None	None	
	c) Erroneous high level alarm	Electrical or mechanical malfunction	None	None	
2. Transfer pump suction strainers 3EG-D001SA, 3EG-D003SB and discharge filters 3EG-F0C2SA, 3EG-F004SB	a) Plugged	Contaminants	Fuel oil transfer pump pressure indication ~~in~~ on respective diesel generator control board	Loss of suction to one fuel oil transfer pump	Redundant fuel oil transfer pump is available which can feed either of two day tanks, through the interconnecting piping between suction and discharge of the pumps
	b) Does not strain or filter	High perforated element	Periodic inspection	Probable malfunction of one diesel generator	Redundant 100% capacity diesel generator is available 1
	c) External leakage	Manufacturing defect	Day tank level alarm ~~in~~ on respective dierel generator control board	Loss of fuel oil transfer path to day tank	Redundant fuel oil transfer system is available 1
3. Transfer pumps A-SA & B-SB	a) Pump or motor	a) Mechanical seal or electrical failure	Pump position indication ~~in~~ on respective diesel generator control board	Loss of one fuel oil transfer pump	Redundant 100% capacity fuel oil transfer pump is available
4. Transfer pumps discharge solenoid valves 3EG-VE038SA and 3EG-VE040SB	a) Fails in open position when system is not operating	Electrical malfunction	Day tank high level ~~indication~~ alarm ~~in~~ on respective diesel generator control board	Overflow of day tank	Functional operability of the system is not diminished since fuel oil supply path to day tank is not restricted. ~~bypass hand operated valve can be administrated~~ 1
	b) Fails in closed position during system operation	Mechanical binding or Electrical malfunction	Day tank low level alarm on respective diesel generator control board	Fuel transfer capability to one diesel will be temporarily lost	Normally closed, hand operated bypass valve will be opened to allow the resumptio[n] of the ~~[illegible]~~ fuel oil flow to day tank. The fuel oil stored in the day tank can provide two and one quarter hours for diesel engine operation. This allows ample time for operator action [illegible] the valve.

Q430.9

Question No.

430.10 (SRP 9.5.4) In the FSAR, you classify the Fuel Oil Gravity Drain Tank(s) as Non-Nuclear Safety. This is not acceptable. The gravity drain tanks and associated pumps, piping, and controls must remain functional during prolonged diesel generator operation (7 days) in order to prevent overflowing of fuel oil and creation of a fire hazard. Revise your FSAR to show the gravity drain tanks, pumps, piping, and components as Seismic Category 1, ASME Section III, Class 3, or demonstrate that your design will not result in unacceptable discharge of fuel oil and fire hazard during diesel generator operation following the design basis seismic event.

Response

Refer to FSAR Figures 9.5.4-1, 9.3.3-1c, 9.5A-3, and 9.5A-4.

The Fuel Oil Gravity Drain Tanks, Gravity Return Fuel Oil Pumps, and Associated Piping and Controls are designated as Non-Nuclear Safety and are provided strictly for housekeeping purposes. The piping is designated to ANSI Standard B31.1 and is seismically supported. Following the design basis seismic event, and subsequent loss of offsite power, either diesel generator is capable of operating continuously without the fuel gravity system. The failure of the non-seismic oil gravity drain system could lead to a leakage of approximately 0.5 gal/hour from the diesel engine injectors and injector fuel plungers of either diesel engine. This leakage will be collected by the non-safety room floor drainage system and drained by gravity away from one operating diesel engine to the floor sump located in the respective Diesel Generator Room, (DG-11 of DG-21). The failure of the diesel generator non-seismic floor drainage system could lead to some fuel oil leakage into the Radwaste Fire Area RW. Fire Zones RW-4 (below DG-21) or RW-62 (below DG-11) located on RAB EL. 362.50 ft., and does not contain essential equipment required for safe shutdown, nor safety-related equipment.

Maximum combustible loading resulting from the diesel fuel gravity system failure, with one Emergency Diesel Generator running seven (7) days is conservatively estimated at 180 gallons, including 96 gallons, considering that both fuel oil gravity drain tanks are full at the time of the design basis seismic event. This additional combustible loading represents 2500 Btu/sq. ft. increase in the fire loading of Fire Area RW and a fire in this area can be contained within the fire area boundaries.

During emergency diesel operation, the Diesel Generator Control Room (Fire Zone DG-12 and DG-22, EL. 390.00 ft) will be attended facilitating manual fire fighting response, if requi

Question No.

430.10 (Cont'd) In conclusion, it is our position that based on the above description, the plant design does not result in unacceptable discharge of fuel oil, nor fire hazard during diesel generator prolonged operation up to seven (7) days, following a design basis seismic event.

Question No.

430.12 (9.5.4) Expand your FSAR to include a discussion of the tornado missile protection provided for the fuel oil storage tanks fill, vent, and return lines, and for the day tank and gravity drain tank vent lines. In your discussion, include details of where these lines are located on the storage tank building and reactor auxiliary building, respectively.

Response The diesel generator fuel oil storage tank vent, fill, overflow and drain pipes extend outside the storage tank room. (The portion of these lines outside the building, directly in front of the opening is fabricated as a ten inch tee having a one inch thick wall and acts as missile barrier to provide protection of the safety related equipment inside the room.) The storage tank vent lines exit the roof of the storage tank room at elevation 437.33 ft and the fill, overflow and drain lines exit the outside wall at elevations 412.17, 407.92 and 403.67 ft respectively. All room penetrations are located above the maximum oil level elevation of 403.00 ft in the event of tank rupture.

The diesel generator fuel oil day tank and gravity drain tank vent lines exit the Reactor Auxiliary Building (RAB) outside wall at elevations 413.00 ft and 411.50 ft respectively. To provide tornado missile protection, these lines are offset in the center of 5 ft thick RAB wall.

FSAR Subsection 9.5.4.3 will be amended to reflect the response to this question.

Insert A

All openings in the diesel generator and storage tank rooms such as vent lines, overflow lines, fill lines and drain lines are designed to block any externally generated missile from entering the Category I structures. ~~and located such that any oil spills will be completely contained within the enclosure.~~

The diesel generator fuel oil storage tank, day tank, and fuel oil gravity drain tank vent lines terminate outside the structure and are equipped with flame arrestor devices.

The diesel generator enclosure is provided with fireproof doors and wall louvers for natural ventilation to the outside atmosphere to insure that any diesel fuel vapors are maintained well below the combustible limit. | 2

Fire hazards are minimized through an automatic Aqueous Film Forming Foam (AFFF) fire protection system located in each fuel oil storage tank structure. The fire protection system also permits manual activation from a local manual release station, see Subsection 9.5.1. Backup fire protection is provided by fire hoses from the yard hydrant system.

Where possible, fuel oil piping is of welded construction to minimize leakage.

The fuel oil piping is routed away from possible ignition sources such as high energy electrical lines.

In addition, all hot surfaces in the diesel generator room are insulated. Due to the diesel generator design there are no open flames in the diesel generator room.

Selection of suitable materials compatible with the type of fuel oil required to operate the diesel generators assures that the system will not be subject to material corrosion. The system design prevents any fuel oil contamination. The temperature of the fuel will be maintained at 40F to 104F.

9.5.4.4 Testing and Inspection

All components of the diesel generator fuel oil storage and transfer system are inspected and cleaned prior to installation.

Instruments are calibrated during testing and automatic controls are tested for actuation at the proper setpoints. Alarm functions are checked for operability and limits during plant preoperational testing. Automatic actuation of system components is tested periodically, see Section 7.4.

After installation all components of the system will undergo initial hydrostatic testing to applicable code test standards set forth in ASME Section III Codes Subsection ND-6000, and will be tested with regard to flow paths, flow and head capacities and operability. Pumps, valves, and controls

Q430.12

QUESTION 430.12

INSERT A

The diesel generator fuel oil storage tank vent, fill, overflow and drain pipes extend outside the storage tank room. The portion of these lines outside the building opening is fabricated as a ten inch tee having a one inch thick wall to provide missile protection of the safety related equipment inside the room. The storage tank vent lines exit the roof of the storage tank room at elevation 437.33 ft and the fill, overlow and drain lines exit the outside wall at elevations 412.17, 407.92 and 403.67 ft respectively. The diesel generator fuel oil storage tank rooms are designed to contain the entire contents of the storage tank in the event of a tank rupture, by locating all room penetrations above the maximum oil level elevation of 403.00 ft.

The diesel generator fuel oil day tank and gravity drain tank vent lines exit the Reactor Auxiliary Building (RAB) outside wall at elevations 413.00 ft and 411.50 ft respectively. To provide tornado missile protection, there lines are offset in the center of 5 ft thick RAB wall.

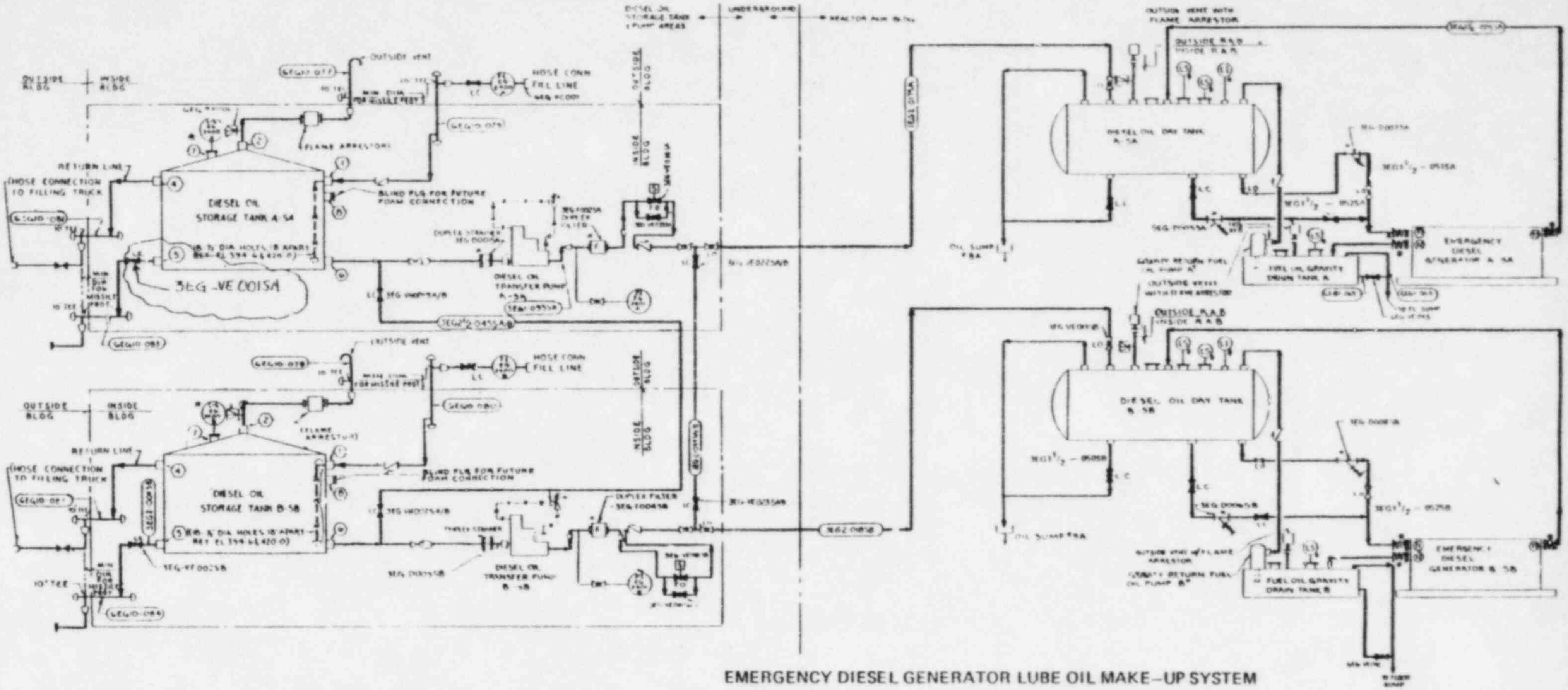
Question No.

430.13 (9.5.4) Refer to FSAR Figure 9.5.4-1. What is the purpose of the valve 3 EG-VE002SB and line 6EG10-084 on storage tank B-SB, as well as similar lines on storage tank A-SA? Also, provide a table explaining the legends and note references on Figure 9.5.4-1.

Response Valves 3 EG-VE001 SA and 3 EG-VE002SB are used to drain the Diesel Oil Storage Tanks. The subject normally closed (locked closed) drain valves and their associated drain lines between the valves and the Diesel Oil Storage Tanks, are designed to ASME Section III, Class 3 requirements to maintain the integrity of the tanks.

Lines 6EG10-083 and 6EG10-084 are part of the Diesel Oil Storage Tank drain lines which penetrate the Diesel Oil Storage Tank room wall to facilitate tank drainage from the outside. (These lines, located directly in front of the penetration, are fabricated a ten inch tee with one inch wall thickness and act as missile barriers to provide protection for the safety related equipment located within the seismic Category I Diesel Oil Storage Tank room.) For further clarification, refer to the response to Question 430.12.

Figure 1.7.2-1 provides the legend used in the Diesel Generator Fuel Oil Storage and Transfer System Figure 9.5.4-1. FSAR Figure 9.5.4-1 will be amended to reflect the response to this question.



Note: Legend is shown on Figure 1.7.2-1

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DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER SYSTEM

FIGURE 9.5.4-1

Question No.

430.15 (SRP 9.5.4) Regulatory Guide 1.137 (by reference to ANSI N195) requires that duplex fuel oil strainers and filters by fitted with differential pressure indicators and alarms. This instrumentation is not discussed in the FSAR, not is it shown on Fig. 9.5.4-1. Revise your FSAR to include this instrumentation, or provide justification for not having same. Show instrumentation and control on Fig. 9.5.4-1.

Response FSAR Subsection 9.5.4.2.2 and Figure 9.5.4-1 will be revised to include differential pressure indicating switches across the duplex fuel oil strainers. The differential pressure indicating switches will alarm logically in their respective Diesel Generator Room and in the Main Control Room via a common trouble alarm. ANSI N195 does not require fuel filter differential pressure indicating switches.

Each tank may be filled with fuel oil directly from a tank truck. A return line to the tanker is necessary to prevent overfilling the reservoir. 1

Each fuel oil storage tank is provided with local level indicators and high-level switches to actuate annunciators in the local Diesel Generator Control Room, adjacent to diesel generator room.

The diesel oil storage tanks are provided with surrounding enclosures such that a maximum oil spill, resulting from a tank failure, is completely contained.

9.5.4.2.2 Diesel Generator Fuel Oil Transfer Pump

In each supply subsystem, a fuel oil transfer pump takes suction from the fuel oil storage and discharges to an associated diesel generator fuel oil day tank, through a discharge solenoid valve.

The fuel oil transfer pumps which are positive displacement pumps are designed to deliver 14 gal/min.

This capacity corresponds to approximately one and one half the maximum consumption rate of each diesel engine under full load conditions. The fuel oil transfer pump is provided with a normally closed solenoid operated valve and normally closed bypass valve on the discharge side of the pump to eliminate leakages from storage tank to day tank to maintain a full storage tank oil inventory. These solenoid operated valves are operated by signals actuated by the fuel oil day tank level switches.

Each pump is located in the fuel oil storage tank area adjacent to the dry cooling tower structure and is driven by a 3 hp, 460V, 3 phase, ac induction motor. In case of loss of offsite power each pump is powered from its corresponding diesel generator bus. 1

Each transfer pump and pump discharge line to the diesel oil day tank are physically separated so that a pump failure or a pipe rupture will have no effect on the other diesel generator subsystem.

Each fuel oil transfer pump is provided with a duplex type strainer at the suction side for pump protection and a duplex, renewable, cartridge type, fuel oil filter at the discharge side for removal of particles from the fuel oil. See Insert A The duplex strainer and filter enable operation of the fuel oil transfer pump if one strainer and/or one filter is out of service or needs replacement.

9.5.4.2.3 Diesel Generator Fuel Oil Day Tank

Each diesel oil day tank is a horizontal, cylindrical, steel tank that stores diesel fuel for immediate use by the emergency diesel generator. Each fuel oil day tank has a capacity of 1100 gallons, and can provide two-and-one-quarter hours supply to its respective diesel engine operating at full load conditions without resupply to the day tank.

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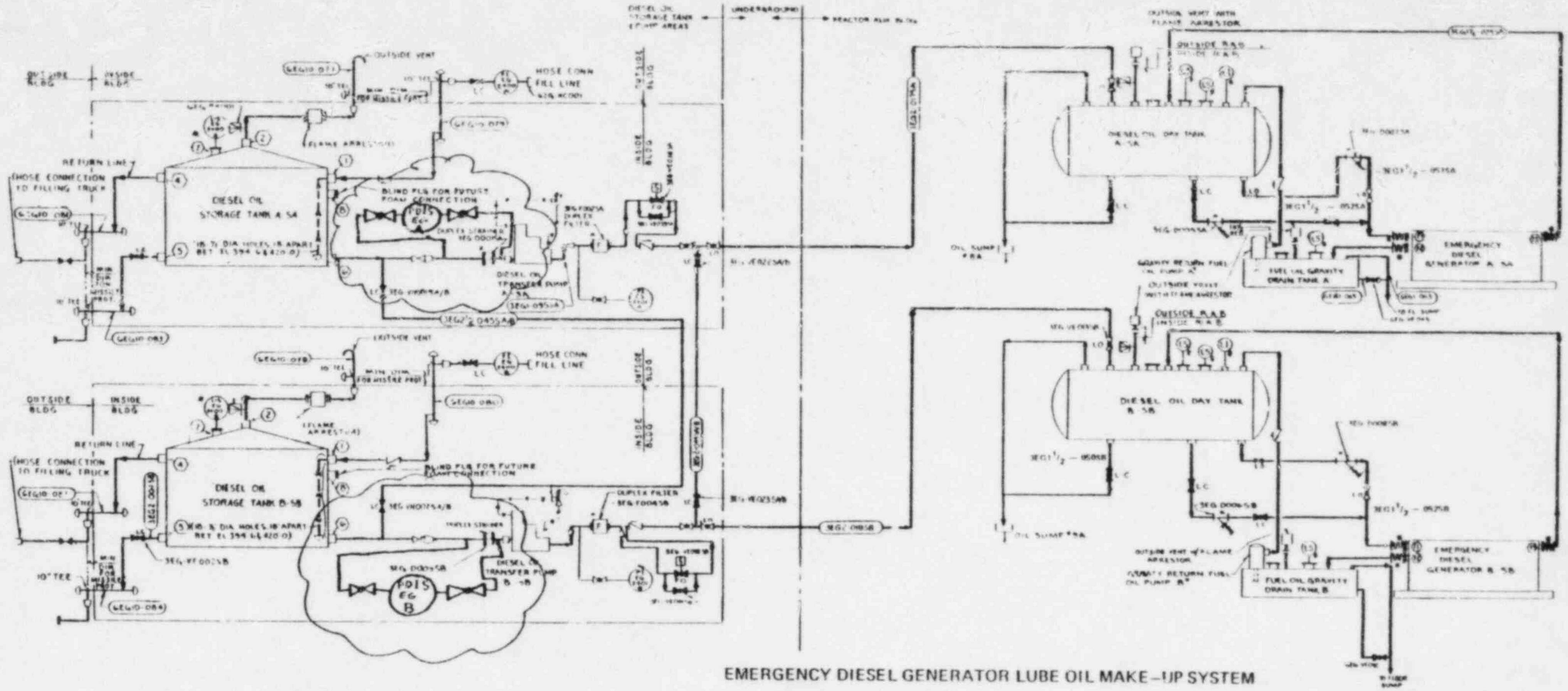
Question 430.15
INSERT A

Each duplex strainer is provided with a pressure differential indicating switch (PDIS) which alarms locally in its respective diesel generator room and in the main control room via a common trouble alarm to alert control room operators of a potentially clogged strainer.



EMERGENCY DIESEL GENERATOR LUBE OIL MAKE-UP SYSTEM

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Nuclear Projects 3 & 5
FINAL SAFETY ANALYSIS REPORT
DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER SYSTEM
FIGURE 9.5.4-1

Question No.

430.16 (SRP 9.5.4) Describe the instruments, controls, sensors and alarms provided for monitoring the diesel engine fuel oil storage and transfer system and describe their function. Discuss the testing necessary to maintain and assure a highly reliable instrumentation, controls, sensors and alarm system and where the alarms are annunciated. Identify the temperature, pressure and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe what operator actions are required during alarm conditions to prevent harmful effects to the diesel engine. Discuss the system interlocks provided.

Response

The Diesel Generator Fuel Oil Storage and Transfer System (DGFOSTS) is shown on Figure 9.5.4-1. The DGFOST system consists of two separate, independent trains of fuel oil supply subsystems serving each of the two standby diesel generator engines. Each of these redundant subsystems consists of a 100 percent capacity fuel oil storage tank, with fill, vent, drain and overflow lines, a duplex filter, a day tank, a gravity drain tank, a gravity drain return pump, interconnecting piping, valves and associated instruments and controls.

Each fuel oil storage tank is provided with local level indicators and high and low-level switches to actuate annunciators in the local Diesel Generator Control Room, adjacent to the diesel generator room.

Both fuel oil day tanks are provided with local level indicators, high and low-level switches, and water detectors which activate alarm annunciators. Two low and high-level switches control the supply valve and transfer pump operation. Water detectors on each tank will generate alarms at the local diesel generator control panel and a Diesel Generator trouble alarm in the Control Room as well, if actuated.

In each supply subsystem, a fuel oil transfer pump takes suction from the fuel oil storage and discharges to an associated diesel generator fuel oil day tank, through a discharge solenoid valve. A three position (hand-off-auto) switch is provided on the Diesel Generator Control Panel for the transfer pump. The system will maintain the proper supply of diesel oil in each day tank by means of electric interlocks between the high and low-level switches in the day tanks, the corresponding pump motor starters, and pump discharge solenoid valves. The low-level switch on each day tank starts the fuel oil transfer pump automatically and opens the respective discharge solenoid valve. The pump will de-energize when the day tank level reaches the high-level limit. Each transfer pump discharge line will be provided with a low-pressure

Response

430.16 (Cont'd) alarm switch. This switch will close its normally closed contacts to give an alarm at the local diesel generator control panel if the fuel oil pressure should decrease to 10.0 psi.

The fuel oil gravity drain tanks are provided witn local level indicators and high and low-level switches for control of the gravity return fuel oil pump.

The instruments are calibrated during testing and automatic controls are tested for actuation at the proper setpoints. Alarm functions are checked for operability and limits during plant preoperational testing. Automatic actuation of system components is tested periodically.

During normal plant operation, maintenance and testing of each DGFOSTS will be individually performed to ensure integrity and reliability of instruments, controls and components. All major components of the system are accessible for inspection and available for testing during normal plant operation.

FSAR Subsection 9.5.4 will be amended to reflect the above response.

Each tank may be filled with fuel oil directly from a tank truck. A return line to the tanker is necessary to prevent overfilling the reservoir. 1

and low

Each fuel oil storage tank is provided with local level indicators and high level switches to actuate annunciators in the local Diesel Generator Control Room, adjacent to diesel generator room.

The diesel oil storage tanks are provided with surrounding enclosures such that a maximum oil spill, resulting from a tank failure, is completely contained.

9.5.4.2.2 Diesel Generator Fuel Oil Transfer Pump

In each supply subsystem, a fuel oil transfer pump takes suction from the fuel oil storage and discharges to an associated diesel generator fuel oil day tank, through a discharge solenoid valve.

The fuel oil transfer pumps which are positive displacement pumps are designed to deliver 14 gal/min.

This capacity corresponds to approximately one and one half the maximum consumption rate of each diesel engine under full load conditions. The fuel oil transfer pump is provided with a normally closed solenoid operated valve and normally closed bypass valve on the discharge side of the pump to eliminate leakages from storage tank to day tank to maintain a full storage tank oil inventory. These solenoid operated valves are operated by signals actuated by the fuel oil day tank level switches.

Each pump is located in the fuel oil storage tank area adjacent to the dry cooling tower structure and is driven by a 3 hp, 460V, 3 phase, ac induction motor. In case of loss of offsite power each pump is powered from its corresponding diesel generator bus. 1

Each transfer pump and pump discharge line to the diesel oil day tank are physically separated so that a pump failure or a pipe rupture will have no effect on the other diesel generator subsystem.

Each fuel oil transfer pump is provided with a duplex type strainer at the suction side for pump protection and a duplex, renewable, cartridge type, fuel oil filter at the discharge side for removal of particles from the fuel oil. The duplex strainer and filter enable operation of the fuel oil transfer pump if one strainer and/or one filter is out of service or needs replacement.

9.5.4.2.3 Diesel Generator Fuel Oil Day Tank

Each diesel oil day tank is a horizontal, cylindrical, steel tank that stores diesel fuel for immediate use by the emergency diesel generator. Each fuel oil day tank has a capacity of 1100 gallons, and can provide two-and-one-quarter hours supply to its respective diesel engine operating at full load conditions without resupply to the day tank.

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will be tested for operation at the proper setpoints. The testing of the system is further discussed in Sections 14.1 and 14.2.

During normal plant operation, maintenance and testing of each DGFOSTS will be individually performed to ensure integrity and reliability of instruments, controls and components. Surveillance of the quality of the fuel oil supply will be done by periodic testing for water and other contaminants. See Section 14.2 for further details.

All major components of the system are accessible for inspection and available for testing during normal plant operation. The ASME Section III Code Class 3 DGFOST system piping will be tested and inspected in accordance with ASME Boiler and Pressure Vessel Code Section III and XI requirements.

9.5.4.5 Instrumentation Applications

Each of the diesel generator fuel oil storage and transfer systems is controlled from the associated emergency diesel generator control board, located inside the Reactor Auxiliary Building. Alarms are provided for each system for early detection of any malfunctions. See Section 7.4.

Each and low diesel oil storage tank is provided with local level indicators and high-level switches to actuate alarm annunciators in the local Diesel Generator Control Room.

Each transfer pump discharge line will be provided with local pressure indicators. The system will maintain the proper supply of diesel oil in each day tank by means of electric interlocks between the high and low-level switches in the day tanks, the corresponding pump motor starters, and pump discharge solenoid valves. The low-level switch on each day tank starts the fuel oil transfer pump automatically and opens the respective discharge solenoid valve. The pump will de-energize when the day tank level reaches the high-level limit.

The Diesel Generator Control Panel is provided with high and low-level annunciators for all the tanks in the system, and electric control switches for remote control of each complete transfer system train.

A category trouble alarm is provided in the Main Control Room. 1

Refer to Subsection 8.3.1 for the diesel generator fuel oil storage and transfer system fuel oil transfer logic.

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Question No.

430.18 In the FSAR, you do not include a section covering corrosion protection for buried piping. Expand the FSAR to include a description of proposed protection of underground piping. Where corrosion protective coatings are being considered (piping and tanks) include the industry standard which will be used in their application. Also discuss what provisions will be made in the design of the fuel oil storage and transfer system in the use of an impressed current type cathodic protection system, in addition to waterproof protective coatings, to minmize corrosion of buried piping or equipment. If cathodic protection is not being considered, provide your justification.

Response It is the intent of the design to furnish DC current flow to all underground ferrous structures of sufficient magntiude to assure adequacy of cathodic protection to all underground pressure piping. Practical considerations, such as the presence of large amounts of copper grounding conductors in the earth, limit the design of the cathodic protection facilities to impressed current systems. Therefore, only impressed current system will be discussed herein.

Dielectric coatings applied to the exterior of ferrous pressure piping systems will effectively prevent soil-instigated corrosion wherever the intergrity of the coating is maintained over the useful life of the structure. Unfortunately, there is no practical means for assuring such continuing integrity of a coating system. Presence of an effective, though imperfect dielectric coating on the surface of a line does significantly reduce the magnitude of the cathodic current necessary to adequately protect that line. However, the discontinuities, or holidays, in the coating have the undesirable effect of concentrating and accelerating corrosion of the structure at that point. Presence of a dielectric coating does significantly reduce the amount of cathodic protection current necessary to protect the structure. Therefore, the corrosion control program for the underground plant piping is an integrated system employing dielectric coatings, concrete encasement and cathodic protection.

Concrete encasement of ferrous pressure piping is employed under slab and within 50 feet of the slab in the plant island area. Due to the presence of large amounts of bare copper and rebar in concrete (which exhibits some of the characteristics of copper in a corrosion system) it becomes very difficult to achieve adequate distribution of cathodic protection current flow in congested areas of the plant underground environment. By placing ferrous piping in concrete, corrosion of the exterior surface may be prevented, without achieving a negative potential shift, due to the favorable alkaline environment.

Question No. 430.18

Response (Cont'd)

Cathodic protection will provide effective mitigation of corrosion to the exterior surface of all ferrous pressure piping in direct contact with soil or water. Other structures, such as fuel oil storage tank bottoms, that are electrically continuous with the plant grounding grid and in contact with the earth will receive cathodic protection.

Bonding of all ductile or cast iron joints and all mechanical couplings is required in order to assure electrical continuity throughout the structure's length. Necessary bonds (mechanical or electrical) to the plant grounding grid are also required. By assuring electrical continuity throughout all underground piping and the grounding grid, stray DC current flow will be avoided. This is necessary to avoid the possibility of cathodic interference current flow in the underground network.

A structure is considered to be adequately protected when it meets at least one of three criteria set forth by the National Association of Corrosion Engineers (NACE) in their Standard RP-01-69 "Control of External Corrosion on Underground or Submerged Metallic Piping Systems". The criteria are:

1 "A negative (cathodic) Voltage of at least 0.85 volts as measured between the structure surface and a saturated copper-copper sulfate reference electrode contacting the electrolyte. Determination of this Voltage is to be made with the protective current applied".

2 "A minimum negative (cathodic) Voltage shift of 300 millivolts, producted by the application of protective current. The Voltage shift is measured between the structure surface and saturated copper-copper sulfate electrode contacting the electrolyte. This criterion of Voltage shift applied to structures not in contact with dissimilar metals".

3 "A minimum negative (cathodic) polarization voltage shift of 100 millivolts measured between the structure surface and a saturated copper-copper sulfate electrode contacting the electrolyte. This polarization Voltage shift is to be determined by interrupting the protective current and measuring the polarization decay. When current is initially interrupted, an immediate voltage shift will occur. The Voltage reading after the immediate shift shall be used as the base reading from which to measure polarization decay".

Question No. 430.18

Response (Cont'd)

The cathodic protection system for the plant underground structures will consist of two (2) remote anode ground beds energized by individual transformer-rectifier units. This system consists of a group of anodes installed remote from all plant underground structures, a DC source, interconnecting cables and an AC power supply. The positive terminal of the transformer-rectifier is connected to the anode ground bed and the negative terminal is connected to the structures to be protected.

The capacity of the transformer-rectifier, number, size and spacing of the anodes, cable size and other factors are calculated according to the soil electrical resistivity, the resistance to remote earth of the station, and the surface area of the structures to be protected which determines the magnitude of the current necessary to achieve protection.

Except for shielded areas within the plant, good current distribution is achieved with a remote ground bed. These shielded areas can be best defined after energization of the remote anode ground beds, with a structure-to-soil potential survey, allowing adequate time for polarization of the underground structures. Any such low potential areas would then be protected by an impressed current system with distributed anode or semi-deep anode ground beds designed to furnish necessary supplemental current to the areas requiring same.

A distributed anode ground bed consists of a group or network of anodes installed at specific intervals and in close proximity of the structures to be protected. Current distribution is concentrated to the structures in the immediate vicinity of the anodes.

Semi-deep anode ground beds behave in a manner similar to distributed anode ground beds. They may be employed when the physical constraints of the site severely limit the practical application of a distributed anode system. A semi-deep anode ground bed consists of a vertical hole drilled to sufficient depth with a number of high silicon cast iron or graphite anodes with individual lead wires installed at staggered depths. The hole is backfilled with a carbonaecous backfill material suitable for the installation. Individual anode leads are terminated in a nearby aboveground junction box which provides a means for monitoring the output of individual anodes.

Question No. 430.18

Response (Cont'd)

Either of the above discussed ground bed systems would be energized by a transformer-rectifier unit as described for the remote anode impressed current system.

FSAR Subsection 6.1.2 will be amended to reflect the response to this question.

6.1.2.2 Insulation

Insulation used to cover the piping and equipment inside the containment is either reflective metallic type or nonmetallic. All nonmetallic insulation is jacketed with stainless steel. Jacketing covers the entire length of the insulation including valves and fittings. All exposed cable insulation is comprised of Hypalon or XLPE-cross linked polyethylene. Both the jacketing and the exposed insulation are qualified to the post-accident conditions given in Section 3.11. Total weight of cable insulation is approximately 60,700 lbs.

6.1.2.3 Other Organic Materials

Plastic and wood are present in the containment in a very insignificant amount. The major lubricant present in significant amount is the lubricating oil associated with the four reactor coolant pumps' lubricating oil system, 403 gallons each, and approximately 28 gallons for various bearings such as fan motors, etc. (total of 1640 gallons) and approximately 9300 lbs. of charcoal present in the HVAC filters. The oil and charcoal are contained in a closed system and are not exposed to the containment spray. Asphalt is not used inside the containment.

6.1.2.4 Corrosion Protection

See Insert A

Q430.18

Question 430.18
INSERT A

6.1.2.4 Corrosion Protection

It is the intent of the design to furnish DC current flow to all underground ferrous structures of sufficient magntiude to assure adequacy of cathodic protection to all underground pressure piping. Practical considerations, such as the presence of large amounts of copper grounding conductors in the earth, limit the design of the cathodic protection facilities to impressed current systems. Therefore, only impressed current systems will be discussed herein.

Dielectric coatings applied to the exterior of ferrous pressure piping systems will effectively prevent soil-instigated corrosion wherever the intergrity of the coating is maintained over the useful life of the structure. Unfortunately, there is no practical means for assuring such continuing integrity of a coating system. Presence of an effective, though imperfect dielectric coating on the surface of a line does significantly reduce the magnitude of the cathodic current necessary to adequately protect that line. However, the discontinuities, or holidays, in the coating have the undesirable effect of concentrating and accelerating corrosion of the structure at that point. Presence of a dielectric coating does significantly reduce the amount of cathodic protection current necessary to protect the structure. Therefore, the corrosion control program for the underground plant piping is an integrated system employing dielectric coatings, concrete encasement and cathodic protection.

Concrete encasement of ferrous pressure piping is employed under slab and within 50 feet of the slab in the plant islant area. Due to the presence of large amounts of bare copper and rebar in concrete (which exhibits some of the characteristics of copper in a corrosion system) it becomes very difficult to achieve adequate distribution of cathodic protection current flow in congested areas of the plant under environment. By placing ferrous piping in concrete, corrosion of the exterior surface may be prevented, without achieving a negative potential shift, due to the favorable alkaline environment.

Cathodic protection will provide effective mitigation of corrosion to the exterior surface of all ferrous pressure piping in direct contact with soil or water. Other structures, such as fuel oil storage tank bottoms, that are electrically continuous with the plant grounding grid and in contact with the earth will receive cathodic protection.

Bonding of all ductile or cast iron joints and all mechanical couplings is required in order to assure electrical continuity throughout the structure's length. Necessary bonds (mechanical or electrical) to the plant grounding grid are also required. By assuring electrical continuity throughout all underground piping and the grounding grid, stray DC current flow will be avoided. This is necessary to avoid the possibility of cathodic interference current flow in the underground network.

A structure is considered to be adequately protected when it meets at least one of three criteria set forth by the National Association of Corrosion Engineers (NACE) in their Standard RP-01-69 "Control of External Corrosion on Underground or Submerged Metallic Piping Systems". The criteria are:

Question 430.18
INSERT A (Cont'd)

1. "A negative (cathodic) Voltage of at least 0.85 Volts as measured between the structure surface and a saturated copper-copper sulfate reference electrode contacting the electrolyte. Determination of this Voltage is to be made with the protective current applied".

2. "A minimum negative (cathodic) Voltage shift of 300 millivolts, produced by the application of protective current. The Voltage shift is measured between the structure surface and a saturated copper-copper sulfate electrode contacting the electrolyte. This criterion of voltage shift applies to structures not in contact with dissimilar metals".

3. "A minimum negative (cathodic) polarization voltage shift of 100 millivolts measured between the structure surface and staturated copper-copper sulfate electrode contacting the electrolyte. This polarization voltage shift is to be determined by interrupting the protective current and measuring the polarization decay. When current is initially interrupted, an immediate Voltage shift will occur. The voltage reading after the immediate shift shall be used as the base reading from which to measure polarization decay".

The cathodic protection system for the plant underground structures will consist of two (2) remote anode ground beds energized by individual transformer-rectifier units. This system consists of a group of anodes installed remote from all plant underground structures, a DC source, interconnecting cables and an AC power supply. The positive terminal of the transformer-rectifier is connected to the anode ground bed and the negative terminal is connected to the structures to be protected.

The capacity of the transformer-rectifier, number, size and spacing of the anodes, cable size and other factors are calculated according to the soil electrical resistivity, the resistance to remote earth of the station, and the surface area of the structures to be protected which determines the magnitude of the current necessary to achieve protection.

Except for shielded areas within the plant, good current distribution is achieved with a remote ground bed. These shielded areas can be best defined after energization of the remote anode ground beds, with a structure-to-soil potential survey, allowing adequate time for polarization of the underground structures. Any such low potential areas would then be protected by an impressed current system with distributed anode or semi-deep anode ground beds designed to furnish necessary supplemental current to the areas requiring same.

A distributed anode ground bed consists of a group or network of anodes installed at specific intervals and in close proximity of the structures to be protected. Current distribution is concentrated to the structures in the immediate vicinity of the anodes.

Question 430.18
INSERT A (Cont'd)

Semi-deep anode ground beds behave in a manner similar to distributed anode ground beds. They may be employed when the physical constraints of the site severely limit the practial application of a distributed anode system. A semi-deep anode ground bed consists of a vertical hole drilled to sufficient depth with a number of high silicon cast iron or grpahite anodes with individual lead wires installed at staggered depths. The hole is backfilled with a carbonaecous backfill material suitable for the installation. Individual anode leads are terminated in a nearby aboveground junction box which provides a means for monitoring the output of individual anodes.

Either of the above discussed ground bed systems would be energized by a transformer-rectifier unit as described for the remote anode impressed current system.

Question No.

430.19 (SRP 9.5.4) Identify all high and moderate energy lines and systems that will be installed in the diesel generator room. Discuss the measures that will be taken in the design of the diesel generator facility to protect the safety related systems, piping and components from the effects of high and moderate energy line failure to assure availability of the diesel generators when needed.

Response

There are no high energy lines in the diesel generator room. The moderate energy systems are as follows:

a) Diesel Generator Fuel Oil Storage and Transfer System

b) Diesel Generator Lube Oil Make-up System

c) Diesel Generator Cooling Water System

d) Component Cooling Water System.

Flooding due to postulated cracks in moderate energy lines are studied and explained in Subsection 3.6A.3.4.2.4. The worst flooding was determined to be due to a crack in the component cooling water system piping. However, no safety-related equipment would be damaged.

Question No.

430.20 (SRP 9.5.4) Section 9.5.4.1 Diesel Generator Fuel Oil Storage and Transfer System (DFGOSTS) does not specifically reference ANSI Standard N195 "Fuel Oil Systems for Standby Diesel Generators." Indicate if you intend to comply with this standard in your design of the DGFOSTS; otherwise provide justification for noncompliance.

Response

The diesel generator fuel oil storage and transfer system is in compliance with ANSI Standard N195-1976, "Fuel Oil Systems for Standby Diesel Generators." FSAR Table 9.5.4-2 will be amended to include the subject standard.

See also the response to Question No. 430.15.

Question No.

430.22 (SRP 9.5.4) In FSAR Section 9.5.4.2.1, you state that additional fuel can be delivered to the site by tanker truck within six hours. Expand this section of the FSAR to include a discussion of unfavorable environmental conditions which may occur in the vicinity of the plant site and how fuel will be delivered under these conditions.

Response

FSAR Subsection 9.5.4.2.1 will be amended to include a discussion of unfavorable environmental conditions that may occur in the vicinity of the plant site and how diesel fuel will be delivered under these conditions.

Q430.22

9.5.4.2 System Description

The diesel generator fuel oil storage and transfer system (DGFOSTS) is shown on Figure 9.5.4-1. The DGFOST system consists of two separate, independent trains of fuel oil supply subsystems serving each of the two standby diesel generator engines. Each of these redundant subsystems consists of a 100 percent capacity fuel oil storage tank, with fill, vent, drain and overflow lines, a duplex filter, a day tank, a gravity drain tank, a gravity drain return pump, interconnecting piping, valves and associated instruments and controls.

Train A normally serves emergency diesel generator A and train B normally serves diesel generator B. All necessary electric power for the operation of each train is supplied from the associated emergency diesel generator bus.

In each diesel fuel oil train, the transfer pump takes suction from the storage tank and discharges fuel to the associated diesel generator day tank to automatically maintain the fuel oil level as shown on Figure 9.5.4-1. Should one of the pumps fail, the operator has the option to align the operating transfer pump from either storage tank to the available day tank. In order to accomplish this, locked closed valves located on the interconnecting piping between the two fuel oil transfer pump suction lines (3EG-VH001SA/B and 3EG-VH002SA/B) and discharge lines (3EG-VE022SA/B and 3EG-VE023SA/B) are manually opened as deemed necessary.

The DGFOSTS components are described in subsequent sections. The design data for major components are shown in Table 9.5.4-1.

9.5.4.2.1 Diesel Generator Fuel Oil Storage Tanks

The DGFOSTS provides adequate storage fuel oil supplies. Based on diesel generator guaranteed fuel consumption rate of 486 gal/hr at full load, each fuel oil storage tank has a usable capacity of 88,000 gallons which is sufficient to supply fuel oil for seven days of continuous operation for one diesel engine operating at full load conditions. The minimum supply requirement is 82,000 gallons. 1

Assuming the loss of one storage tank, seven days is considered adequate time for obtaining additional fuel oil, since additional fuel can be available at the site within six hours. No. 2 Grade diesel fuel oil can be obtained in Montesano, approximately 10 miles away, McCleary, approximately 10 miles away, and Aberdeen, approximately 20 miles. Thus, a minimum 14 day total diesel oil inventory is available onsite for operation of a single emergency diesel generator. The diesel generator fuel oil storage tanks are located in separate rooms in a missile protected seismic Category I diesel oil tank storage building adjacent to the Dry Cooling Tower structure. 1

The tanks operate at ambient temperature and atmospheric pressure, and are both designed in accordance with seismic Category I and Supply System Quality Class I requirements.

Adverse weather effects on road travel, as described in Section 12.5.3 of the WNP-3 Emergency Plan, will not prevent prompt delivery of fuel to the site. Flooding will not prevent access to the site, as described in Section 10.3 of the WNP-3 Emergency Plan.

Question No.

430.24 (SRP 9.5.4) Expand your FSAR to incude a discussion of the corrosion protection you will use to protect the interior surface of the fuel oil storage tanks.

Response The interior surfaces of the fuel oil tanks will receive corrosion protection from the inhibitive characteristics of the fuel oil. As the tanks will be over 90% full, the majority of surface area will be immersed in oil and therefore protected.

As fuel is drawn from the tank, there will be sufficient oil residue on surfaces to provide corrosion protection for periods of up to 4 to 6 weeks. The tanks are not expected to remain empty for more than 7 days as indicated in Subsection 9.5.4.2.1.

FSAR Subsection 9.5.4.2.1 will be amended to reflect the response to this question.

Each tank may be filled with fuel oil directly from a tank truck. A return line to the tanker is necessary to prevent overfilling the reservoir. 1

Each fuel oil storage tank is provided with local level indicators and high-level switches to actuate annunciators in the local Diesel Generator Control Room, adjacent to diesel generator room.

The diesel oil storage tanks are provided with surrounding enclosures such that a maximum oil spill, resulting from a tank failure, is completely contained.

← Insert 1

9.5.4.2.2 Diesel Generator Fuel Oil Transfer Pump

In each supply subsystem, a fuel oil transfer pump takes suction from the fuel oil storage and discharges to an associated diesel generator fuel oil day tank, through a discharge solenoid valve.

The fuel oil transfer pumps which are positive displacement pumps are designed to deliver 14 gal/min.

This capacity corresponds to approximately one and one half the maximum consumption rate of each diesel engine under full load conditions. The fuel oil transfer pump is provided with a normally closed solenoid operated valve and normally closed bypass valve on the discharge side of the pump to eliminate leakages from storage tank to day tank to maintain a full storage tank oil inventory. These solenoid operated valves are operated by signals actuated by the fuel oil day tank level switches.

Each pump is located in the fuel oil storage tank area adjacent to the dry cooling tower structure and is driven by a 3 hp, 460V, 3 phase, ac induction motor. In case of loss of offsite power each pump is powered from its corresponding diesel generator bus. 1

Each transfer pump and pump discharge line to the diesel oil day tank are physically separated so that a pump failure or a pipe rupture will have no effect on the other diesel generator subsystem

Each fuel oil transfer pump is provided with a duplex type strainer at the suction side for pump protection and a duplex, renewable, cartridge type, fuel oil filter at the discharge side for removal of particles from the fuel oil. The duplex strainer and filter enable operation of the fuel oil transfer pump if one strainer and/or one filter is out of service or needs replacement.

9.5.4.2.3 Diesel Generator Fuel Oil Day Tank

Each diesel oil day tank is a horizontal, cylindrical, steel tank that stores diesel fuel for immediate use by the emergency diesel generator. Each fuel oil day tank has a capacity of 1100 gallons, and can provide two-and-one-quarter hours supply to its respective diesel engine operating at full load conditions without resupply to the day tank.

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The interior surfaces of the fuel oil tanks will receive corrosion protection from the inhibitive characteristics of the fuel oil. As the tanks will be over 90% full, the largest majority of surface area will be immersed in oil and therefore protected.

As fuel is drawn from the tank, there will be sufficient oil residue on surfaces to provide corrosion protection for periods of up to 4 to 6 weeks. The tanks are not expected to remain empty for more than 7 days as indicated above.

Question No.

430.25 (SRP 9.5.5) Describe the instrumentation, controls, sensors, and alarms provides for monitoring of the diesel engine cooling water system an describe their function. Discuss the testing necessary to maintain and assure a highly reliable instrumentation, controls, sensors, and alarm system, and where the alarms are annunciated. Identify the temperature, pressure, level, and flow (where applicable) sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe what operator actions are required during alarm conditions to prevent harmful effects to the diesel engines. Discuss the systems interlocks provided.

Response In response to your question the following information is provided:

Jacket Water System Instrumentation and Controls

a) Expansion Tank Instrumentation

The remotely located expansion tank is provided to take care of the expansion of the coolant, in both the intercooler coolant and jacket coolant systems during normal engine operation.

This tank is equipped with a fill valve, a vent, a low level alarm switch (CLLA), a level control switch (CLC), a coolant make-up solenoid valve, a sight glass, and a drain line.

A fill cap is provided, on the top of the expansion tank, for adding a water treatment compound to the system to prevent corrosion in the coolant systems.

The expansion tank level switch (CLC) and the coolant make-up solenoid valve (CSV) (provided on the 1 in. fill line from the demineralized water supply) work together to maintain a constant level of coolant in the expansion tank. When the coolant level in the expansion tank decreases to approx. 15-3/8 in. below the level of the switch mounting flange, the level switch (CLC) energizes the make-up solenoid valve to open, allowing water (from the demineralized water supply) to flow into the expansion tank. The water flow continues until the level in the expansion tank reaches approx. 8-3/8 in. from the bottom of switch mounting flange. The level switch (CLC) de-energizes the make-up solenoid valve (CSV), which shuts off the flow of water to the expansion tank. An alarm is given whenever the filling device actuates.

Question No. 430.25

Response (Cont'd)

A low level alarm switch (CLLA) mounted on the expansion tank gives an alarm if the coolant level in the expansion tank should fall below a predetermined point. The switch is set to give an alarm when the level decreases to 18-3/4 in. below the level of the switch mounting flange.

b) Temperature Control Valve

A thermostatically controlled 3-way valve is provided to divert the flow of coolant around the jacket coolant heat exchanger (when the temperature of the coolant discharge from the engine is below 165°F) to permit fast engine warm ups. This valve also controls the flow of coolant through the jacket coolant heat exchanger to maintain the temperature of the coolant discharged from the engine in the 170° to 180° range with all loads and ambient temperatures.

c) Pressure Switches

- Coolant Pressure Switch (CPS)

This switch is provided as a backup for the high speed portion of the tachometer relay (ESSB). This switch is connected to the discharge line of the engine driven pump. This switch is set to operate at the coolant pressure existing when the engine speed has increased to 375 rpm.

- Coolant Pressure Low Alarm Switch (CPLA)

This switch is connected to the discharge line of the engine driven pump. This switch will actuate, to alarm if the coolant pressure should decrease to 25 psi.

d) Temperature Switches

Three temperature switches are connected to the jacket water discharge line from the engine. The coolant temperature high alarm switch (CTHA) is set to alarm if the temperature of the coolant should increase to 185°F. The coolant temperature high shutdown switch (CTHS) is set to trip, in test mode only, if the temperature of the coolant should continue to increase to 195°F. The third switch is the coolant temperature low alarm switch (CTLA) which will alarm when the coolant temperature decreases to 135°F.

e) Filling and Venting

Since check valves are used in the jacket coolant cooling system, to restrict the flow of coolant during the operation of the jacket coolant keepwarm heating system, special care is required during the filling of the system to assure that the system is full of coolant.

Question No. 430.25

Response (Cont'd)

A small filling bypass line, between the inlet to the thermostatic bypass valve and the inlet to the jacket coolant heat exchanger, is provided with a normally closed manually operated valve. The valve in this filling bypass line should be opened only when filling the system with coolant. When this valve is opened, it allows the coolant to bypass the normally closed ("C") port of the thermostatic bypass valve, and fill the jacket coolant heat exchanger.

Intercooler Water System Instrumentation and Controls

a) Temperature Control Valve

A thermostatic 3-Way valve is provided in this system to keep the temperature of the coolant (to the air coolers) high enough to prevent any condensation, and temperature inducted expansion and/or contraction difficulties under the following conditions:

a. During periods of low ambient temperature

b. During periods of low coolant temperature

c. During periods of low load conditions

d. Any combination of the above conditions

This thermostatic valve begins to open the "C" port to the heat exchanger at 95°F. The "C" port (to the intercooler heat exchanger) will be fully opened and the bypass "B" port will be fully closed when the coolant temperature is 110°F.

b) Injector Nozzle Cooling

A branch line of the intercooler system is provided so that the coolant is supplied to the injection nozzle headers for each cylinder bank.

A three-way thermostatic mixing valve allows the jacket coolant and the intercooler to mix, to produce a mixed coolant (at approximately 120°F under all conditions of load and ambient temperatures) to enter the injector nozzle cooling headers. The coolant discharged from the injector nozzle cooling system is returned to the remote mounted expansion tank.

Question No. 430.25

Response (Cont'd)

Diesel Generator Shutdown & Interlocks

The diesel generator is shutdown in a jacket water temperature high condition (in test mode only). There are no other shutdowns initiated by the diesel engine cooling water system.

One interloc^ is provided to de-energize the jacket coolant water heater upon starting of the diesel generator.

Tables 1, 2 and 3 list the local instrumenation, alarm signals to diesel control panel and control devices respectively.

FSAR Subsection 9.5.5 will be amended to reflect the response to this question.

Question No. 430.25

Response (Cont'd)

Table 1

LOCAL INSTRUMENTATION

Tag No.	Service	Range/Unit	Loction	Remark
CSP	Jacket water (J.W.) coolant pressure switch	at 375 rpm	Skid	Backup for speed switch
CPLA	J.W. coolant pressure low alarm switch	25 psi	Skid	
CTHA	J.W. coolant temperature high alarm switch	185°F	Skid	
CTLA	J.W. coolant temperature low alarm switch	135°F	Skid	
CTHS	J.W. coolant temperature high shutdown switch	195°F	Skid	In test mode only
CHT	J.W. heater thermostat	150°F - 155°F	Skid	
CLLA	J.W. expansion tank level low alarm switch	low	Tank	
CLC	J.W. expansion tank level control switch	8-3/8" from bottom	Tank	Maintain level from demineralized water
CRTI	RTD temperature of coolant from engine	100	Skid	
CRTX	RTD temperature of coolant to engine	100	Skid	

[All switches are included in the present Fig. 9.5.5-1]

Question No. 430.25

Response (Cont'd)

Table 2

ALARM SIGNALS TO DIESEL CONTROL PANEL

Initiating Devices	Alarm Description	Condition	Set Point	Remark
CPLA	Jacket Water pressure low	low pressure	25 psi	
CTHA & CTLA	J.W. temperature, high or low	Out of range	185°F - 135°F	
CLLA	J.W. expansion tank low level	low level	18 3/4 in.	
CLR	J.W. expansion tank fill	Filling	15 3/8 in - 8 3/8 in.	Operating Range

Question No. 430.25

Response (Cont'd)

Table 3

CONTROL DEVICES

Tag No.	Service	Range/Unit Application	Loction	Remark
#4	J.W. pressure meter	0-61 psi	Panel	
JWM	J.W. temperature meter	0-200°F	Panel	
RS3	J.W. temperature meter switch	To Engine/ from Engine	Panel	
SS42	J.W. warm up pump switch	Hand/off/ Auto	Term box on skid	
LI26	J.W. coolant pump off, light	Green	Term box on skid	
LI27	J.W. coolant pump on, light	Red	Term box on skid	
SS41	J.W. heater switch	Off/On/ Auto	Term box on skid	
LI24	J.W. heater off, light	Green	Term box on skid	
LI25	J.W. heater on, light	Red	Term box on skid	

The DGCWS will be protected from freezing and long-term corrosion by an Ethylene Glycol solution which will be maintained throughout the life of the unit. Since this is a closed system no organic fouling is expected. The design data for major components of this system is shown in Table 9.5.5-1 and the instrumentation and controls for this system are described in Section 7.4. 1

9.5.5.3 Safety Evaluation

The Diesel Generator Cooling Water System meets the single failure criterion in that if a failure of the system prevents the operation of its associated diesel generator, the remaining diesel generator will not be affected and will provide adequate power to safely shutdown the plant or to mitigate the effects of a LOCA during loss of offsite power conditions.

Failure of the non-safety portion of the system piping will not impact the operation of the system. 1

In the event of loss of offsite power, DGCWS pumps which supply cooling water to the heat exchangers will begin operation automatically upon startup of engines. Full flow of component cooling water will be available in 15 seconds. 1

A failure mode and effects analysis of the DGCWS is presented in Table 9.5.5-2.

9.5.5.4 Inspection and Testing Requirements

The system will be operated and tested initially with regard to flow path, flow capacity and mechanical operability. To insure continued integrity of the diesel generator closed cooling water system, scheduled inspection and testing of equipment will be performed as part of the overall engine performance checks at regular intervals. Testing of the diesel generator system is discussed in Section 14.2.

Instrumentation will be provided to monitor cooling water temperature, pressure and expansion tank level, and alarm on high jacket water temperature. These instruments will receive periodic calibration and inspection to verify their accuracy. 1

The cooling water in the closed loop system will be periodically analyzed and treated as necessary to maintain the desired quality.

All major components of the system are accessible for inspection, and available for testing during normal plant operation. The ASME Section III, Class 3 DGCWS piping will be inspected and tested in accordance with ASME Boiler and Pressure Vessel Code Section XI and III requirements, respectively.

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9.5.5.5 Instrumentation and Controls

9.5.5.5.1 Jacket Water System

a) Expansion Tank Instrumentation

The remotely located expansion tank is provided to take care of the expansion of the coolant, in both the intercooler coolant and jacket coolant systems during normal engine operation.

This tank is equipped with a fill valve, a vent, a low level alarm switch (CLLA), a level control switch (CLC), a coolant make-up solenoid valve, a sight glass, and a drain line.

A fill cap is provided, on the top of the expansion tank, for adding a water treatment compound to the system to prevent corrosion in the coolant systems.

The expansion tank fill switch (CLC) and the coolant make-up solenoid valve (CSV) (provided on the 1 in. fill line from the demineralized water supply) work together to maintain a constant level of coolant in the expansion tank. When the coolant level in the expansion tank decreases to approx. 15-3/8 in. below the level of the switch mounting flange, the fill switch (CLC) energizes the make up solenoid valve to open, allowing water (from the demineralized water supply) to flow into the expansion tank. The water flow continues until the level in the expansion tank reaches approx. 8-3/8 in. from the bottom of switch mounting flange. The fill switch (CLC) de-energizes the make up solenoid valve (CSV), which shuts off the flow of water to the expansion tank. An alarm is given whenever the filling device actuates.

A low level alarm switch (CLLA) mounted on the expansion tank gives an alarm if the coolant level in the expansion tank should fall below a predetermined point. The switch is set to give an alarm when the level decreases to 18-3/4 in. below the level of the switch mounting flange.

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b) Temperature Control Valve

A thermostatically controlled 3-way valve is provided to divert the flow of coolant around the jacket coolant heat exchanger (when the temperature of the coolant discharge from the engine is below 165°F) to permit fast engine warm ups. This valve also controls the flow of coolant through the jacket coolant heat exchanger to maintain the temperature of the coolant discharged from the engine in the 170° to 180° range with all loads and ambient temperatures.

c) Pressure Switches

- Coolant Pressure Switch (CPS)

This switch is provided as a back-up for the high speed portion of the tachometer relay (ESSB). This switch is connected to the discharge line of the engine driven pump. This switch is set to operate at the coolant pressure existing when the engine speed has increased to 375 rpm.

- Coolant Low Pressure Alarm Switch (CPLA)

This switch is connected to the discharge line of the engine driven pump. This switch will actuate, to alarm if the coolant pressure should decrease to 25 psi.

d) Temperature Switches

Three temperature switches are connected to the jacket water discharge line from the engine. The high coolant temperature alarm switch (CTHA) is set to alarm if the temperature of the coolant should increase to 185°F. The high coolant temperature shutdown switch (CTHS) is set to trip, in test mode only, if the temperature of the coolant should continue to increase to 195°F. The third switch is the low coolant temperature alarm switch (CTLA) which will alarm when the coolant temperature decreases to 135°F.

e) Filling and Venting

Since check valves are used in the jacket coolant cooling system, to restrict the flow of coolant during the operation of the jacket coolant keepwarm heating system, special care is required during the filling of the system to assure that the system is full of coolant.

A small filling bypass line, between the inlet to the thermostatic bypass valve and the inlet to the jacket coolant heat exchanger, is provided with a normally closed manually operated valve. The valve in this filling bypass line should be opened only when filling the system with coolant. When this valve is opened, it allows the coolant to bypass the normally closed ("C") port of the thermostatic bypass valve, and fill the jacket coolant heat exchanger.

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9.5.5.5.2 Intercooler Water System

a) Temperature Control Valve

A thermostatic 3-way valve is provided in this system to keep the temperature of the coolant (to the air coolers) high enough to prevent any condensation, and temperature induced expansion and/or contraction difficulties under the following conditions:

a. During periods of low ambient temperature

b. During periods of low coolant temperature

c. During periods of low load conditions

d. Any combination of the above conditions.

This thermostatic valve begins to open the "C" port to the heat exchanger at 95°F. The "C" port (to the intercooler heat exchanger) will be fully opened and the bypass "B" port will be fully closed when the coolant temperature is 110°F.

b) Injector Nozzle Cooling

A branch line of the intercooler system is provided so that the coolant is supplied to the injection nozzle headers for each cylinder bank.

A three-way thermostatic mixing valve allows the jacket coolant and the intercooler to mix, to produce a mixed coolant (at approximately 120°F under all conditions of load and ambient temperatures) to enter the injector nozzle cooling headers. The coolant discharged from the injector nozzle cooling system is returned to the remote mounted expansion tank.

9.5.5.5.3 Diesel Generator Shutdown & Interlocks

The diesel generator is shutdown in a jacket water temperature high condition (in test mode only). There are no other shutdowns initiated by the diesel engine cooling water system.

One interlock is provided to de-energize the jacket coolant water heater upon starting of the diesel generator.

Tables 9.5.5-3, 4 and 5 list the local instrumentation, alarm signals to diesel control panel and control devices respectively.

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Table 9.5.5-3

LOCAL INSTRUMENTATION

Tag. No.	Service	Range/Unit	Location	Remark
CPS	Jacket water (J.W.) pressure switch	at 375 rpm	Skid	Back up for speed switch
CPLA	J.W. pressure low alarm switch	25 psi	Skid	
CTHA	J.W. temperature high alarm switch	185°F	Skid	
CTLA	J.W. temperature low alarm switch	135°F	Skid	
CTHS	J.W. temperature high shutdown switch	195°F	Skid	In test mode only
CHT	J.W. heater thermostat	150°F - 155°F	Skid	
CLLA	J.W. expansion tank level low alarm switch	low	Tank	
CLR	J.W. expansion tank fill alarm switch	high	Tank	
CLC	J.W. expansion tank level control switch	8-3/8" from bottom	Tank	Maintain level from demineralized water
CRTI	RTD temperature of coolant from engine	100 Ω	Skid	
CRTX	RTD temperature of coolant to engine	100 Ω	Skid	

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Table 9.5.5-4

ALARM SIGNALS TO DIESEL CONTROL PANEL

Initiating Devices	Alarm Description	Condition	Set Point	Remark
CPLA	Jacket Water low pressure	low pressure	25 psi	
CTHA & CTLA	J.W. temperature, high or low	Out of range	185°F - 135°F	
CLLA	J.W. expansion tank low level	low level	NA	
CLR	J.W. expansion tank fill	Filling	NA	

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Table 9.5.5-5

CONTROL DEVICES

Tag. No.	Service	Range/Unit Application	Location	Remark
#4	J.W. pressure meter	0-60 psi	Panel	
JWM	J.W. temperature meter	0-200°F	Panel	
RS3	J.W. temperature meter switch	To Engine from Engine	Panel	
SS42	J.W. warm up pump switch	Hand/off/Auto	Term box on skid	
LI26	J.W. coolant pump off, light	Green	Term box on skid	
LI27	J.W. coolant pump on, light	Red	Term box on skid	
SS41	J.W. heater switch	Off/On/Auto	Term box on skid	
LI24	J.W. heater off, light	Green	Term box on skid	
LI25	J.W. heater on, light	Red	Term box on skid	

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Question No.

430.32 (SRP 9.5.5) Provide a description of how the diesel engine jacket water keepwarm system operates. Include such things as operating temperature range, source of power for pump and heater, controls, and instrumentation.

Response

The jacket water keepwarm heating system (JWKHS) is designed to maintain the required jacket coolant temperature between 150°F and 155°F to permit the diesel engine to reach its rated speed in the specified time of ten seconds. This eliminates the time delay for engine warmup. The jacket water keepwarm heating system consists of a motor driven centrifugal pump, electric heater, pressure relief valve, piping and instrumentation. The JWKHS system takes suction from the main jacket water system loop, thru a branch line just before the 3-way thermostatic valve and jacket water heat exchanger. This system circulates jacket coolant through the keepwarm heater and returns to main jacket water system loop downstream of the main engine jacket water pump, as shown on Figure 9.5.5-1. A check valve is provided on the keepwarm piping downstream of the heater to prevent bypassing of the jacket coolant to the main engine heaters during operation. The keepwarm pump operates continuously whenever the engine is in a standby mode.

A "three position" control switch is provided for manual selection of pump operating conditions. When the switch is in "auto" position, a speed relay (LSX) will open the circuit to stop the keepwarm pump when the engine is in operation. In all modes of diesel engine operation, the keepwarm heater is controlled by a thermostat, in order to maintain the coolant temperature between 150F minimum and 155F maximum. A low temperature switch, located in the suction line of the keepwarm pump, provides an alarm signal to the annunciator at the local Diesel Generator Control Panel and a "System Trouble" alarm in the Control Room upon failure of the jacket water keepwarm system. This temperature switch is set to actuate at a coolant temperature of 135F. A temperature gauge is provided on the Diesel Generator Control Panel, to monitor the jacket water temperature. A pressure relief valve is provided for the keepwarm heater protection in the event of restricted coolant flow and failure of the heater to cut-out automatically. This relief valve is located on the piping downstream of the heater, and is set at 60 psi. The power source to the 1.5 HP keepwarm pump and 75 KW heater is provided from the non-Class 1E, 480V, AC motor control center powered by the unit auxiliary transformer as well as the offsite power source.

FSAR Subsection 9.5.5.2.1 will be amended to reflect the above response.

Item 4) which senses the temperature and directs it through or around the heat exchanger as required to maintain the proper temperature. The water then returns to the pump suction.

A thermostatic control electric heater is provided to maintain a constant, warm engine jacket water temperature to assure quick starts when the engine is on standby. A motor-driven centrifugal pump supplies a flow of warm water from the heater to the water jacket to achieve this purpose. Upon startup, the diesel engine jacket water circulating system will be transferred from the heating mode to the engine driven cooling mode. delete

INSERT 1 →

9.5.5.2.2 Intercooler Water System

The Cooling Water System also includes the Intercooler Water System. This system is a closed circuit which removes the heat of compression generated by the turbocharger from combustion air.

Water is drawn from the engine intercooler by an engine-driven centrifugal intercooler pump and is directed to an intercooler thermostatic three-way valve (see Table 9.5.5-1, Item 9) which senses the temperature and directs the water through or around the intercooler heat exchanger proportionally as required to maintain the proper temperature. The water then goes to the engine intercoolers. Cool water from this system is blended as required with hot jacket water by the injector cooling thermostatic three-way valve to provide slightly warmer water for injection nozzle cooling. After cooling the fuel injector nozzles it is directed to the expansion tank and then returns to the jacket water and intercooler systems through the pump surge lines. Block valves allow isolation of fuel injector nozzles for replacement without draining the major systems. 1

The Intercooler Water System also furnishes water to cool the alternator shaft outboard bearing.

The closed loop jacket water and intercooler water systems include an expansion tank with sufficient volume to provide for thermal expansion of the water and for minor leakages. The location of the expansion tank ensures that the pump suction piping and most of the remaining system is initially filled with water. During startup, air trapped in the engine will be displaced by the pump discharge. The expansion tank is sized for seven days of expected losses for continuous diesel operation.

Makeup water to the expansion tank of the DGCWS is provided by the safety-related condensate storage tank through the condensate makeup pump. A vacuum breaker is provided on the vent line of the tank to insure operation of the tank should the vent line become blocked. The expansion tank is sized for seven days of expected losses for continuous diesel operation.

In the event of loss of offsite power, the component cooling water system pumps, which supply cooling water to the diesel generator jacket water and intercooler heat exchangers, will begin operation automatically upon startup of the diesel engines.

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INSERT 1

The jacket water keepwarm heating system (JWKHS) is designed to maintain the required jacket coolant temperature between 150°F & 155°F to permit the diesel engine to reach its rated speed in the specified time of ten seconds. This eliminates the time delay for engine warmup. The jacket water keepwarm heating system consists of a motor driven centrifugal pump, electric heater, pressure relief valve, piping and instrumentation. The JWKHS system takes suction from the main jacket water system loop, thru a branch line just before the 3-way thermostatic valve and jacket water heat exchanger. This system circulates jacket coolant through the keepwarm heater and returns to main jacket water system loop downstream of the main engine jacket water pump, as shown on Figure 9.5.5-1. A check valve is provided on the keepwarm piping downstream of the heater to prevent bypassing of the jacket coolant to the main engine heaters during operation. The keepwarm pump operates continuously whenever the engine is in a standby mode.

A "three position" control switch is provided for manual selection of pump operating conditions. When the switch is in "auto" position, a speed relay (LSX) will open the circuit to stop the keepwarm pump when the engine is in operation. In all modes of diesel engine operation, the keepwarm heater is controlled by a thermostat, in order to maintain the coolant temperature between 150°F minimum and 155°F maximum. A low temperature switch, located in the suction line of the keepwarm pump, provides an alarm signal to the annunciator at the local Diesel Generator Control Panel and a "System Trouble" alarm in the Control Room upon failure of the jacket water keepwarm system. This temperature switch is set to actuate at a coolant temperature of 135°F. A temperature gauge is provided on the Diesel Generator Control Panel, to monitor the jacket water temperature. A pressure relief valve is provided for the keepwarm heater protection in the event of restricted coolant flow and failure of the heater to cut-out automatically. This relief valve is located on the piping downstream of the heater, and is set at 60 psi. The power source to the 1.5 HP keepwarm pump and 75 KW heater is provided from the non-Class 1E, 480V, AC motor control center powered by the unit auxiliary transformer as well as the offsite power source.

Q430.32

Question No.

430.34 (SRP 9.5.6) Expand your description of the diesel engine starting system. The FSAR text should provide a detail system description of what is shown on Figures 9.5.6-1 and 9.5.6-2. The FSAR text should also describe: 1) components and their function, 2) operating pressures and relief valve settings, 3) instrumentation, controls, sensors and alarms, and 4) a diesel engine starting sequence. In describing the diesel engine starting sequence include the number of air start valves used and whether one or both air start systems are used.

Response

The Diesel Generator Starting System is an integral part of the Diesel Generator Package and is supplied by the Diesel Generator Manufacturer. The arrangement of the DGSS is shown on Figure 9.5.6-1.

Each diesel generator is equipped with two independent train air start systems. Either train can start the engine and supply control air. Each train provides air to each of two banks of cylinders and consists of an ac motor driven air compressor, air dryer, air receivers with safety relief valves, associated piping, valves, and instrumentation and control equipment.

Each air compressor is driven by an ac motor fed from a separate normal power supply. The air compressor motor is controlled by a pressure switch at the associated air receiver. This pressure switch is set to start the motor on decreasing pressure at 600 psi and stop the motor on increasing pressure at 670 psi. By manually opening the dual cross connect valves on the cross connection line on the inlet side of the air receivers, either air compressor can be used to fill and pressurize both receivers. Each air compressor is provided with a safety valve on the discharge side set to open at 700 psi. In addition, each air compressor is provided with an automatic unloader to allow it to come up to rated speed before starting to fill the air receiver. The air compressors are not required during startup and/or operation of the diesel engine.

A crankcase heater is provided for each compressor to maintain the temperature of the crankcase oil above the optimum temperature of 95F. A thermostat, set to actuate on decreasing temperature at 95F, controls the crankcase heater. Each air compressor is provided with a condensate drainpot which is periodically drained automatically by a timer and solenoid operated drain valve.

A refrigerant type air dryer is provided at the discharge side of each air compressor, to provide moisture free air for starting and

Response

430.34 (Cont'd)

controls. A check valve, at the inlet of the air receiver, separates the non-safety portion of the system from the safety-related portion, thus preventing a sudden loss of air due to a break in the non-safety portion of the air start system.

Each air receiver is sized to provide sufficient air capacity without makeup for five diesel generator normal cold start cycles, independent of a malfunction or failure of the other train. The startup time is defined as the total elapsed time between receipt of an automatic start signal and the closure of the diesel generator circuit breaker in the safety-related ac power distribution system. A normal successful start is considered to be a start that results in the diesel generator unit reaching rated speed of 514 rpm, frequency of 60 Hz and voltage of 4160 volts within 10 seconds of receipt of the start signal.

Both air starting systems are used for normal starts, therefore, the combined capacity of both air receivers is 10 cold start cycles without recharging the air receivers. The average expected cranking cycle duration is three to three and one half seconds. A timer is provided to limit the duration of the cranking cycle to a maximum of seven seconds. If this duration exceeds seven seconds, the air supply for cranking will be shut off. Each air train is provided with a low pressure alarm. Each receiver is provided with a safety relief valve set to open at 700 psi. By closing the two normally operated shutoff valves, each air receiver can be isolated for maintenance. A manually operated drain valve is provided at the lowest point of the air receiver for use in the periodic blowdown of the accumulated moisture and foreign materials. A cross connection line, with two normally closed valves, is furnished on the discharge side of the air receivers to provide operational flexibility.

On the engine skid, an air start solenoid operated three way valve (normally closed; energize to open) is provided which pilots the main air start control valve to allow the starting air to enter the engine under the control of the air start distributor. Preceding these solenoid valves, a line strainer and filter are provided to remove dirt and foreign material from the line. Each air line is also provided with a low air pressure alarm switch set to actuate on decreasing pressure at 435 psi and to annunciate on the diesel generator control board. A barring interlock device is provided between the air start solenoid valve and the main air start valve to prevent engine start during maintenance. Only when the barring device is disengaged will the air start solenoid valve be able to admit air to the main air start valve and start the engine. When actuated, it shuts off starting air flow into the engine and is annunciated on the diesel generator control board.

Response

430.34 (Cont'd)

A shutdown air accumulator with a solenoid operated shutdown valve (normally closed; energize to open) is provided, which holds enough air trapped by a check valve on the upstream side of the accumulator, to close the fuel racks and shut the engine down even if both starting air systems lose pressure.

FSAR Subsection 9.5.6.2 will be amended to reflect this response.

Also, refer to the Supply System responses for Questions 430.35 and 430.38.

9.5.6 DIESEL GENERATOR STARTING SYSTEM

The Diesel Generator Starting System (DGSS) is designed to provide sufficient charging air to allow starting of its associated diesel generator.

9.5.6.1 Design Bases

The DGSS bases are as follows:

a) the DGSS is designed to store sufficient compressed air in each air storage tank for performing the diesel generator cranking cycle five times without recharging the Air Receiver System.

b) the DGSS is designed to remain functional during and after an SSE.

c) the DGSS is designed such that a single failure of any component cannot cause loss of the system capability to mitigate the consequences of an accident or to safely shutdown the reactor.

d) the DGSS is capable of being monitored and controlled from the local diesel generator control panel and is monitored in the Main Control Room via a common diesel generator trouble alarm.

9.5.6.2 System Description

The diesel generator - is starting system is an integral part of the diesel generator package and ~~will be~~ supplied by the diesel generator manufacturer. The arrangement of the DGSS is shown on Figure 9.5.6-1.

Insert 1

Each diesel generator is equipped with - Two independent ~~a dual~~ train ~~pressurized~~ air starting systems. Each ~~independent~~ train provides air to each of two banks of cylinders and consists of an ac motor driven air compressor, air dryer, air receivers with safety relief valves, associated piping, valves, instrumentation and control equipment. Two cross-ties between trains are furnished on the suction and discharge of the receivers by means of double manual isolation valves to provide operational flexibility. This flexibility will permit the operator to maintain needed or technical specification pressure on both receivers even with an air compressor out of service. Each compressor is powered from a separate bus.

INSERT 2

Each ~~system~~ -train air receiver is sized to provide sufficient air capacity without makeup for five diesel generator normal cold start cycles ~~attempts~~, independent of a malfunction or failure of the other ~~system~~. The startup time is defined as the total elasped time between receipt of an automatic start signal and the closure of the diesel generator circuit breaker in the safety-related ac power distribution system. A ~~The~~ normal successful start is considered to be a start that results in the diesel generator unit reaching rated speed of 514 rpm, frequency of 60 Hz, and voltage of 4160 volts within 10 seconds of receipt of the start signal. 1

There is a manually operated plug valve located on the lowest point of the air receivers which can be used for periodic blowdown of the accumulated moisture

Q 430.34

both air receivers

~~and foreign~~ materials. Both air starting systems are used for normal starts. Therefore, the combined capacity of ~~the dual train system~~ is 10 cold start cycles without recharging the air receivers. The average expected cranking cycle duration is three to three and one half seconds. A ~~limit switch~~ timer is provided to limit the duration of the cranking cycle to a maximum of seven seconds. If this duration exceeds seven seconds, the air supply for cranking will be shutoff. ~~The air receivers are provided with a pressure switch to start and stop the compressor as required.~~ Each air train is provided with a low pressure alarm. Insert 3 The compressors are not required during the starting operation or during diesel engine operation. Two complete automatic refrigerant type air dryers on the discharge side of the air compressors provide moisture-free air by reducing the air dewpoint for starting and control. A check valve located upstream of the air receiver ensures that a broken line in the non-safety portion of the piping will not result in a sudden loss of air. The main air start control valve and air start solenoid valves are used for startup of the system.

A shutdown air accumulator with a solenoid operated shutdown valve (normally closed, energize to open) and is provided, which holds enough air trapped by a check valve on the upstream side of the accumulator to close the fuel racks ~~to~~ shut the diesel engine down even if both starting air systems lose pressure. Insert 4 The design data for major components of this system is shown in Table 9.5.6-1.

Insert 5

9.5.6.3 Safety Evaluation

The portion of the diesel generator starting system between the diesel generator and the first check valves upstream of the air receivers is classified as Nuclear Safety Class 3 and designed to ASME Section III, Class 3, seismic Category I requirements to ensure system operation during an SSE. The non-safety portions of the starting air system are designed in accordance with the applicable codes and standards listed in Table 9.5.4-2. The system is shown on Figure 9.5.6-1. 1

The air starting systems for one diesel are physically and electrically separated from those for the other diesel to assure that no single failure can cause malfunction of both divisions of standby ac power. 1

The single failure criterion is satisfied and significantly enhanced by having a dual train air starting system for each diesel generator.

The dual train starting system ensures that a failure of any components of any train cannot cause loss of system ability to start the diesel, to supply emergency power, so as to safely mitigate the consequences of an accident and safely shutdown the reactor. A failure in the non-safety portion of the system piping will not have any impact in the safe operation of the system. A failure mode and effects analysis of the DGSS is presented in Table 9.5.6-2. 1

9.5.6.4 Inspection and Testing Requirements

The system will be operated and tested initially with regard to flow path, flow capacity and mechanical operability in accordance with Section 14.0. To

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Insert 1

Either train can start the engine and supply control air.

Insert 2

Each air compressor is driven by an ac motor fed from a separate normal power supply. The air compressor motor is controlled by a pressure switch at the associated air receiver. This pressure switch is set to start the motor on decreasing pressure at 600 psi and stop the motor on increasing pressure at 670 psi. By manually opening the dual cross connect valves on the cross connection line on the inlet side of the air receivers, either air compressor can be used to fill and pressurize both receivers. Each air compressor is provided with a safety valve on the discharge side set to open at 700 psi. In addition, each air compressor is provided with an automatic unloader to allow it to come up to rated speed before starting to fill the air receiver. The air compressors are not required during startup and/or operation of the diesel engine.

A crankcase heater is provided for each compressor to maintain the temperature of the crankcase oil above the optimum temperature of 95°F. A thermostat, set to actuate on decreasing temperature at 95°F, controls the crankcase heater. Each air compressor is provided with a condensate drainpot which is periodically drained automatically by a timer and solenoid operated drain valve.

A refrigerant type air dryer is provided at the discharge side of each air compressor to provide moisture free air for starting and controls. A check valve, at the inlet of the air receiver, separates the non-safety portion of the system from the safety related portion thus preventing a sudden loss of air due to a break in the non-safety portion of the air start system.

Insert 3

Each receiver is provided with a safety relief valve set to open at 700 psi. By closing the two manually operated shutoff valves, each air receiver can be isolated for maintenance. A manually operated drain valve is provided at the lowest point of the air receiver for use in the periodic blowdown of the accumulated moisture and foreign materials. A cross connection line, with two normally closed valves, is furnished on the discharge side of the air receivers to provide operational flexibility.

On the engine skid, an air start solenoid operated three way valve (normally closed; energize to open) is provided which pilots the main air start control valve to allow the starting air to enter the engine under control of the air start distributor. Preceding these solenoid valves, a line strainer and filter are provided to remove dirt and foreign material from the line. Each air line is also provided with a low air pressure alarm switch set to actuate on decreasing pressure at 435 psi and to annunciate on the diesel generator control board.

A barring interlock device is provided between the air start solenoid valve and the main air start ~~solenoid~~ valve to prevent engine start during maintenance. Only when the barring device is disengaged will the air start solenoid valve be able to admit air to the main air start valve and start the engine. When actuated, it shuts off starting air flow into the engine and is annunciated on the diesel generator control board.

INSERT 4

There are four shuttle valves used in series to control the rack boost function of the fuel rack servo cylinder. The operations of each of the valves are as follows:

a) The first shuttle valve selects the starting air header that will supply the rack boost pressure.

b) The second shuttle valve vents the boost pressure in case of overspeed governor actuation during cranking.

c) The third shuttle valve vents the boost pressure if a shutdown signal from any source other than the overspeed governor activates the shutdown solenoid during cranking.

d) The fourth shuttle valve vents the boost pressure when the engine has built-up sufficient lube oil pressure to move the shuttle against the spring pressure.

Control air used to operate the pressure transmitters in the lube oil and fuel oil systems, the five solenoid operated 3 way valves and the pressure switches are supplied from a branch line connected to the starting air inlet lines to the engine. The five solenoid valves are connected downstream of the control air oil removal filter. They are as follows:

a) AC control power solenoid valve

b) Fuel level solenoid valve

c) Low speed solenoid valve

d) Oil heater solenoid valve

e) Emergency stop solenoid valve.

These valves, with the exception of the emergency stop valve, are normally closed (energized to open). The emergency stop valve is normally open (energized to close). Operation of these solenoid valves allows control air pressure to be admitted to, or shut-off from the pressure operated switch associated with each valve. The design data for major components of this system is shown on Table 9.5.6-1.

Q430.34

9.5.6.2.1 Instrumentation and Controls

The instrumentation, controls, sensors, interlocks and alarms provided in the design of the diesel engine air start system are the following:

9.5.6.2.1.1 Air Receiver Pressure Gauges

A 0-800 psi range pressure switch is provided on each air receiver. Readings are made periodically to ensure that the compressors are charging the air receiver adequately and maintaining the air pressure within the range of 600-680 psi.

9.5.6.2.1.2 Compressor Start-Stop Pressure Switches

Each air compressor is automatically controlled by a pressure switch mounted on the air receiver it is charging. This pressure switch is set to start the compressor motor on decreasing air pressure at 600 psi and stop on increasing pressure at 670 psi. These switches can be tested periodically by means of test connections or the pressure gauges in the line.

9.5.6.2.1.3 Low Pressure Alarm Switches

Low air pressure switches are provided in the dual inlet air lines on the engine skid. These switches are set to actuate on decreasing starting air pressure at 435 psi. Starting air pressure low alarms will be displayed on the engine annunciator located in diesel generator local control board and retransmitted to control room annunciator as diesel generator trouble. Low starting air pressure will also be displayed on bypass inoperable status panel alerting the operator that the diesel generator starting air system is in trouble.

9.5.6.2.1.4 Barring Interlock Device

A barring interlock device switch is provided between the air start solenoid valve and the main air start valve. If these switches are actuated, starting air flow into the engine is shut off and the engine cannot be started. Only when the barring device is disengaged will the air start solenoid valve be able to admit air to the main start valve and start the engine. Whenever the barring devices are engaged an alarm "Barring Device Engaged" will be displayed on the local annunciator on the diesel generator control board and retransmitted to control room annunciator as diesel generator trouble.

Q430.34

TABLE 9.5.6-2 (Cont'd)

NO	COMPONENT NAME	FAILURE MODE	CAUSE	EFFECT ON SYSTEM	METHOD OF DETECTION	INHERENT COMPENSATING PROVISION	REMARKS
		Fails closed or/ leaks	Material or electrical failure	Bleeds off the air receiver	Low Pressure alarm	Redundant air starting solenoid valve on redundant train is available	
7.	Pressure switch for compressor start	Inoperable	Material or electrical	Low pressure in system	Low pressure alarm	Redundant train is available	
8.	Air piping from compressor to air receivers	Line Break	Seismic Event	None	Visual	Seismically qualified check valve prevents loss of air from the receivers	Line is non-safety related
9.	Air piping from receivers to engine	Line Break	Corrosion	Low pressure in one air train	Low pressure alarm	Redundant air train is available	
10.	Shutdown solenoid valve	Fails closed or/ leaks	material or electrical failure	Bleeds off the air shutdown air accumulator	Low pressure alarm	Redundant air train is available	Failure will not affect starting of diesel engine

Q430.34

Question No.

430.35 (SRP 9.5.6) Describe the instrumentation, controls, sensors and alarms provided for monitoring the diesel engine air starting system, and describe their function. Describe the testing necessary to maintain a highly reliable instrumentation, control, sensors and alarm system and where the alarms are annunciated. Identify the temperature, pressure and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe any operator actions required during alarm conditions to prevent harmful effects to the diesel engine. Discuss system interlocks provided. Revise your FSAR accordingly.

Response

The instrumentation, controls, sensors, interlocks and alarms provided in the design of the diesel engine air start system are the following:

1) Air Receiver Pressure Gauges

A 0-800 psi range pressure switch is provided on each air receiver. Readings are made periodically to ensure that the compressors are charging the air receiver adequately and maintaining the air pressure within the range of 600-680 psi.

2) Compressor Start-Stop Pressure Switches

Each air compressor is automatically controlled by a pressure switch mounted on the air receiver it is charging. This pressure switch is set to start the compressor motor on decreasing air pressure at 600 psi and stop on increasing pressure at 670 psi. These switches can be tested periodically by means of test connections or the pressure gauges in the line.

3) Low Pressure Alarm Switches

Low air pressure switches are provided in the dual inlet air lines on the engine skid. These switches are set to actuate on decreasing starting air pressure at 435 psi. Starting air pressure low alarms will be displayed on the engine annunciator located in diesel generator local control board and retransmitted to control room annunciator as diesel generator trouble. Low starting air pressure will also be displayed on bypass inoperable status panel alerting the operator that the diesel generator starting air system is in trouble.

Response

430.35 (Cont'd)

4) Barring Interlock Device

A barring interlock device switch is provided between the air start solenoid valve and the main air start valve. If these switches are actuated, starting air flow into the engine is shut off and the engine cannot be started. Only when the barring device is disengaged will the air start solenoid valve be able to admit air to the main start valve and start the engine. Whenever the barring devices are engaged an alarm "Barring Device Engaged" will be displayed on the local annunciator on the diesel generator control board and retransmitted to control room annunciator as diesel generator trouble.

FSAR Subsection 9.5.6 will be amended to reflect the response to this question.

Refer to the response to Question # 430.34

Question No.

430.38 (SRP 9.5.6) Diesel generators in many cases utilize air pressure or air flow devices to control diesel generator operation and/or emergency trip functions such as air operated overspeed trips. The air for these controls is normally supplied from the emergency diesel generator air starting system. Provide the following:

a) Expand your FSAR to discuss any diesel engine control functions supplied by the air starting system or any air systems. The discussion should include the mode of operation for the control function (air pressure and/or flow), a failure modes and effects analysis, and the necessary P&ID's to evaluate the system.

b) Since air systems are not completely air tight, there is a potential for slight leakage from the system. The air starting system uses a non-seismic air compressor to maintain air pressure in the seismic Category I air receivers during the standby condition. In case of an accident, a seismic event, and/or loop, the air in the air receivers is used to start the diesel engine. After the engine is started, the air starting system becomes non-essential to diesel generator operation unless the air system supplies air to the engine controls. In this case the controls must relay on the air stored in the air receivers, since the air compressor may not be available to maintain system pressure and/or flow. If your air starting system is used to control engine operation, with the compressor not available, show that a sufficient quantity of air will remain in the air receivers, following a diesel engine start, to control engine operations for a minimum of seven days assuming a reasonable leakage rate. If the air starting system is not used for engine control describe the air control system provided and provide assurance that it can perform for a period of seven days or longer.

Response

Item A

The diesel generator starting system is an integral part of the diesel generator package and is supplied by the diesel generator manufacturer. The arrangement of the DGSS is shown on Figure 9.5.6-1.

On the engine skid, an air start solenoid operated three way valve (normally closed, energize to open) is provided which pilots the main air start control valve to allow the starting air to enter the engine under control of the air start distributor. Preceding these solenoid valves, a line strainer and filter are provided to remove dirt and foreign material from the line. Each air line is also provided with a low air

Response

430.38 (Cont'd)

pressure alarm switch set to actuate on decreasing pressure at 435 psi and to annunciate on the diesel generator control board.

A barring interlock device is provided between the air start solenoid valve and the main air start valve to prevent engine start during maintenance. Only, when the barring device is disengaged, will the air start solenoid valve be able to admit air to the main air start valve and start the engine. When actuated, it shuts off starting air flow into the engine and is annunciated on the diesel generator control board.

A shutdown air accumulator with a solenoid operated shutdown valve (normally closed, energize to open) is provided, which holds enough air trapped by a check valve on the upstream side of the accumulator to close the fuel racks and shut the diesel engine down even if both starting air systems lose pressure. There are four shuttle valves used in series to control the rack boost function of the fuel rack servo cylinder. The operations of each of the valves are as follows:

a) The first shuttle valve selects the starting air header that will supply the rack boost pressure.

b) The second shuttle valve vents the boost pressure in case of overspeed governor actuation during cranking.

c) The third shuttle valve vents the boost pressure if a shutdown signal from any source other than the overspeed governor activates the shutdown solenoid during cranking.

d) The fourth shuttle valve vents the boost pressure when the engine has built-up sufficient lube oil pressure to move the shuttle against the spring pressure.

The control air used to operate the pressure transmitters in the lube oil and fuel oil systems, the five solenoid operated 3 way valves and the pressure switches are supplied from a branch line connected to the starting air inlet line to the engine. The five solenoid valves are connected downstream of the control air oil removal filter. They are as follows:

a) AC control power solenoid valve

b) Fuel level solenoid valve

Response

430.38 (Cont'd)

c) Low speed solenoid valve

d) Oil heater solenoid valve

e) Emergency stop solenoid valve.

The valves, with the exception of the emergency stop valve, are normally closed (energized to open). The emergency stop valve is normally open (energized to close). Operation of these solenoid valves allow control air pressure to be admitted to, or shut-off from the pressure operated switch associated with each valve.

Refer to the Supply System responses to Questions 430.34 and 430.35.

A failure mode and effects analysis of the diesel generator starting system is presented in FSAR Table 9.5.6-2.

Item B

A response to Item B of question 430.38 has been requested from the Diesel Generator Manufacturer. When the information becomes available it will be transmitted for NRC review.

Question No.

430.40 (SRP 9.5.6) The air starting system for your plant is defined as a high energy system. A high energy line pipe break in the air starting system of one diesel generator, plus any single active failure in any auxiliary system of the other diesel generator could result in loss of all onsite AC power. This is unacceptable. Provide the following information:

a) Assuming a pipe break at any location in the safety related portion of the air start system, demonstrate that no damage from the resulting pipe whip, jet impingement, or missiles (air receivers, or engine mounted air tanks) will cause failure of the redundant diesel generators or its auxiliary systems.

b) Demonstrate that a pipe break in the non-safety portion of the air start systems (compressor and piping up to ASME Section III check valves) will not cause damage to the corresponding safety portions of the systems or to its diesel generator and its auxiliary systems.

Response

The air starting system is an integral part of the diesel generator package. This system does not function during normal plant operation, and therefore, it is not classified as a high energy system and it is exempt from pipe rupture considerations. A failure in the safety or non-safety-related portions of the air starting system may cause failure of their related diesel generator, but the redundant diesel generator will be available to perform the required safety function.

The two redundant diesel generator rooms are physically separated by the Fuel Handling Building, and are located in the northeast and southeast corners of the Reactor Auxiliary Building at EL. 390.00 ft. Consequently, damage to one diesel generator is not communicated to its redundant counterpart.

Question No.

430.41 (SRP 9.5.7) Describe the instrumentation, controls, sensors and alarms provided for monitoring the diesel engine lubrication oil system and describe their function. Describe the testing necessary to maintain a highly reliable instrumentation, control, sensors and alarm system and where the alarms are annunciated. Identify the temperature, pressure and level sensors which alert the operator when these parameters exceed the ranges recommended by the engine manufacturer and describe any operation action required during alarm conditions to prevent harmful effects to the diesel engine. Discuss systems interlocks provided. Revise your FSAR accordingly.

Response

The instrumentation, controls, sensors and alarms including recommended setpoints monitoring the Diesel Generator Lubrication System are described below.

1. Water Detector

   This detector is provided in the prelube/keepwarm system to detect the presence of water in the lube oil system. It is located in the line, on the inlet side of the lube oil filter. This detector will be set to detect the presence of 2 percent of water. When activated this detector will energize the annunciator.

2. Pressure Switches

   a - Actuation of one of the Low Lube Oil Pressure Switches (Items 15, 16, 17 and 18 of Figure 9.5.7-1) will energize the annunciator circuits, and will alarm to show the lube oil pressure has reached a dangerous low-level. Actuation of any two pressure switches (Items 15 and 17 or 15 and 18 or 16 and 17 or 17 and 18) will cause the shutdown of the engine.

   The settings of these pressure switches are below the normal operating lube oil pressure. The setpoints are as follows:

   Item 15 - The normally closed contacts of this switch close, on decreasing pressure, at 70.0 psi and reopen, on increasing pressure, at 80.0 psi.

   Item 16 - The normally closed contacts of this switch close, on decreasing pressure, at 65.0 psi and reopen, on increasing pressure, at 75.0 psi.

Response

430.41 (Cont'd)

Items 17 and 18 - The normally closed contacts of both switches close, on decreasing pressure, at 60.0 psi and reopen, on increasing pressure, at 70.0 psi.

b - High Crankcase Pressure Switch

This pressure switch is mounted on the engine and is connected to the engine crankcase. This switch will close its normally open contacts and cause the engine to be shutdown if the pressure in the crankcase should increase to 0.6 inches of water (pressure) for any reason and if the engine was started in the test mode.

3. Temperature Switches

a - High Oil Temperature Alarm Switch (Item 13 of Figure 9.5.7-1) is connected to the engine driven lube oil pump discharge line. This switch will actuate to energize the annunciator and alarm when the lube oil temperature increases to 167F and reclose on decreasing temperature at 160F.

b - Low Oil Temperature alarm switch (Item 20 Figure 9.5.7-1) has its sensing element located in the engine lube oil sump. This switch will actuate to energize the annunciator and alarm when the temperature of the lube oil in the sump decreases to 120F and closes on increasing temperature at 125F.

4. Lube Oil Sump Level Control System

A remotely mounted lube oil make-up tank, a make-up control solenoid valve (Item 28 of Figure 9.5.7-1) and a sump level control switch (Item 26 of Figure 9.5.7-1) maintain a predetermined level of lube oil in the engine lube oil sump. When the oil level in the engine sump falls below a predetermined point, the sump level control switch actuates to energize the make-up control solenoid valve. The normally closed valve will now open, allowing oil to flow from the make-up tank to the engine lube oil sump. When the oil level in the engine sump rises to a predetermined point, the sump level control actuates to energize the make-up control solenoid valve. This valve now closes to shut off the flow of oil from the make-up tank to the engine lube oil sump.

5. Lube Oil Level Alarm Switches

a - Low Lube Oil Level Alarm Switch (Item 19 of Figure 9.5.7-1)

Response

430.41 (Cont'd)

This switch is mounted opposite the drier end on the engine sump. It will actuate to energize the annunciator circuits which will give an alarm when the oil level in the engine sump decreases to the "Low" mark on the crankcase dip stick.

b - High Lube Oil Level Alarm Switch (Item 21 of Figure 9.5.7-1)

This switch is mounted on the side of the engine sump. It will actuate to energize the annunciator circuits, which will give an alarm when the oil level in the engine sump rises above the "Full" mark on the crankcase dip stick.

6. Lube Oil Temperature Measurement

Resistance Temperature Detectors are installed in the lube oil lines to and from the engine to measure the temperature. The signals are sent to a remote meter located in the generator control panel. One meter is used by both RTD's. A selector switch is positioned to the temperature measurement selected to be indicated.

7. Pressure Test Connections

a - Pressure Test Connections are provided in the inlet and outlet of the lube oil strainer. When the pressure differential between the inlet and outlet exceeds 10.0 psi, the strainer elements should be removed and cleaned.

b - Pressure test connections are provided in the inlet and outlet of the lube oil filter. When the pressure differential between the inlet and outlet exceeds 15.0 psi, the filter element must be removed and replaced with new elements.

8. Rocker Arm Lube Oil System - Engine Mounted

a - Rocker Arm Lube Oil Reservoir Level

This reservoir is equipped with a sight glass, a vent, connections for supply and return lines, and a drain connection. The supply line to this reservoir has a level control valve, a manual shut-off valve and a high level alarm switch (Item 24 of Figure 9.5.7-1) the alarm switch will actuate to energize the annunciator circuit, which will give an alarm when the level in the rocker arm oil reservoir becomes too high.

Response

430.41 (Cont'd)

b - Low Rocker Arm Oil Pressure Alarm Switch (Item 23 of Figure 9.5.7-1)

This switch will actuate to start the rocker arm prelube pump and energize the annunciator circuits which will give an alarm when the rocker arm lube oil pressure (at the discharge of the duplex filter) decreases to 11.5 psi, and reopen on increasing pressure at 12.0 psi.

c - Rocker Arm Oil Pressure Regulating Valve

This valve is provided to regulate the rocker arm oil pressure at the discharge of the duplex filter. This valve will open when the rocker arm lube oil pressure, at the discharge of the duplex filter, becomes too high. Opening this valve allows some of the rocker arm lube oil to return to the suction side of the engine driven rocker arm lube oil pump. This valve will be set to open at 15.0 psi.

9. System Alarms

The following system malfunctions will be displayed in alarm windows of the annunciator which is located on the generator control panel:

a - Lube Oil Temperature High/Low

b - Rocker Arm Lube Oil Level High

c - Rocker Arm Lube Oil Pressure Low

d - Lube Oil Sump Level High/Low

e - Crankcase Pressure High

f - Lube Oil Pressure Low

g - Lube Oil Water Detector

10. Interlocks

The lube oil heater control is interlocked with the prelube/keepwarm pump and engine controls so that the oil heater will not operate unless the pump is in operation and the engine is not running.

FSAR Subsection 9.5.7 will be amended to reflect the above information.

To protect the crankcase oil from contamination by possible cooling water and fuel leaks at the cylinder head upper deck level, the valve rockers are lubricated and drained by a separate rocker lube system. A crankcase evacuation system is provided to extract accumulated combustible gases in order to reduce the hazards of crankcase explosions. A number of explosion covers are provided on the diesel engine crankcase to permit controlled release of gases in the unlikely event of an explosion. A gear-type pump, mounted at the free end of the engine, is driven by the engine crankshaft. The pump draws oil from an engine-mounted reservoir and discharges under pressure through a duplex filter to a header. Pipes from the header feed each cylinder head rocker assembly with lube oil. Drain pipes return the oil through a drain header back to the reservoir. The system includes a small AC motor-driven pre-lubrication pump mounted on the engine. Alarms are provided for indicating low and high engine lube oil sump level. | 1

The AC motor-driven pre-lubricating pump mounted on the diesel engine skid draws oil from the main sump through a suction strainer and discharges it through an electric heater and a 5 micron filter into the main lube system. For engine standby this system provides continuous pre-lubrication and filtering of the oil charge at the keep-warm temperature. During engine operation, the system is used for continuous filtration of the oil charge. On engine initial startup, the pump is used for filling the external system and for pre-lubrication of the engine. For maintenance operations, the auxiliary pump is used for draining the engine sump. | 1 | 1

The cooling water for lube oil heater exchanger is provided by the component cooling water system through the diesel generator cooling water system.

The diesel generator lubrication system includes a safety-related lube oil makeup tank with the vent pipe routed outside of the RAB, and equipped with a flame arrestor, fill line, drain line, and overflow line. The lube oil makeup tank feeds the diesel engine sump by gravity through a safety-related solenoid valve which provides makeup for oil losses of the system during required emergency operation. A vacuum breaker is provided on the vent pipe of the tank to insure operation of the tank in the event the vent pipe becomes blocked. The design data and classification for major components of this system is shown in Table 9.5.7-1. Instrumentation for the DGLS is described in FSAR Subsection 8.3.1. | 1

INSERT 2

9.5.7.3 Safety Evaluation

The diesel generator lubrication system is capable of supplying sufficient lubricating oil to its associated diesel generator. | 1

The lube oil systems for both diesel generators are completely independent of one another and are capable of supplying lube oil without augmentation from other sources. The lube oil pump is driven by the diesel engine with which it is associated. Because of these arrangements and the redundancy of the emergency diesel generator design and installation, a failure of any single active component of the DGLS cannot result in a complete loss of any diesel

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9.5.7.2.1 Instrumentation and Controls

The instrumentation, controls, sensors and alarms provided for monitoring the Diesel Generator Lubrication System are as follows:

9.5.7.2.1.1 Water Detector

This detector is provided in the prelube/keepwarm system to detect the presence of water in the lube oil system. It is located in the line, on the inlet side of the lube oil filter. This detector will be set to detect the presence of 2% of water. When activated this detector will energize the annunciator.

9.5.7.2.1.2 Pressure Switches

a. Low Lube Oil Pressure Switches (Items 15, 16, 17 and 18 of Figure 9.5.7-1)

   Actuation of one of these switches will energize the annunciator circuits, and will alarm to show the lube oil pressure has reached a dangerous low level. Actuation of any two pressure switches will cause the shutdown of the engine.

b. High Crankcase Pressure Switch

   This pressure switch is mounted on the engine and is connected to the engine crankcase. This switch will close its normally open contacts and cause the engine to be shutdown if the pressure in the crankcase should increase to 0.6 inches of water (pressure) for any reason and if the engine was started in the test or manual mode.

9.5.7.2.1.3 Temperature Switches

a - High Oil Temperature Alarm Switch (Item 13 of Figure 9.5.7-1) is connected to the engine driven lube oil pump discharge line. This switch will actuate to energize the annunciator and alarm when the lube oil temperature increases to 167°F.

b - Low Oil Temperature Alarm Switch (Item 20 of Figure 9.5.7-1) has its sensing element located in the engine lube oil sump. This switch will actuate to energize the annunciator and alarm when the temperature of the lube oil in the sump decreases to 120°F.

9.5.7.2.1.4 Lube Oil Sump Level Control System

A remotely mounted lube oil make-up tank, a make-up control solenoid valve (Item 28 of Figure 9.5.7-1) and a sump level control switch (Item 26 of Figure 9.5.7-1) maintain a predetermined level of lube oil in the engine lube oil sump. When the oil level in the engine sump falls below a predetermined point, the sump level control switch actuates to energize the make-up control solenoid valve. The normally closed valve will now open, allowing oil to flow from the make-up tank to the engine lube oil sump. When the oil level in the engine sump rises to a predetermined point, the sump level control actuates to energize the make-up control solenoid valve. This valve now closes to shut off the flow of oil from the make-up tank to the engine lube oil sump.

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9.5.7.2.1.5 Lube Oil Level Alarm Switches

a - Low Lube Oil Level Alarm Switch (Item 19 of Figure 9.5.7-1)

This switch is mounted opposite the drier end on the engine sump. It will actuate to energize the annunciator circuits which will give an alarm when the oil level in the engine sump decreases to the "Low" mark on the crankcase dip stick.

b - High Lube Oil Level Alarm Switch (Item 21 of Figure 9.5.7-1)

This switch is mounted on the side of the engine sump. It will actuate to energize the annunciator circuits, which will give an alarm when the oil level in the engine sump rises above the "Full" mark on the crankcase dip stick.

9.5.7.2.1.6 Lube Oil Temperature Measurement

Resistance Temperature Detectors are installed in the lube oil lines to and from the engine to measure the temperature. The signals are sent to a remote meter located in the generator control panel. One meter is used by both RTD's. A selector switch is positioned to the temperature measurement selected to be indicated.

9.5.7.2.1.7 Pressure Test Connections

a - Pressure Test Connections are provided in the inlet and outlet of the lube oil strainer. When the pressure differential between the inlet and outlet exceeds 10.0 psi, the strainer elements should be removed and cleaned.

b - Pressure Test Connections are provided in the inlet and outlet of the lube oil filter. When the pressure differential between the inlet and outlet exceeds 15.0 psi, the filter element must be removed and replaced with new elements.

9.5.7.2.1.8 Rocker Arm Lube Oil System - Engine Mounted

a - Rocker Arm Lube Oil Reservoir Level

This reservoir is equipped with a sight glass, a vent, connections for supply and return lines, and a drain connection. The supply line to this reservoir has a level control valve, a manual shut-off valve and a high level alarm switch (Item 24 of Figure 9.5.7-1). The alarm switch will actuate to energize the annunciator circuit, which will give an alarm when the level in the rocker arm oil reservoir becomes too high.

b - Low Rocker Arm Oil Pressure Alarm Switch (Item 23 of Figure 9.5.7-1)

This switch will actuate to start the rocker arm prelube pump and energize the annunciator circuits which will give an alarm when the rocker arm lube oil pressure (at the discharge of the duplex filter) decreases to 11.5 psi.

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9.5.7.2.1.8 (Cont'd)

c - Rocker Arm Oil Pressure Regulating Valve

This valve is provided to regulate the rocker arm oil pressure at the discharge of the duplex filter. This valve will open when the rocker arm lube oil pressure, at the discharge of the duplex filter, becomes too high. Opening this valve allows some of the rocker arm lube oil to return to the suction side of the engine driven rocker arm lube oil pump. This valve will be set to open at 15.0 psi.

9.5.7.2.1.9 System Alarms

The following system malfunctions will be displayed in alarm windows of the annunciator which is located on the generator control panel:

a - Lube Oil Temperature High/Low

b - Rocker Arm Lube Oil Level High

c - Rocker Arm Lube Oil Pressure Low

d - Lube Oil Sump Level High/Low

e - Crankcase Pressure High

f - Lube Oil Pressure Low

g - Lube Oil Water Detector

9.5.7.2.1.10 Interlocks

The lube oil heater control is interlocked with the prelube/keepwarm pump and engine controls so that the oil heater will not operate unless the pump is in operation and the engine is not running.

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generator function. Alternately considered, a single failure may be assessed as a failure of the diesel generator with which it is associated; in such a circumstance, the remaining diesel generator is adequate to safely shutdown the plant or mitigate the effects of a Loss of Coolant Accident (LOCA) during loss of offsite power conditions.

The failure of the non-safety portion of the system will not have an impact on the safe operation of the system. A failure mode and effects analysis of the DGLS is presented in Table 9.5.7-2.

When the engine is not operating, lube oil is heated by the electric heater and is circulated with an electric pump. Extreme lube oil viscosities which accompany low lube oil temperatures are thus prevented, and quick starting of the diesel engine is assured.

9.5.7.4 Inspection and Testing Requirements

including the condition of wiring and connections.

The system will be operated and tested initially with regard to flow path, flow capacity and mechanical operability. To insure continued integrity of the Diesel Generator Lubrication System, scheduled inspection and testing of equipment will be performed as part of the overall engine performance checks at regular intervals. Testing of the diesel generator system is discussed in Sections 8.3 and 14.2.

All major components of the system are accessible for inspection, and available for testing during normal plant operation. The ASME Section III, Class 3 DGLS piping will be inspected and tested in accordance with ASME Boiler and Pressure Vessel Code Sections XI and III requirements, respectively.

Instruments are calibrated during testing and automatic controls are tested for actuation at the proper setpoints. Alarm functions are checked for operability and limits during plant preoperational testing. Automatic actuation of system components is tested periodically.

During normal plant operation, maintenance and testing will be individually performed to ensure integrity and reliability of instruments, controls and components.

Q430.41

Question No.

430.49 (SRP 9.5.7) Provide a discussion of the measures that will be taken to maintain the required quality of the lube oil, including the inspection and replacement when oil quality is degraded.

Response

Representative samples of diesel lube oil will be collected quarterly. Viscosity, water and sediment, and additive retention will be determined for each sample. If the diesel lube oil does not meet the manufacturer's specifications it will be replaced or, in the case of water and sediment, treated to remove impurities.

Question No.

430.51 (SRP 9.5.8) In FSAR Section 9.5.8.1, you state that the combustion air intake filter and combustion air silencer are "non-safety equipment." This is not acceptable. We require these components to be Seismic Category I and conform to ASME Section III, Class 3 requirements, or provide justification for nonconformance and include the industry standards used for the design, construction, and inspection of the combustion air intake filter and silencer.

Response

The combustion air intake filter and silencer are safety-related equipment, and FSAR Subsection 9.5.8.1 will be revised accordingly. The filter and silencer meet Quality Group C criteria as discussed in Regulatory Guide 1.26 Rev. 3, Supply System Quality Class I and Seismic Category 1 criteria, the details of which follow:

(a) Material is ASTM A36 and A53B.

(b) Seismic design loads are:

$F_{ex} = (-1 \pm 2)$ x weight of intake filter

$F_{ey} = F_{ez}$ 3.5 x weight of intake filter

$F_{ex} = (-1 \pm 1.6)$ x weight of silencer

$F_{ey} = F_{ez}$ 2.6 x weight of silencer

These loads are assumed to act simultaneously in the worst combination.

(c) Welding is performed in accordance with AWS D1.1.

(d) Since the loads on the intake filter and silencer are not the result of pressure, and since leakage will not affect the operability of the diesel generator, no pressure or leak test is required.

9.5.8 DIESEL GENERATOR COMBUSTION AIR INTAKE AND EXHAUST SYSTEM

This section discusses the mechanical features of the diesel generator combustion air intake and exhaust system.

9.5.8.1 Design Bases

In addition to the design criteria for the diesel generator ancillary systems described in Subsection 9.5.4, the following are also design bases for the diesel generator combustion air intake and exhaust system (DGAIES).

a) The DGAIES is capable of supplying adequate combustion air and disposing of resultant exhaust products to permit continuous operation of both diesel generators for each unit.

including filter and silencers, meet Quality Group C

b) The diesel generator normal exhaust piping within the RAB, the diesel generator alternate exhaust piping and the diesel generator air intake piping ~~are designed to ASME Section III, Class 3~~, seismic Category I requirements. ~~The above mentioned exhaust piping is designated ASME Section III, Class 3 although the allowable piping stress is obtained from ANSI B31.1 due to the high temperature of the diesel generator exhaust.~~ 1

criteria as presented in Regulatory Guide 1.26 rev 3, Supply System Quality Class I and

combustion

The air ~~intake filter, the air intake and~~ exhaust silencer, and the normal exhaust expansion joint outside the RAB are classified as non safety equipment. The normal exhaust piping outside the RAB is classified as non safety piping. ~~and designed in accordance with ANSI B31.1 requirements.~~

c) The material for the diesel generator exhaust piping and equipment is selected for high exhaust temperature conditions.

d) All portions of the DGAIES designated as safety-related are missile protected and located in the confines of the seismic Category I RAB. 1

e) The DGAIES design conforms to applicable portions of the codes and standards listed in Table 9.5.4-2.

f) The system is designed for the design basis ashfall.

9.5.8.2 System Description

The diesel generator combustion air intake and exhaust system is an integral part of the diesel generator package and most of the system equipment is supplied by the diesel generator manufacturer.

The arrangement of the diesel generators and components of the DGAIES are shown on Figure 9.5.8-1.

9.5.8.2.1 Intake and Exhaust System

The diesel generator combustion air intake and exhaust system consists of an air intake filter, an air intake silencer, an exhaust silencer, exhaust expansion joints, air intake rubber expansion joints, air intake and exhaust

Q430.51

Question No.

430.54 (SRP 9.5.8) Show by analysis that potential fire in the diesel generator building together with a single failure of the fire protection system will not degrade the quality of the diesel combustion air so that the remaining diesel will be able to provide full rated power.

Response

As shown on FSAR Figure 1.2-11, the two diesel generators, and their respective combustion air intakes, are situated on opposite sides of the Reactor Auxiliary Building, and enclosed by three-hour fire walls, ceilings and floors. The Fuel Handling Building is also located between the two DG rooms. Each diesel generator has an independent intake and exhaust system. In the unlikely event of a fire in the diesel generator "A" or "B" rooms, the smoke generated would be exhausted by the ventilation system through HVAC vent Stack #4, or #1, respectively. The shortest distance between a Stack (#1) and an intake ("A") is 189 feet (horizontal) and 103 feet (vertical).

Due to the fact that the hot smoke would be exhausted in the upward direction 103 feet above the air intake, it is very improbable that the quality of the DG combustion air would degrade to such a level as to cause a malfunction of the remaining diesel generator. Also, since the air intakes are situated on the sides of RAB (EL. 398.00 ft.), the RAB and/or the FHB will further disperse any smoke exhausted from either of the stacks.

Even though the postulation of a fire in a diesel generator room, and a single failure of the fire protection system coupled with a loss of offsite power is beyond the design basis of the plant, a conservative analysis was performed to determine the impact such a fire would have on the remaining diesel generator. The results indicate that the smoke exhausted would deplete the oxygen available for combustion by only 0.1 percent. This would have a negligible impact on the ability of the remaining diesel generator to provide full rated power.

Further assistance is provided by the fact that even with a single failure of the fire protection system (sprinklers fail to operate), the fire detection system would alert the Control Room operator to take corrective action.

FSAR Subsection 9.5.8.3 will be amended to reflect the response to this question.

9.5.8.3 Safety Evaluation

The diesel generator combustion air intake and exhaust system meets the single failure criterion in that the failure of the system and its associated diesel generator will not affect the remaining diesel generator set which provides adequate power to safely shutdown the plant. A failure mode and effects analysis of the system is presented in Table 9.5.8-2.

The diesel generator combustion air intake and exhaust system is capable of supplying an adequate quantity of filtered combustion air to the engine and of disposing of the resultant exhaust gases without creating an excessive backpressure on the engine. Intake air filters will reduce particulates such as airborne dust or volcanic ash to concentrations sufficiently low enough to permit the diesel generator to operate in accordance with the design basis criteria.

The combustion air intakes are located on the south and east walls of the Reactor Auxiliary Building (RAB) 3 1/2 feet above grade elevation. The diesel generator hot exhaust gases are discharged in the upward direction through the normal exhaust pipe which terminates above roof of the RAB approximately 95 feet above grade elevation or through emergency exhaust pipe terminating approximately 35 feet from their respective air intake openings. These design features will preclude the possibility of recirculation of the diesel engine combustion products into the air intake thereby reducing the oxygen content below acceptable levels. No atmospheric conditions such as ice or snow are expected to clog or in any way affect the intake and exhaust openings.

There are no gas storage facilities near the air intake opening, therefore accidental release of any gases is not expected. The consequences of high and moderate energy pipe breaks in the vicinity have been accounted for in the design of the system.

Insert 1 →

9.5.8.4 Inspection and Testing Requirements

Pre-operational and periodic tests and inspections of all system functions will be performed in accordance with the plant operating procedures. Periodic testing of the diesel generators proves the integrity of the intake and exhaust systems. Testing of the diesel generator system is discussed in Sections 8.3 and 14.2.

All major components of the system are accessible for inspection, and testing during normal plant operation. The ASME Section III, Class 3 DGAIES piping will be inspected and tested in accordance with ASME Boiler and Pressure Vessel Code Sections XI and III, respectively.

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In the unlikely event of a fire in one diesel generator room, coupled with a single failure of the fire protection system, the results of an analysis indicate that the smoke exhausted through the ventilation system (vent Stack #1 or #4) would deplete the oxygen in the combustion air of the remaining diesel generator by only 0.1%. This would have negligible impact on the ability of the remaining diesel generator to provide full rated power. Further assurance is provided by the fact that even with a single failure of the fire protection system (sprinklers fail to operate), the fire detection system would alert the control room operator to take corrective action.

Q430.54

Question No.

430.55 (SRP 9.5.8) Experience at some operating plants has shown that diesel engines have failed to start due to accumulation of dust and other deleterious material on electrical equipment associated with starting of the diesel generators (e.g., auxiliary relay contacts, control switches etc.). Describe the provisions that have been made in your diesel generator building design, electrical starting system, and combustion air and ventilation air intake design(s) to preclude this condition to assure availability of the diesel generator on demand.

Also describe under normal plant operation what procedure(s) will be used to minimize accumulation of dust in the diesel generator room; specifically address concrete dust control.

Response

Provisions have been made in the building design to preclude dust generation from concrete surfaces. Diesel generator area floors are prepared, primed and topcoated with nuclear coatings. Diesel generator room walls and ceilings are covered with acoustical panels having smooth surfaces. Diesel Generator Control Room walls are prepared, primed and topcoated with nuclear coatings to a smooth finish and the ceiling is constructed of a concrete slab formed with a galvanized steel deck.

The Diesel Generator starting system electrical controls such as auxiliary relay contacts, control switches or other circuit components are housed inside NEMA 12 enclosures. These enclosures protect the enclosed controls from dust, lint, fibers, liquid drippings and deleterious materials by excluding an entrance path to the inside of the enclosure.

The NEMA 12 enclosures are provided with hinged oil resistant synthetic gasketed doors with integral locks for authorized entry only. Since some dust accumulation outside the enclosures may occur during normal operation, administrative controls will be used to remove accumulated dust from the exterior surfaces of the enclosures. These administrative controls will minimize entry of dust during access to controls by authorized personnel.

The diesel generator combustion air intake filter is located in a separate room adjacent to the outside air intake missile protected opening and louver. This arrangement permits dust accumulation to be centralized in the filter room and prevents infiltration of dust into the diesel generator area. The combustion air filter housing is provided with an access door which permits periodic inspection and replacement of disposable filter elements that become loaded with dust from the outside air. The frequency of

Response

430.55 (Cont'd)

replacement of the filter elements is dependent on the local dust conditions.

During normal operation when the diesel generators are not running the diesel control rooms are cooled and ventilated by ventilating units HV-2A-SA and HV-2B-SB. Each ventilating unit includes an automatic roll air filter designed to separate dust particulates from the air supplied to the spaces of the diesel generator areas. The filters will minimize dust particulate in the diesel control rooms.

The provisions in the overall design, described above, assure dust accumulation is controlled and the administrative procedure will prevent dust accumulation on controls so that an adverse environmental effect will not jeopardize the diesel generator capability to start on demand.

Administrative controls will be provided to minimize the accumulation of dust in the diesel generator room.

Question No.

430.56 (SRP 9.5.8) Describe the instrumentation, controls, sensors and alarms provided in the design of the diesel engine combustion air intake and exhaust system which alert the operator when parameters exceed ranges recommended by the engine manufacturer and describe any operator action required during alarm conditions to prevent harmful effects to the diesel engine. Discuss system interlocks provided. Revise your FSAR accordingly.

Response

The instrumentation, controls, sensors interlocks, and alarms provided in the design of the diesel engine combustion air intake and exhaust system are the following:

Air Intake Manometer

A manometer connection is provided in one of the air intake lines, between the discharge of the air intake silencer and the engine. A manometer reading is made, with clean air filter panels in place, to establish a baseline reading. Readings are made periodically and compared with the baseline reading to ensure the air intake system is operating properly.

Air Manifold High Temperature Alarm Switches

A high temperature alarm switch is connected to the combustion air manifolds on each side of the engine. Both of these switches are set to alarm if the temperature of the combustion air should increase to 158F or greater.

Air manifold high temperature alarm will be displayed on alarm windows of the engine annunciator, which is located on the generator control panel.

Air Exhaust Manometer

A manometer connection is provided on the air exhaust line between the engine and the exhaust silencer. A manometer reading is made periodically to insure the air exhaust system is operating properly.

High Exhaust Pressure Alarm Switch

This pressure alarm switch is connected to the exhaust line and it will annunciate if the exhaust pressure increases to 1.0 psi.

Crankcase Vacuum Manometer

The manometer (mounted on the generator control panel) has its sensing element located in the engine crankcase. This manometer

Response

430.56 (Cont'd)

indicates the engine crankcase vacuum in inches of water. Normal crankcase vacuum is in the range of 0.5 to 2.0 inches of water, when the engine is operating at full rated load.

High Crankcase Pressure Alarm Switch (CCP)

The high crankcase pressure alarm switch (CCP) is connected to the line between the engine crankcase and the crankcase vacuum manometer. This pressure switch (CCP) will alarm and cause the engine to shutdown if the engine crankcase pressure should increase to +0.6 inches of water.

FSAR Subsection 9.5.8.2.2 will be amended to reflect the response to this question.

adaptors, an exhaust pressure relief check valve, a crankcase vacuum ejector and oil separator, and associated piping and instrumentation. The air intake flow and gas exhaust of the system is not dependent upon the actuation of flow control devices.

Upon initiation of a diesel generator start signal, combustion air is drawn by turbocharger suction from the atmosphere into the air intake filter, through the intake silencer and the flexible connector and delivered to the engine. The air intake filter, intake silencer and the combustion air piping are sized to provide an adequate supply of air to the engine. The air flow requirement for each diesel engine is 31,000 CFM (total for both banks) at 101.5F. The air intake filter is open to atmosphere and is located outside of the diesel generator engine room within the RAB. The air intake room opening is protected from external missile by shield bars.

The 18 cylinder engine exhaust gases are discharged from the exhaust gas turbine of each turbocharger, through expansion joints, into two 28 inch exhaust pipes leading to the main 48 inch normal exhaust pipe, and through the exhaust silencer located outside of the Reactor Auxiliary Building. An alternate 36 inch emergency exhaust path is provided for each diesel generator set to ensure the operation of the generators in the event that the normal exhaust path is not available. An emergency diesel generator exhaust valve is provided for each of the alternate exhaust paths (3AG-R003SA and 3AG-R004SB). Each valve is a weight-balanced type which is normally closed, and is designed to lock open when the engine exhaust reaches a pressure of 15 inches of water. If the exhaust pressure is such that it lifts the clapper off its seat, but fails to engage the locking mechanism (at a pressure of less than 15 inch H_2O), the counter-balance will force the valve closed thereby ensuring that the generator exhausts through the normal exhaust path. The normal exhaust path is designed for maximum diesel generator engine exhaust back pressure. Both normal and emergency exhaust path openings through the seismic Category I Reactor Auxiliary Building are protected against externally generated missiles. This missile protection design prevents any missile from entering the building and damaging safety-related equipment, and precludes transmission of any load generated by the missile to the piping and/or components of the diesel generator systems. The exhaust gas flow from the diesel engine is approximately 79,300 ACFM (total, both banks) at 870F operating temperature. The design data for major components of the system is shown in Table 9.5.8-1.

9.5.8.2.2 Crankcase Vacuum System

The engine crankcase is maintained at a partial vacuum by an ejector powered by air manifold pressure. The ejector draws vapor from the crankcase through an oil separator and discharges to the atmosphere. A final drip catcher guards against pollution of the outside air. The crankcase vacuum is constantly monitored and a pressure switch activates an alarm if the crankcase pressure rises above the safe value.

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9.5.8.2.3 Instrumentation and Controls

The instrumentation, controls, sensors, interlocks and alarms provided in the design of the diesel engine combustion air intake and exhaust system are the following:

9.5.8.2.3.1 Air Intake Manometer

A manometer connection is provided in one of the air intake lines, between the discharge of the air intake silencer and the engine. A manometer reading is made, with clean air filter panels in place, to establish a baseline reading. Readings are made periodically and compared with the baseline reading to ensure the air intake system is operating properly.

9.5.8.2.3.2 Air Maniforld High Temperature Alarm Switches

A high temperature alarm switch is connected to the combustion air manifolds on each side of the engine. Both of these switches are set to alarm if the temperature of the compustion air should increase to 158°F or greater.

Air manifold high temperature alarm will be displayed on alarm windows of the engine annunciator, which is located on the generator control panel.

9.5.8.2.3.3 Air Exhause Manometer

A manometer connection is provided on the air exhaust line between the engine and the exhaust silencer. A manometer reading is made periodically to insure the air exhaust system is operating properly.

9.5.8.2.3.4 High Exhaust Pressure Alarm Switch

This pressure alarm switch is connected to the exhaust line and it will annunciate if the exhaust pressure increases to 1.0 psi.

9.5.8.2.3.5 Crankcase Vacuum Manometer

The manometer (mounted on the generator control panel) has its sensing element located in the engine crankcase. This manometer indicates the engine crankcase vacuum in inches of water. Normal crankcase vacuum is in the range of 0.5 to 2.0 inches of water, when the engine is operating at full rated load.

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9.5.8.2.3.6 High Crankcase Pressure Alarm Switch (CCP)

The high crankcase pressure alarm switch (CCP) is connected to the line between the engine crankcase and the crankcase vacuum manometer. This pressure switch (CCP) will alarm and cause the engine to shutdown if the engine crankcase pressure should increase to +0.6 inches of water.

TABLE 9.5.8-2

FAILURE MODE AND EFFECTS ANALYSIS -
DIESEL GENERATOR COMBUSTION AIR INTAKE
AND EXHAUST SYSTEM

No	Component Name	Failure Mode	Cause	Effects of System	Method of Detection	Inherent Compensating Provision	Remarks
1)	Air Intake Filter	Plugged Filter	Blockage due to particulates buildup	Malfunction of one diesel generator/ no air received by engine	Low air intake pressure	Redundant 100% capacity diesel generator is available	
2)	Air Intake Opening	Blocked	Opening covered by large object	Malfunction of one diesel generator/ no air received by engine	Low air intake pressure	Redundant 100% capacity diesel generator is available	
3)	Air Intake Silencer	Internal failure/ Blocked airflow	Corrosion	Malfunction of one diesel generator	Low air intake pressure	Redundant 100% capacity diesel generator is available	
4)	Exhaust Silencer	Internal failure/ Exhaust blocked	Corrosion/ missile effects	No effect	Pressure indicator on exhaust piping	Exhaust thru alternate exhaust path	
5)	Exhaust Valve	Fails in closed position	Mechanical failure	No effect on normal operation, however, if valve failure occurs in conjunction with loss of normal exhaust path diesel engine will trip	Annunciator Indication on control board on the DG Trouble Panel	Redundant 100% capacity diesel generator is available	
		Fails open	Mechanical failure/ Corrosion	No effect, exhaust through normal and emergency line	Periodic testing	N/A	Diesel generator is operable, however, engine will experience exhaust surges

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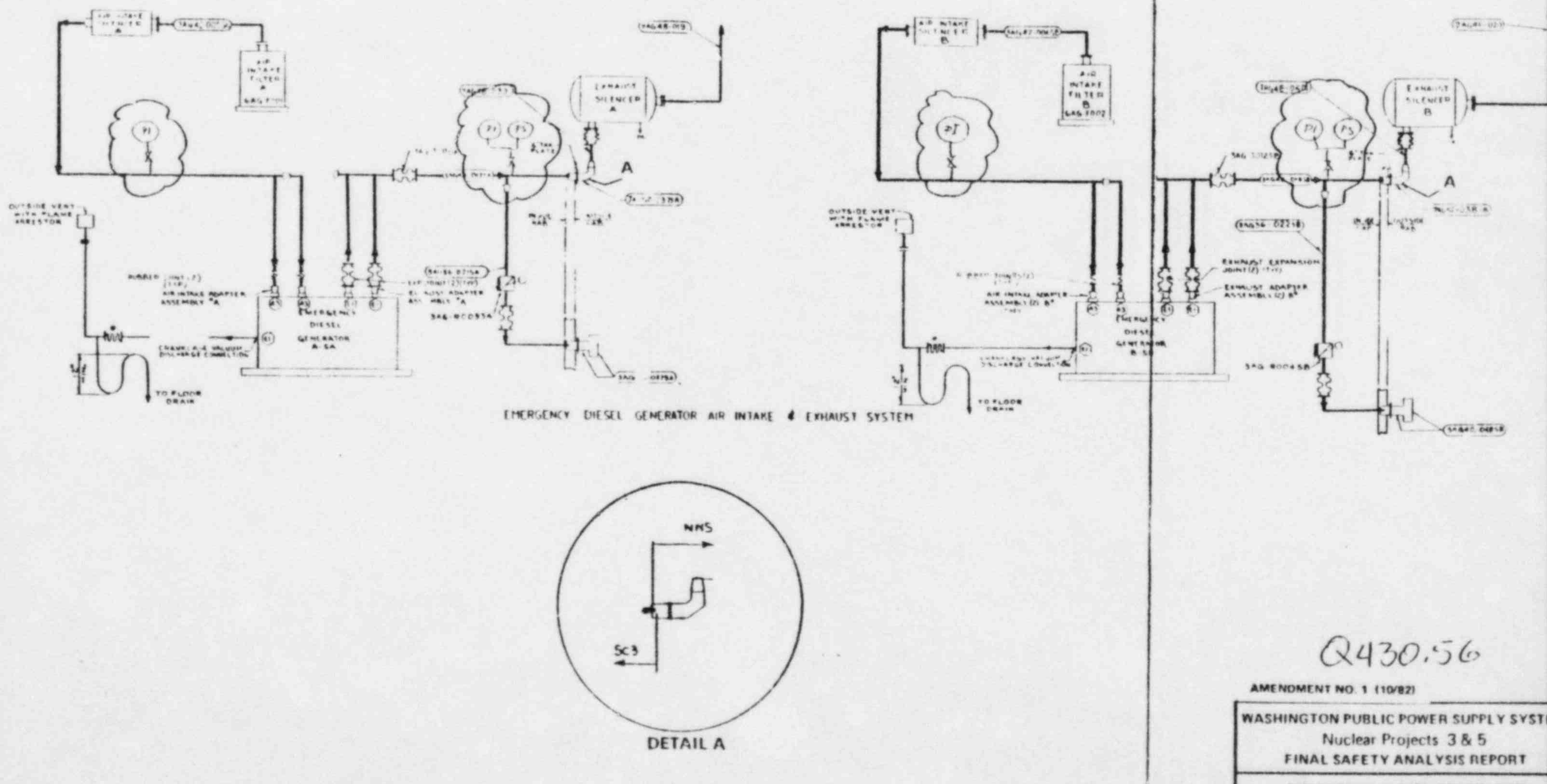

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AMENDMENT NO. 1 (10/82)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
Nuclear Projects 3 & 5
FINAL SAFETY ANALYSIS REPORT

EMERGENCY DIESEL GENERATOR
AIR INTAKE & EXHAUST SYSTEM

FIGURE 9.5.8-1

REF DWG: PART OF WPPS 3240-G-1071 SH2

Question No.

430.57 (SRP 9.5.8) Provide the results of an analysis that demonstrates that the function of your diesel engine air intake and exhaust system design will not be degrade to an extent which prevents developing full engine rated power or cause engine shutdown as a consequence of any meteorolgical or accident condition. Include in your discussion the potential and effect of fire extinguishing (gageous) medium.

Response The Emergency Diesel Generator Air Intake and Exhaust Systems are located within a sesimic Category I structure which is designed to withstand the effects of a safe shutdown earthquake, tornado, and tornado generated missiles. The portion of the exhaust system which is located outside the structure is designed and supported to withstand the effects of safe shutdown earthquake (SSE) and tornadoes.

An alternate exhaust path, in addition to the normal exhaust path, has been provided in the event the normal path is not available. Tornado missile protection has been provided for the exposed alternate exhaust piping and portions of the exposed normal exhaust piping. (See Figure 9.5.8-1). The two exhaust paths of each diesel are located a minimum of 35 feet from their respective combustion air intake to preclude the possiblity of recirculating exhaust products and thereby reducing the oxygen concentration in the combustion air (refer to Question 430.52(3)). Additionally, no gas storage facilities are located near the diesel combustion air intakes.

Both Diesel Generator Combustion Air Intake and Exhaust Systems are arranged such that no atmospheric conditions such as ice or snow is expected to clog or in any way affect the air intake or exhaust openings (refer to Question 430.53).

The diesel generator rooms have been provided with preaction type sprinkler systems and therefore will not degrade the diesel combustion air as a result of discharging gaseous extinguishing media.

Refer to FSAR Subsection 9.5.8.3 and Table 9.5.8-2 for the Diesel Generator Combustion Air Intake and Exhaust Systems safety evaluation and failure mode and effects analysis, respectively.

Question No.

430.60 (SRP 10.2) Expand your FSAR to include a description of the motor operated steam extraction valves in the lines from the steam turbines to the first, second, third, and fourth stage heaters. Discuss the sequence of operation of these valves in the event of a turbine trip and/or load rejection, including the valve closure times, and show that the turbine stabilizes.

Response

The technical content of the concerned identified herein is beyond the scope of SRP 10.2 and the subject valves are not Nuclear Safety Related; however, the following information is provided for your use.

The motor operated valves in the extraction steam lines from the Main Steam Turbine to the first, second, third and fourth stage condensate and feedwater heaters are for water induction protection. If abnormally high water level is sensed in any of these heaters, these motor operated valves will close, isolating the misoperating heater from the steam turbine. These valves do not close on either a turbine trip or load rejection.

To aid in reducing turbine overspeed resulting from a turbine trip when the generator is disconnected from the grid, Reverse Current Valves (RCV) are placed in series with these motor operated valves to these heaters (see Figure 10.3-2). The turbine design requires that the RCV's close within one second after a turbine trip to keep turbine overspeed to less than 111 percent of rated speed. The closing of the RCV will prevent the steam in the extraction steam lines and heater from travelling back through the turbine to a lower pressure source and thereby mitigate turbine overspeed. The RCV's act as a swing check valve, piston assisted, to close the valve. As such, when the extraction steam reverses after a turbine trip the valves close. Closing will occur within 0.5 seconds after a turbine trip signal. These valves will therefore be closed well within the design requirements of one second.

The FSAR will be revised to reflect the response of this question.

OPC action. All governor and interceptor valves are then rapidly closed. Load drop anticipator reset is determined by the speed being less than 103 percent and an elapsed time of five seconds following breaker opening.

Overspeed Action - Complete Loss of Load

Governor and interceptor valves are closed when turbine speed is equal to, or greater than, 103 percent of rated speed. The interceptor valves are opened when the speed drops below 103 percent and an elapsed time of five seconds following breaker opening occurs. Since the breaker open condition causes the reference to reset to rated speed, the speed error signal of the normal speed control loop holds the governor valves closed until the speed decreases to rated speed. At this time, the governor valves open to maintain rated speed.

The OPC System may be tested using the OPC key-switch on the Operator Panel. If the breaker is open and the key is turned to the OPC TEST position, a signal is generated. The OPC System then closes the valves as though an actual overspeed condition has occurred.

Three speed channels are located in the analog system: two OPC speed channels and the supervisory speed channel. The selected OPC speed channel is compared to a reference voltage to detect a system overspeed condition. The selected OPC speed signal is also used to drive the speed meter on the operator panel and is provided to the Digital System as an analog input.

The electrohydraulic operated solenoid valves 20-1/OPC and 20-2/OPC are controlled by the OPC portion of the DEH controller (see Figure 10.2-2). They are arranged in parallel and are energized closed under normal operating conditions. In the closed position, they block a path for draining of the OPC Trip Header fluid and pressure can be established | 2
under the interceptor valve and governor valve servoactuators. In the event of an OPC action, such as occurs if the unit reaches 103 percent of rated speed, the solenoid valves open releasing the OPC Trip Header fluid to drain thereby unseating the dump valves and causing the immediate closing of the interceptor valves and governor valves.

Check valves between the autostop emergency trip fluid circuit and the OPC fluid circuit retain the pressure in the autostop emergency trip line, and the reheat stop and throttle valves remain open. With a reduction in speed to rated speed, the solenoid valves will close, the interceptor and governor valves will reopen, and the governor valves will take over control of the turbine and keep the unit at rated speed.

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Upon receipt of a Turbine Trip signal the Reverse Current Valves (RCV) in each extraction steam line from the turbine will start to close. The RCV's are constructed as a free swing check valve, piston assisted in the closing direction. The valves will close when the flow stops or reverses. The RCV's will close within 0.5 seconds after a receipt of a turbine trip signal. This closure time is within the 1 second closure time required by the turbine design. Closing the RCV's within 1 second will keep the turbine overspeed to less than 111% of rated speed.

Question No.

430.62 (SRP 10.3) As explained in issue No. 1 of NUREG-0138, credit is taken for all valves downstream of the Main Steam Isolation Valves (MSIV) to limit blowdown of a second steam generator in the event of a steam line break upstream of the MSIV. In order to conform satisfactory performance following such a steam line break provide a tabulation and descriptive test (as appropriate) in the PSAR of all flow paths that branch off the main steam lines between the MSIV's and the turbine stop valves. For each flow path originating at the main steam lines, provide the following information:

a) system identification
b) maximum steam flow in pounds per hour
c) type of shut-off valve(s)
d) size of valve(s)
e) quality of the valve(s)
f) design code of the valve(s)
g) closure time of the valve(s)
h) actuation mechanism of the valve(s) (i.e., solenoid operated, motor operated diaphragm valve, etc.)
i) motive or power source for the valve actuating mechanism

in the event of the postulated accident, termination of steam flow from all systems identifed above, except those that can be used for mitigation of the accident, is required to bring the reactor to a safe cold shutdown. For these systems describe that design features have been incorporated to assure closure of the steam shutoff valve(s). Describe what operator actions (if any) are required.

Response No credit has been taken for any valves downstream of the MSIV's to limit blowdown of a second steam generator in the event of a Main Steam Line Break upstream of the MSIV since they are not safety-related and are located in a non-Seismic Category I structure.

Each main steam isolation valve has two physically separate and electrically independent hydraulic actuators in order to provide redundant means of valve operation. An electrical or mechanical malfunction of one actuator shall, therefore, have no effect on the operation of the redundant valve actuator. A Main Steam Isolation Actuation Signal (MSIS) is tramsitted to each actuator.

Question No.

430.63 (SRP 10.4.1) Provide the permissible cooling water inleakage and time of operation with inleakage to assure that condenstate/feedwater quality can be maintained within safe limits.

Response Inleakage of Cooling Water into the condenser is indicated by an increase in condensate/feedwater conductivity.

If the conductivity exceeds the values specified in Combustion Engineering Chemistry Design Guide 00000-PE-CG and NSSS Chemistry Manual CENPD-28, it is considered as an abnormal condition and operator action is required to bring the condensate polisher on line immediately to return the conductivity to normal specification levels.

The sectionalizated design of the Condenser Waterbox permits the location and isolation of a faulty section, and the required corrective action such as plugging of a faulty tube while the unit is in operation.

Question No.

430.65 (SRP 10.4.1) Indicate that design provisions have been made to preclude failures of condenser tubes or components from turbine bypass blowdown or other high temperature drains into the condenser shell.

Response The turbine bypass blowdown lines discharge into the condenser through spray pipes located in the condenser neck at a level sufficiently higher than the condenser tubes. The spray pipes help to diffuse the high energy discharge away from the tubes and thus preclude tube failure due to impingement.

All other high temperature drains discharge through spray pipes or baffles are provided to deflect the discharge away from the tubes and minimize impingement effect on condenser tubes.

<u>Question No.</u>

430.66 (SRP 10.4.1)	Discuss the effect of loss of main condenser vacuum on the operation of the main steam isolation valves.
<u>Response</u>	Loss of main condenser vacuum will trip the turbine and the turbine trip will cause a reactor trip. The Main Steam Isolation Valves will close only on Main Steam Isolation Signal, which is discussed in Subsection 10.3.2 and Subsection 7.3.1.1.2. After a turbine trip, the MSIV's will remain open (as long as a MSIS is not initiated) and the atmospheric dump valves will provide a heat removal path to remove the reactor decay heat and limit the steam generator pressure rise. Therefore, loss of condenser vacuum does not affect the operation of the Main Steam Isolation Valves.

Question No.

430.67 (SRP 10.4.1) Discuss the effect of main condenser degradation (leakage, vacuum, loss) on reactor operation.

Response

For a discussion of the effect of main condenser degradation (leakage, vacuum loss) on reactor operations, refer to CESSAR-F Subsection 15.2.3 "Loss of Condenser Vacuum." For a tabulation of the sequence of events from t = o sec. to t = 1800 sec., refer to CESSAR-F Table 15.2.3-1 "Sequence of Events for the Loss of Condenser Vacuum (LOCV)." For a discussion of the effect of main condenser leakage on reactor operation, refer to FSAR Subsections 10.4.1.2 and 10.4.1.3.

Question No.

450.4 (SRP 6.5.3)	FSAR Table 6.5.3-1 idetifies the leak rate for the primary containment and specific fractions of the containment leakage to particular pathways. Provide the basis for the specified leakage fractions. The staff also notes that the "conservative" case in Table 6.5.3-1 is non-conservative with respect to offsite consequences because the "anticipated" case contains more unfiltered direct leakage to the environment.
Response	The basis for the leakage fractions specified in Table 6.5.3-1 is given in appendix 15I. Table 6.5.3-1 will be amended to reflect the correct leakage fractions (see the Supply System response to Question 450.7). The leakage fractions to the annulus, the controlled ventilation area and bypass leakage are expressed as fractions of the leak rate of the primary containment. For example, for the bypass leakage fraction under the "anticipated" case 10 percent of the containment leakage value of 0.12 volume percent per day may be released unfiltered. Similarly under the "conservative" case, 8 percent of 0.5 volume percent may be in the form of bypass leakage. Consequently, the bypass leakage value for the "conservative" case is indeed more conservative than the "anticipated" case.

Question No.

450.5 (SRP's 9.4.2, 9.4.3) The systems descriptions of the safety-related and non-safety-related portions of the Fuel Handling Ventilation System, Reactor Auxiliary Building Main Ventilation System and the ECCS Area/Fuel Handling Building Filtered Exhaust Systems are not provided in sufficient detail for us to complete our review. It is not clear how these three systems interact during an accident. Provide one drawing which shows the interconnection of all these systems and a description of the alignment of the isolation dampers in these systems for both normal operation and for the loss-of-coolant and fuel handling accidents.

Response

Figures 6.5-14, 6.5-15 and 6.5-16 will be added to the WNP-3 FSAR to illustrate how the safety-related ECCS Area/Fuel Handling Building Filtered Exhaust System interacts with the non-safety Reactor Auxiliary Building Main Ventilation System and the Fuel Handling Building Ventilation System for normal operation, loss-of-coolant accident and fuel handling accidents, respectively. The figures, which are schematic diagrams, can be correlated with Table 6.5.1-4 for normal, LOCA and Fuel Handling Building accident operating modes respectively to assist in the description of the alignment of isolation valves and dampers and the air flow paths.

During normal operation, the safety-related ECCS Area/Fuel Handling Building Filtered Exhaust System is shut down and the ECCS Areas receive ventilation and cooling from the non-safety RAB Main Ventilation System. The Fuel Handling Building receives ventilation and cooling from the non-safety Fuel Handling Building Ventilation System with the safety-related isolation supply and exhaust dampers D-10A-SA, D-10B-SB and D-11A-SA, D-11B-SB respectively in the open position. The safety-related exhaust isolation valves B007SA and B107SB remain in the closed position.

It is assumed that an accident occurs without a loss-of-offsite power. During a LOCA the RAB Main Ventilation System safety supply and exhaust isolation valves at the ECCS Areas are closed. Both trains of ECCS Area/Fuel Handling Building Exhaust System are started and the system safety isolation valves to the ECCS Area are open. The isolation valves B007SA and B107SB to the Fuel Handling Building remain in the closed position to assist the safety system to draw down the ECCS Area envelope to 0.25 inches water gage below atmospheric pressure.

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INSERT A

Figures 6.5-14, 6.5-15 and 6.5.16 illustrate the interaction of the ECCS Area/FHB Filtered Exhaust System with the RAB Main Ventilation System and the Fuel Handling Building Ventilation System during the Normal, LOCA and Fuel Handling Accident operating modes respectively.

WNP-3/5
FSAR

TABLE 6.5.1-4

ECCS AREA/FHB FILTERED EXHAUST SYSTEM OPERATING VALVE SCHEDULE

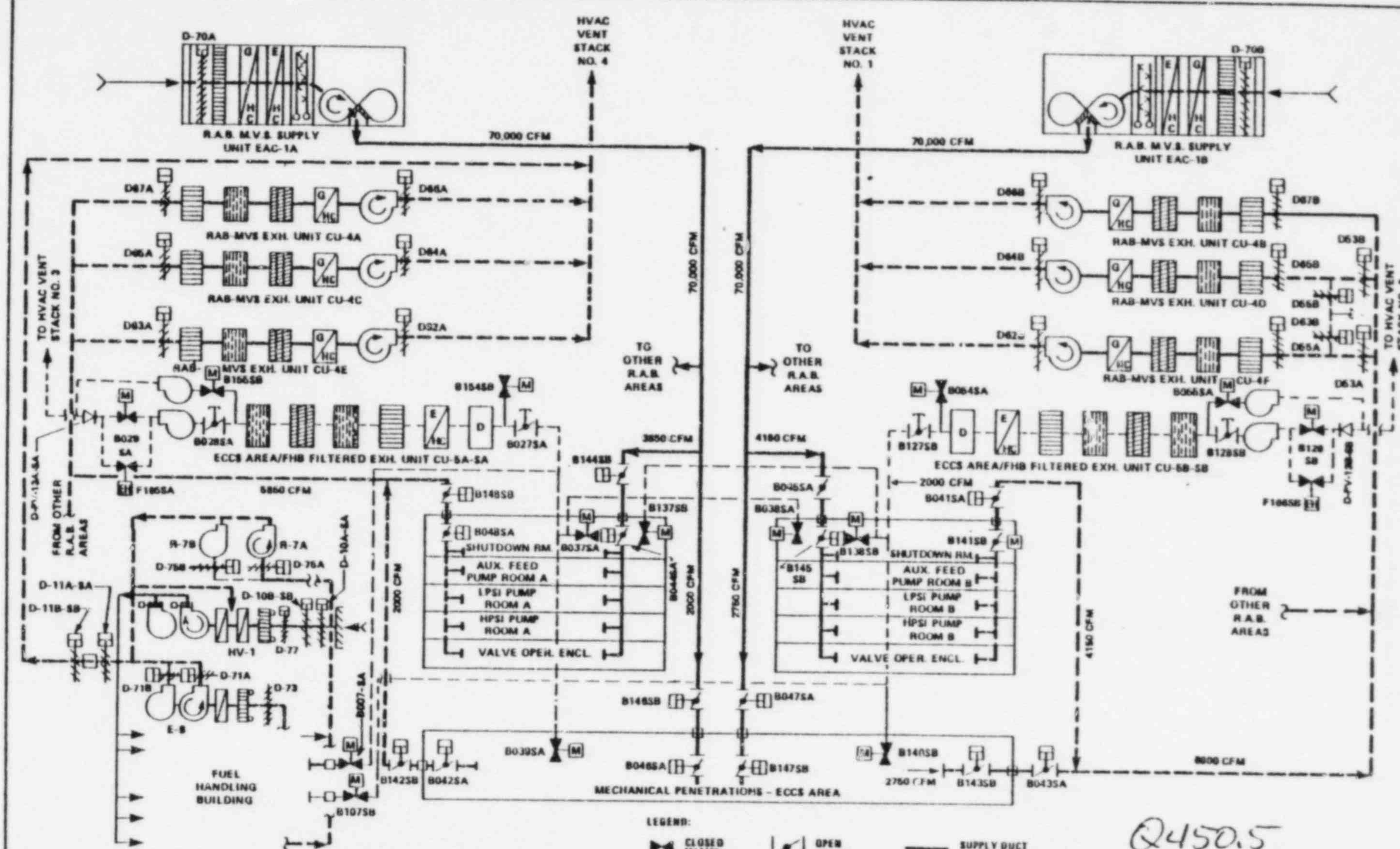
Valve or Damper No.	Unit or Area Served	Function	Type of Operator	Norm	loca	FHB ACC.	FAIL POSITION
2PV-B027SA (2PV-B127SB)	CU-5A (CU-5B)	Unit Isolation	H	L.O	L.O	L.O	-
2PV-B028SA (2PV-B128SB)	CU-5A (CU-5B)	Unit Isolation	H	L.O	L.O	L.O	-
2PV-B029SA (2PV-B129SB)	CU-5A (CU-5B)	Flow Modulation Control	~~EH~~ M	FAI ~~C~~	Mod. C/O	Mod. C/O	~~C~~ FAI
2PV-B037SA (2PV-B137SB)	ECCS, RAB El.335	Emergency Exh.	M	C	O	C	FAI
2PV-B038SA (2PV-B138SB)	ECCS, RAB El.335	Emergency Exh.	M	C	O	C	FAI
2PV-B039SA (2PV-B140SB)	Mech. Pen RAB.El.362	Emergency Exh.	M	C	O	C	FAI
2PV-B041SA (2PV-B141SB)	ECCS, RAB, El.335	Norm. Exh. Isol.	P	O	C	O	C
2PV-B042SA (2PV-B142SB)	Mech. Pen RAB.El.362	Norm. Exh. Isol.	P	O	C	O	C
2PV-B043SA (2PV-B143SB)	Mech. Pen RAB.El.362	Norm. Exh. Isol.	P	O	C	O	C
2PV-B044SA (2PV-B144SB)	ECCS, RAB, El.335	Norm. Supply Isol.	P	O	C	O	C
2PV-B045SA (2PV-B145SB)	ECCS, RAB, El.335	Norm. Supply Isol.	P	O	C	O	C
2PV-B046SA (2PV-B146SB)	Mech. Pen RAB,El.362	Norm. Supply Isol.	P	O	C	O	C
2PV-B047SA (2PV-B147SB)	Mech. Pen RAB,El.362	Norm. Supply Isol.	P	O	C	O	C
2PV-B048SA (2PV-B148SB)	ECCS, RAB, El.335	Norm. Exh. Isol.	P	O	C	O	C
2PV-B154SB (2PV-B054SA)	CU-5A (CU-5B)	Decay Heat Clg.	M	C	C*	C*	FAI
2PV-B155SB (2PV-B055SA)	CU-5A (CU-5B)	Decay Heat Clg.	M	C	C*	C*	FAI
2PV-B007SA (2PV-B107SB)	FHB	Emergency Exh.	M	C	C	O	FAI
D-10A-SA (D-10B-SB)	FHB	O.A.I. Isol.	P	O	O	C	C
D-11A-SA (D-11B-SB)	FHB	Norm. Exh. Isol.	P	O	O	C	C
2PV-[illegible]SA (2PV-[illegible]SB)	CU-5A (CU-5B)	Flow Modulation	EH	FAI	Mod	Mod	FAI

Notes:
- M - Electric Operator - two position
- P - Pneumatic Operator - two position
- EH - Electro-Hydraulic
- MOD - Modulating
- H - Hand Operated
- L.O. - Locked Open
- O - Full Open
- C - Full closed
- FAI - Fail As Is
- O.A.I. - Outside Air Intake
- Isol. - Isolation

Component designations are for Train A; designation for Train B are in parenthesis.

*Valves will be open during Decay Heat Removal Process only.

Q450.5



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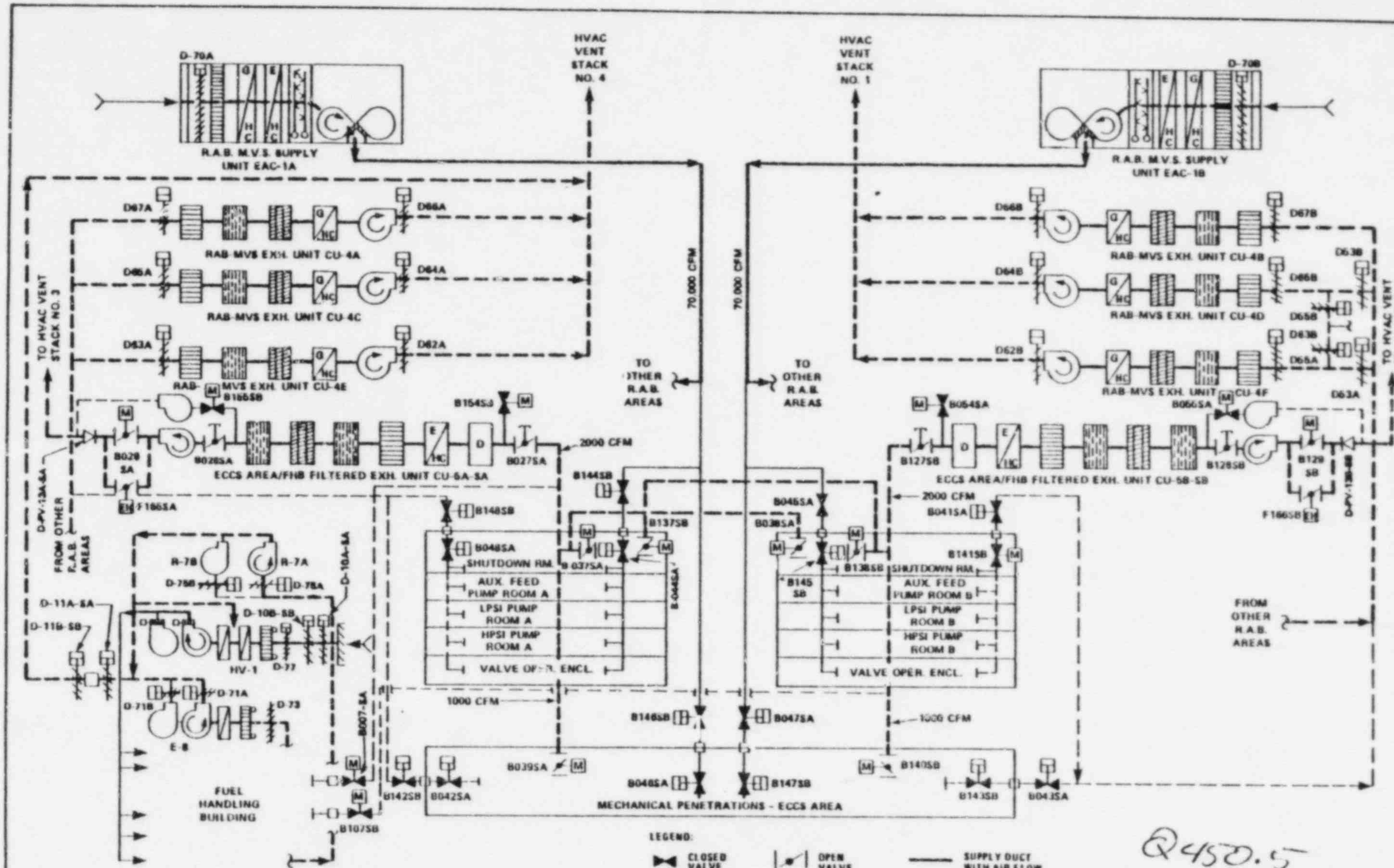
RAB ECCS AREAS & FUEL HANDLING BUILDING VENTILATION NORMAL OPERATING MODE

FIGURE 6.5-14



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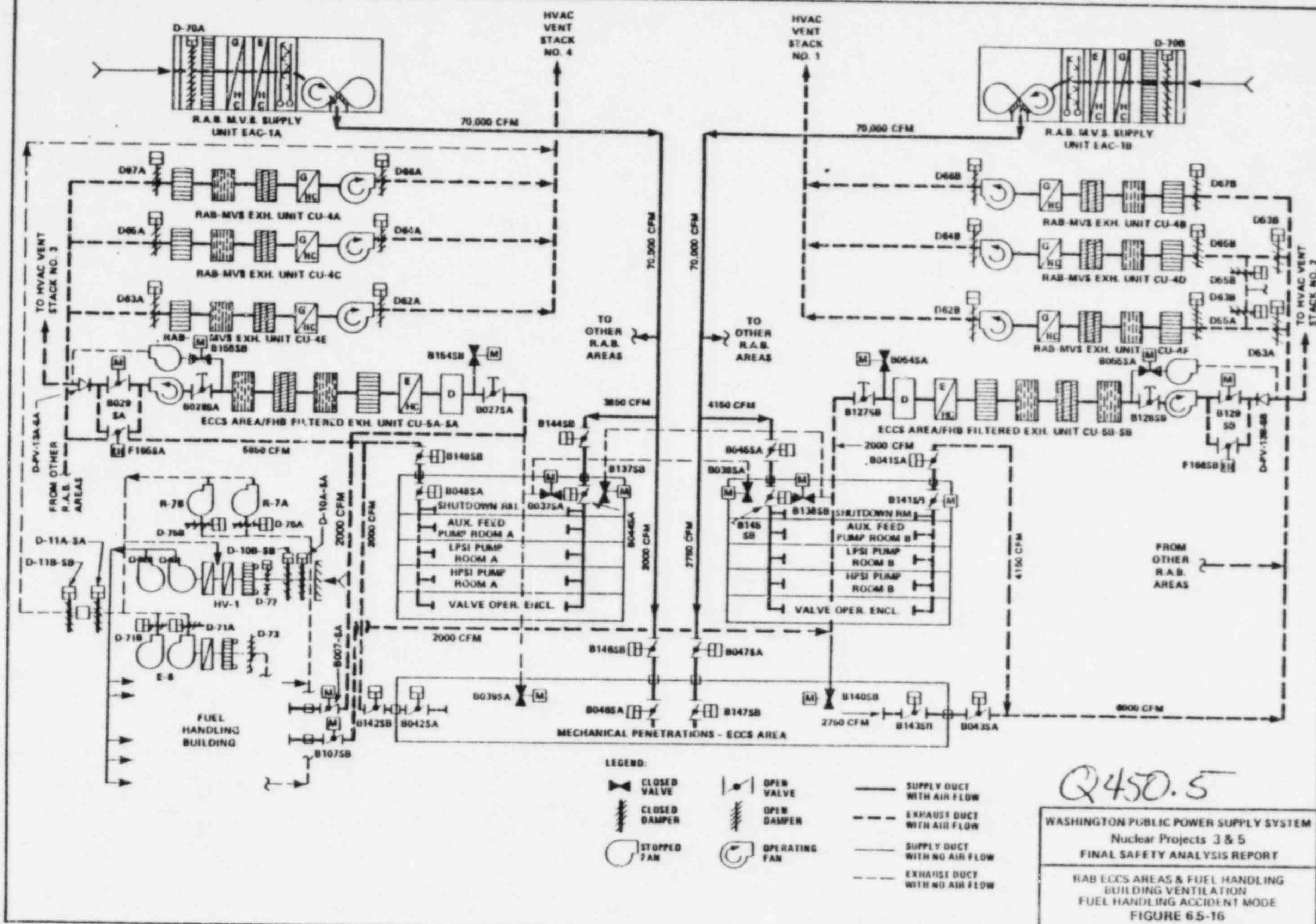
RAB ECCS AREAS & FUEL HANDLING BUILDING VENTILATION LOCA OPERATING MODE

FIGURE 6.5-15



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RAB ECCS AREAS & FUEL HANDLING BUILDING VENTILATION FUEL HANDLING ACCIDENT MODE
FIGURE 6.5-16

Question No.

450.7 (SRP 15.6.5) The containment pathway fractions given in FSAR Table 15-1 are not consistent with the fractions presented in FSAR Table 6.5.3-1. Resolve this apparent discrepancy and modify the FSAR as necessary, Please identify your intent to include technical specifications for all assumed containment leakage pathway fractions.

Response The correct leakage fractions are:

- to annulus	0.40
- to control ventilation area	0.38
- bypass leakage	0.22

Table 6.5.3-1 will be amended to reflect the correct leakage fractions.

The values for the various leakage pathway fractions will be included in the plant technical specifications.

Also, see the response to Question 450.9.

TABLE 6.5.3-1

PRIMARY CONTAINMENT OPERATION
FOLLOWING A DESIGN BASIS ACCIDENT

General

Type of Structure: Free Standing Steel Shell

Internal Fission Product Removal System: Containment Spray System | 1

ESF Primary Filter System: None

Total Free Volume of Primary Containment: 3,218,000 ft^3 | 1

Mode of Hydrogen Purge: To annulus

Time-Dependent Parameters	Anticipated	Conservative	
Leak Rate of Primary Containment:	0.12 volume percent per day	0.5 volume percent for first day and 0.25 volume percent per day thereafter	1 1
Leakage Fractions To Annulus:	0.40	0.40	
To Controlled Ventilation Area:	0.50	~~0.52~~ 0.38	
Bypass Leakage:	0.10	~~0.08~~ 0.22	
Effectiveness of Fission Product Removal System (containment spray), Decon Factor (DF):	10	5	
Initiation of Backup Hydrogen Purge:	not in use	($\geq$ 8.5 days @ 3% H_2)	
Hydrogen Purge Rate, Scfm (assuming 2-H_2 Recombiners fail - not assumed for doses):	not in use	200	1

Q450.7

Question No.

450.9 On Page 15I-6 of Appendix 15I of the FSAR it is stated that the post-accident containment leakage is limited by technical specifications to 0.2 percent of the containment volume per day for the first 36 hours, and then 50 percent of this value for the duration of the accident. Table 15-1 lists the containment leak rate as 0.5 percent per day for the first 24 hours and then 50 percent of this value for the duration of the accident. Identify the proper set of containment leakage assumptions used in calculting the EAB LOCA dose of 250 Rem (as given in FSAR Table 15-3) and modify the FSAR as necessary. (Note that FSAR Table 6.5.3-1 also prescribes a containment leak rate of 0.5 percent per day.)

Response The proper set of containment leak rate and leakage pathway fractions (expressed) as a fraction of containment leak rate is as follows:

a) Containment leak rate

0-24 hour	0.5% per day
1-30 day	0.25% per day

b) Leakage pathway fractions (of containment leak rate)

i.	to Annulus	0.40
ii.	to controlled ventilation area	0.38
iii.	Bypass	0.22

Subsection 15I.1.3.1 will be amended to reflect the correct assumptions.

Also, see the response to Question 450.7

L_{2n} = Secondary containment leak rate coefficient [sec^{-1}]

E = air exchange rate between sprayed and unsprayed region [cfm]

Vs, Vu = volumes of sprayed and unsprayed regions, respectively [cubic-ft]

$A_{2mn}(t)$ = Activity in Secondary Containment [Ci]

R_2 = First order removal coefficient for Shield Building Recirculation System [sec^{-1}]

Q_{mn} = Total activity released to the environs [Ci]

A_{ijmn} = Integration constants for sprayed and unsprayed regions primary containment, i=1,2; j=s,u

B_n = Breathing rate. The following values of B are used:

0 - 8 hours	3.47×10^{-4} m^3/sec
8 - 24 hours	1.75×10^{-4} m^3/sec
1 - 30 days	2.32×10^{-4} m^3/sec

$\frac{X}{Q}$ = Atmospheric dispersion factor (sec/m^3)

$TDCF_{mn}$ = Thyroid dose conversion factor [rem/Ci-inhaled] (See Table 15I-1)

$WDCF_{mn}$ = Whole body dose conversion factor [rem-m^3/sec-Ci]. (See Table 15I-1.)

15I.1.3 PRIMARY CONTAINMENT LEAKAGE PATHWAYS

15I.1.3.1 Introduction

Post accident containment leakage is limited by Technical Specifications to 0.5 ~~0.2~~ percent of the containemnt volume per day for the first 24 ~~36~~ hours and 50 percent of this value for the duration of the accident. From a dose evaluation standpoint, this leakage can take any of three following pathways:

a) Leakage to Shield Building annulus which will be treated by the Shield Building Ventilation System.

Q450.9

Question No.

450.10 (SRP 15.7.4) Standard Review Plan Section 15.7.4 requires an evaluation of the offsite consequences following a fuel handling accident inside containment. Provide this analysis, including all the assumptions used, and describe the method of detection and the response times of the ventilation systems. Provide a drawing which identifies the location of the monitors used and the exhaust locations for the ventilation system with respect to the refueling pool.

Response

FSAR Subsection 15.7.4 indicates that isolation of the containment will be effected prior to any radioactive releases that can take place following a fuel handling accident inside containment. The analysis which is presented provides the justification for this conclusion.

Following a fuel handling accident inside containment, the gaseous radioactivity and direct radiation will be detected by the Refueling Pool Ambient Radiation Monitors (RE-HV67601AS/BS, RE-HV67602AS/BS). A description of these monitors is given in Subsection 11.5.2.4. The location of these monitors is shown on Figure 12.3-13a. Upon detection of the radioactivity, the monitors will initiate the closure of the containment isolation valves and shutdown of the containment purge. The isolation time of the valves is 5 seconds. The detection and response time of the radiation monitors does not add any significant time to the overall system response. Consequently, as long as the total travel time of gaseous radioactivity from the refueling pool surface to the first isolation valve is more than the ventilation system isolation time of 5 seconds, any radioactivity released as a result of the accident will be contained.

The total time for gaseous radioactivity travel consists of transit time between the refueling pool surface and the entrance of the exhaust duct plus travel time from the duct entrance to the first containment isolation valve. These times were evaluated as follows:

A. Travel time from refueling pool surface to exhaust duct entrance. The equations of flow for round hoods is obtained from "Industrial Ventilation," 8th edition, by the American Conference of Governmental Industrial Hygienists. The velocity profile is given by:

$$V = \frac{Q}{10\ x^2 + A} \qquad (1)$$

sponse

0.10 (Cont'd)

where:

V = centerline velocity at distance x from hood, ft/min.

X = distance outward along axis, ft
(equation is accurate only for limited distance of x, where x is within 1.5D, where D is duct diameter)

Q = air flow rate, cfm

A = area of hood opening, ft^2

D = diameter of round hoods or side of essentially square hood, ft

Using Equation (1) above, the average velocity between the hood and any distance $_x$ can be obtained as follows:

$$V \text{ avg.} = \frac{1}{x}\int_0^x \frac{Q}{10 \quad x^2 \quad +A} \, dx \qquad (2)$$

$$V \text{ avg.} = \left[\frac{Q}{x \quad (10A)^{1/2}} \quad \tan^{-1}\left(\frac{x \ (10A)^{1/2}}{A}\right)\right]_{x^1 = 0}^{x^1 = x}$$

The intake header is at EL. 445 ft. The water level in the refueling pool is a EL. 423 ft.

The distance between pool surface and intake header is then: 445 ft -423 ft = 22 ft.

$X = 1.5D = 1.5 \times \frac{36}{12} = 4.5$ ft.

(x is evaluated using the smaller side of the intake header)

Q = 14,000 cfm

$A = \frac{48in \times 36in}{144} = 12 \ ft^2$

V avg. in the first 45 ft of the distance from the intake header equals:

$$V \text{ avg} = \frac{14,000}{4.5 \times (10 \times 12)^{1/2}} \quad \tan^{-1} \quad \frac{4.5 \ (10 \times 10)^{1/2}}{12}$$

V avg = 378.3 ft/min

Travel time for the first 4.5 ft becomes:

Question No.

450.11 Provide a drawing which identifies the locations of the redundant radiation monitors above the spent fuel pool as well as the exhaust intakes for the Fuel Handling Building Ventilation System with respect to the spent fuel pool.

Response Attached please find copies of drawing WPPS-3240-G-4341 which shows the Fuel Handling Building Ventilation System ductwork arrangement at the spent fuel pool, including the exhaust intakes. For locations of the redundant radiation monitors above the spent fuel pool, refer to FSAR Figure 12.3-17a.

Question No.

451.4 (SRP 2.3.3) If precipitation measurements have continued between 1980 and the present, have any rainfall amounts exceeded previous onsite measured amounts for 24 hours, monthly or annual totals provided in Tables 2.3-86, 2.3-87, and 2.3-88? Provide the amounts and identify the corresponding dates, months and year.

Response Rainfall measurements for the period of October 1980 through September 1981 have been collected and processed. Total monthly rainfall in February 1981 (12.00"), April 1981 (9.09"), June 1981 (4.12"), and September 1981 (4.87") exceed previously recorded onsite values for the same months in other monitoring years. The absolute monthly maximum (16.49" in January 1974) was not exceeded. FSAR Tables 2.3-86, 2.3-87, and 2.3-88 will be amended based on the 1979 through 1981 monitoring period.

There was no exceedance of any of the short-term precipitation extremes during the additional 1980-81 monitoring year. Slight changes in the new tables are due to round off error caused by using English-to-metric-to English unit conversion, which was not applied to the original tables.

TABLE 2.3-86

MONTHLY PRECIPITATION DATA TOTALS FOR THE WNP 3/5 SITE AND ELMA, WASHINGTON

see attached page

Month[a,b]	Total Monthly Precipitation (inches)		Maximum 24-Hr Precipitation (inches)		Days with Measurable Precipitation (0.01 inch or more)	
	On-Site	Elma	On-Site	Elma	On-Site	Elma
May 1973	1.93	3.40	.98	.82	13	13
June	3.16	4.23	.72	.77	15	15
July	.11	.17	.04	.06	6	4
August	.45	.35	.16	.21	9	5
September	2.85	2.92	.64	.57	12	9
October	5.58	6.02	.91	1.04	24	19
November	14.33	13.40	1.21	2.20	27	25
December	14.89	14.42	1.89	1.63	28	28
January 1974	16.49	15.47	2.30	1.77	22	21
February	9.29	9.05	.97	1.12	23	21
March	12.02	11.50	1.57	1.75	26	22
April	6.22	6.93	.80	1.24	20	19
May	4.08	3.94	.68	.63	22	19
June	2.74	2.45	1.00	1.05	11	8
July	2.47	2.03	.63	.71	12	10
August	.30	.27	.26	.25	5	2
September	.59	.46	.41	.36	8	3
October	—	1.67	—	.67	—	7
November	—	8.84	—	2.15	—	17
December	10.70	12.33	1.40	1.73	22	28
January 1975	10.05	11.82	1.72	1.50	26	25
February	7.50	7.05	1.52	1.81	23	21
October 1979	6.45	7.75	1.44	1.37	23	13
November	1.07	3.26	.68	.72	4	14
December	12.08	18.48	4.00	2.78	18	29
January 1980	6.30	6.50	1.94	1.98	13	16
February	10.41	9.95	3.06	1.86	20	20
March	5.04	4.72	.97	.89	25	25
April	3.50	4.91	.81	.90	16	15
May	1.25	1.81	.41	.55	10	13
June	1.17	2.26	.27	.64	15	15
July	.79	.71	.62	.43		5
August	1.25	1.27	.42	.26	9	8
September	2.72	2.95	.86	.68	18	14

(a) Period of record May 1973 - February 1975 and October 1979 - September 1980.

(b) Onsite Precipitation data missing for period 9-17-74 to 12-2-74.

TABLE 2.3-87

COMPARISON OF ONSITE AND ELMA MONTHLY AND ANNUAL PRECIPITATION TOTALS (a)

Month	Monthly Precipitation (Inches) Mean Onsite Total	Mean Elma Total	Departure of Elma Total from Normal
Jan	10.95	11.26	1.83
Feb	9.07	8.68	.19
Mar	8.53	8.11	1.22
Apr	4.86	5.92	1.42
May	2.42	3.05	.59
Jun	2.36	2.98	.90
Jul	1.12	.97	-.01
Aug	.67	.63	-.66
Sep	2.79	2.94	.26
Oct	6.02	6.89	.13
Nov	7.70	8.33	-.79
Dec	12.56	15.08	5.03
Annual	69.05	74.84	10.11

see attached page

(a) Averages for May 1973 - February 1975 and October 1978 - September 1980.

TABLE 2.3-88

MAXIMUM ONSITE PRECIPITATON FOR VARIOUS DURATIONS [a]

Duration (hrs)	Maximum Precipitation (inches)
1	0.65
2	0.90
3	1.15
6	1.70
12	2.72
18	3.63
24	4.01

(a) Period of record is May 1973 - February 1975 and October 1979 - September 1980.

see attached page

TABLE 2.3-86

MONTHLY PRECIPITATION DATA TOTALS FOR THE WNP-3 SITE AND ELMA, WASHINGTON

Month[a]	Total Monthly Precipitation (inches)		Maximum 24-Hr Precipitation (inches)		Days with Measurable Precipitation (0.01 inch or more)	
	On-Site	Elma	On-Site	Elma	On-Site	Elma
October 1979	6.56	7.75	1.45	1.37	23	13
November	1.09	3.26	0.81	0.72	4	14
December	12.13	18.48	3.99	2.78	18	29
January 1974	6.35	6.50	3.18	1.98	13	16
February	10.51	9.95	3.05	1.86	20	20
March	5.19	4.72	1.29	0.89	25	25
April	3.57	4.91	0.97	0.90	16	15
May	1.29	1.81	0.43	0.55	10	13
June	1.24	2.26	0.39	0.64	15	15
July	0.81	0.71	0.64	0.43	7	5
August	1.29	1.27	0.44	0.26	9	8
September	2.78	2.95	0.86	0.68	18	14
October	1.81	2.18	0.61	0.44	16	9
November	10.07	13.44	2.21	1.94	27	24
December	13.81	12.79	1.94	1.58	29	24
January 1980	2.57	2.74	0.57	0.78	22	13
February	12.00	11.67	2.81	2.42	17	17
March	5.24	5.12	1.54	1.49	17	14
April	9.09	9.28	1.58	2.26	24	23
May	2.50	2.47	0.46	0.33	16	18
June	4.12	4.28	1.28	0.82	19	19
July	0.74	1.03	0.61	0.71	5	7
August	1.06	1.05	0.46	0.31	13	5
September	4.87	5.61	1.60	1.63	22	18

(a) Period of record is October 1979 through September 1981.

Q451.4

TABLE 2.3-87

COMPARISON OF ONSITE AND ELMA MONTHLY AND ANNUAL PRECIPITATION TOTALS [a]

Month	Monthly Precipitation (Inches)		
	Mean Onsite Total	Mean Elma Total	Departure of Elma Total from Normal
January	4.45	4.62	-4.81
February	11.26	10.81	2.32
March	5.24	4.92	-1.97
April	6.34	7.10	2.60
May	1.93	2.14	-0.32
June	2.72	3.27	1.19
July	0.79	0.87	-C.11
August	1.18	1.16	-0.13
September	3.86	4.28	1.60
October	4.21	4.97	-1.79
November	7.60	8.35	-0.77
December	12.99	15.64	5.59
Annual	62.57	68.13	3.40

(a) Averages for October 1979 through September 1981.

Q451.4

TABLE 2.3-88

MAXIMUM ONSITE PRECIPITATON FOR VARIOUS DURATIONS (a)

Duration (hrs)	Maximum Precipitation (inches)
1	0.49
2	0.90
3	1.15
6	1.69
12	2.71
18	3.61
24	3.99

(a) Period of record is October 1979 through September 1981.

Q451.4

Question No.

471.11 NUREG-0800, Standard Review Plan, lists several Regulatory Guides and NUREGS as programs acceptable to meet the Regulations. Several of these Regulatory Guides and NUREGs have been referenced in your FSAR as having been "used as guidance" or as "the technical basis." You should indicate if the guidance in the Regulatory Guides and NUREGs listed below were fully implemented. If not, the particular guidance not followed should be specified and an alternative control described.

1. Regulatory Guide 1.8 as it applies to personnel qualifications in Section 12.1.2.

2. Regulatory Guide 1.140 as it applies to ventilation design features in Section 12.3.3.3.

3. Regulatory Guide 8.2 as it applies to instrumentation in Section 12.3.4.

4. Regulatory Guide 8.8 as referenced in Section 12.4.1.1.

5. Regulatory Guide 8.8 and Regulatory Guide 1.97 where they apply to Health Physics instrumentation selection in Section 12.5.2.2.

6. Regulatory Guide 8.4, Regulatory Guide 8.8 and Regulatory Guide 8.14 as they apply to selection of personnel monitoring instruments in Section 12.5.2.4.

7. NUREG-0041 as it applies to respiratory protection devices in Section 12.5.2.4.

8. Regulatory Guide 8.9, Regulatory Guide 8.20 and Regulatory Guide 8.26 as they apply to your bioassey program in Section 12.5.3.4.2.

Response

1) Reg. Guide 1.8 - FSAR Table 1.8-1 under Reg. Guide 1.8 has a note that refers to Section 17.2 of the FSAR. Section 17.2 refers to the Supply System Operational Quality Assurance Program Description.

2) Table 1.8-1 amended April 1983 shown in compliance with Regulatory Guide 1.140 Rev. 1, 10/79 which has been used as guidance for design of the non-ESF air cleaning systems. The ANSI standards ANSI N509-1976 and ANSI N510-1975 frequently mentioned in the regulatory guide are the technical basis that was fully implemented.

FSAR Subsection 12.3.3.3 will be revised to reflect the extent of compliance and the correct revision of R.G. 1.140.

Question No.

471.13 As specified in Section 12.1.1 of Regulatory Guide 1.70, you should describe the management policy related to ensuring that occupational radiation exposures are ALARA. Describe related activities to be conducted by the management individuals having responsibility for radiation protection and the policy of maintaining occupational exposures ALARA. In particular, identify those individuals responsible for ensuring effective control in the major areas listed in Subsection 12.1.1.1 of WNP-3 FSAR.

Response

The Supply System Health Physics Program Description No. 3.1.2, approved by the Director of Support Services contains the following ALARA policy statement:

"Washington Public Power Supply System shall conduct all operations involving radiation and radioactive material such that radiation exposures to employees, contractors and the general public are maintained as low as is reasonably achievable. "Reasonably achievable" takes into account the state of technology and the economics of exposure reduction in relationship to the benefits to health and safety."

The individuals responsible for the major areas listed in Subsection 12.1.1.1 are:

a) Upper management direction and support - The Director of Support Services,

b) Detailed ALARA Policy and Procedures - The Plant Manager,

c) Consideration of ALARA during design of facilities and equipment - The Engineering and Program Directors of WNP-3,

d) Development of good procedures and radiation practices, including preplanning and proper use of appropriate equipment and work techniques by well trained personnel - The Plant Health Physics/Chemistry Manager,

e) Audit and appraisal of performance - The Manager of Radiological Programs, and

f) Implementation of improvements wherever and whenever they are reasonably achievable - The Plant Manager.

Question No.

471.15 Section 12.5.3.1.2 of WNP-3 FSAR provides for a general exemption of health physics personnel or personnel escorted by health physics personnel. This is not in compliance with the 10 CFR 20.203 requirement of maintaining "positive control over each individual entry" to a high radiation area, and should be deleted from the FSAR. (SRP reference, section 12.3-12.4).

Response

Attached is a marked up page from Subsection 12.5.3.1.2.

12.5.3.1.2 Personnel Control Procedures

The WNP-3/5 Plant Administrative Procedures and Health Physics Procedures contain the administrative control procedures for entry into radiation and high radiation areas. The procedures limit the entry and time spent in radiation areas to the time necessary to perform routine operations, maintenance and surveillance activities. The Radiation Work Permit (RWP) is used as the primary tool to insure the control at WNP-3/5. ~~Health Physics/Chemistry personnel or personnel who are provided direct coverage by Health Physics/Chemistry Technicians may be exempt from the issuance of a RWP on a case to case basis as approved by plant management~~. Provision will be included on an individual basis for exposure tracking by job category and function.

The radiation work permit is issued for a particular task or function, and is required before entering a radiation area. This permit provides current data on radiation levels within the area of interest, any restrictions on allowable work time, protective clothing and respiratory protective requirements, information on special tools or equipment needed, special radiation safety and personnel monitoring requirements and any other special instructions

Q471.15

Question No.

471.16 As per the requirements of NUREG-0800, Sections 12.3-12.4 Facility Design Features, describe the local audible and visible alarming radiation monitors that alert personnel if the lead shot bags, provided for shielding the fuel transfer tube access way, are removed during fuel transfer operations.

Response It is unlikely that removal of the lead shot bags provided for shielding the fuel transfer tube access way would be attempted during fuel transfer operations. In any case the removal of the lead shot bags would be performed under a radiation Work Permit (RWP) which would have a pre-job radiation survey and ALARA review by Health Physics. The RWP would also have to be approved by the Shift Manager or his designee. If the conditions warrant, portable continuous radiation monitoring equipment with local and audible and visual alarms will be set up to warn workers of unexpected radiation dose rates.

Question No.

471.19 From the resume listed in Appendix 13B of WNP-3 FSAR, your Radiation Protection Manager does not meet the criteria of Regulatory Guide 1.8. Provide additional information outlining the RPM's experience, particularly that which applies to his radiation protection work in an actual nuclear power station. Also, your Radiation Protection Manager backup coverage is not discussed. The qualifications of the individual who will act as RPM in the RPM's absence (e.g., while on vacation) should be described in the FSAR. It is our position that the temporary replacement should have at least a B.S. degree in science or engineering, 2 years experience in radiation protection: 1 year of which should be nuclear power plant experience, and 6 months of which should be onsite (in accordance with the December 1979 draft of ANSI 3.1). Describe your plan to meet these qualifications for your RPM backup.

Response

The individual in the position of Health Physics/Chemistry Manager has changed. The resume of the new manager is attached.

A change to Subsection 13.1.2.2.8 showing the Health Phy' :s Supervisor as the backup RPM is attached.

operational phases of the plant. Offsite support to this department is provided by the Technology Directorate personnel as discussed in Subsection 13.1.1.1.3 1

13.1.2.2.7 Nuclear Engineering Supervision

The Plant Nuclear Engineering Supervisor supervises the activities of the Nuclear Engineering staff in the functional areas of nuclear engineering, plant performance engineering, computer engineering.

13.1.2.2.8 Radiation Protection Supervision

The Health Physics/Chemistry Manager functions as the Radiation Protection Manager (RPM) and is responsible for managing the plant radiation protection and chemistry control programs. The Health Physics/Chemistry Manager reports to the Plant Manager. The Health Physics/Chemistry Manager is assisted by the Health Physics Supervisor, Health Physicists, Chemistry Supervisor, Chemist, Health Physics/Chemistry Foremen and Technicians. 1

a) The Health Physics Supervisor supervises the plant Health Physics program. The Health Physics Supervisor is responsible for ensuring that radiation protection procedures and programs are implemented by assigning Health Physics/Chemistry technicians to various plant activities and monitoring their performance and specifying radiation protection requirements for radiological controlled areas. The Health Physics Supervisor will be the back-up ~~Chemistry~~ RPM in the absence of the Health Physics/Chemistry Manager.

b) The Chemistry Supervisor supervises the activities of the Chemistry/Radiochemistry section. The Chemistry Supervisor is responsible for activities in the Chemistry Laboratory, Radiochemistry Laboratory, and radiological Counting Room. The Chemistry Supervisor is also responsible for the development and implementation of plant chemistry, radiochemistry, and appropriate programs that provide monitoring of plant processes and discharges.

13.1.2.2.9 Instrumentation and Controls Engineering Supervision

Provided by the Plant Engineering Supervisor.

13.1.2.2.10 Instrumentation and Controls Maintenance Supervisions

Refer to Subsection 13.1.2.2.11 for a description of duties and responsibilities.

13.1.2.2.11 Maintenance Department

The Maintenance Department is responsible for all plant maintenance and is under the direction of the Maintenance Manager. The Maintenance Manager reports to the Plant Manager. Reporting to the Maintenance Manager, are the Mechanical Supervisor, the Instrument and Control Supervisor, and Electrical Supervisor. 1

MATTHEW LYON

MANAGER, HEALTH PHYSICS/CHEMISTRY

Educational Background	Professional Level Experience
Chabot College A. A. (1964) San Jose State College B. A. Physical Science (1965) U. S. Bureau of Radiological Health Occupational Radiation Health (1968) General Electric Company BWR Chemistry (1979) University of Washington Assessment of Environmental Releases of Radioactivity (1980) National Center for Air Pollution Control Meteorological Aspects of Pollution (1967) Various Company Sponsored Management Courses	• General Electric Company Health Physics Technician (1961-1965) • Controls for Radiation, Incorporated Shift Health Physicist (1965-1967) • Wisconsin Michigan Power Company Plant Health Physicist at Point Beach (1967-1971) • Tennessee Valley Authority Plant Health Physics Supervisor at Browns Ferry (1971-1974) Supervisor Radiation Control Section (1974-1976) • Puget Sound Power & Light Company and Northwest Energy Services Company (Subsidiary of PSP&L and others) Health Physicist-Operations (1976-1980) Licensing Engineer (1980-1981) Staff Health Physicist (1981-1982) • Washington Public Power Supply System Senior Health Physicist (1982-1983) Manager, Health Physics/Chemistry (1983 - Present) • Recent assignments to operating plants as Health Physicist: 1979 - 1 month at Trojan during outage 1981 - 4 months at Trojan during outage 1981 - 2 months at Rancho Seco during operation

Question No.

471.20 Based on information contained in NUREG-0731, "Criteria for Utility Management and Technical Competence," it is our position that the radiation protection group should be a separate organization from the chemistry group. Subsection 12.5.1.2 of your FSAR indicates your radiation protection and chemistry technicians are combined. These technicians report via two technical staffs to the RPM. Chemistry and radiation protection are two separate specialties. Therefore, a qualified technician must meet the work experience requirement (4.5.2 of ANSI N18.1-1971) for each individual. Also, it is our position (based on NUREG-0731) that the chemistry staff report to a Technical Manager other than the RPM. Your FSAR should be revised to outline how your planned radiation protection program reflects these positions.

Response

The WNP-3 Health Physics/Chemistry organization complies with the characteristics specified in NUREG-0731, para. II.A.1 as follows:

- The organization includes one or more individuals knowledgeable in each of the fields,
- The reporting chain of the radiation protection function is independent of the operations, technical and maintenance functions,
- The Health Physics/Chemistry Manager has a clear line of authority to the Plant Manager,
- The organizations activities are clearly defined,
- Each functional area is separately supervised, and
- Qualified backup personnel are available.

Additionally, the organization presented in NUREG-0731 "is a representative type organization." We do not find the NUREG to prohibit the current WNP-3 organizational structure.

It is the Supply System's intent that Health Physics/Chemistry Technicians meet or exceed the ANSI N18.1 qualification criteria. It is noted however, that time requirements for the specialties are not considered to be additive in that many of the knowledge and skill areas are common. Current industry documents, INPO 82-006 Radiological Protection Technician Qualifications and INPO 82-007 Chemistry Technician Qualifications illustrate the overlap of the two specialties. Of the 33 training areas for Radiation Protection, 20 are common to the Chemistry Technician qualification criteria.

Question No.

471.22 Provide the information requested in II.F.1.(3) and III.D.3.3 of NUREG-0737 "Clarification of TMI Action Plan Requirements."

Response

1. The Containment high range radiation monitors at WNP-3 meet the requirements of Regulatory Guide 1.97. Therefore, they satisfy the requirements of NUREG-0737, Section II.F.1.(3).

2. In plant iodine sampling will be accomplished under accident conditions by using portable air samplers and silver zeolite sample media. Analysis will be performed in the plant laboratory, if conditions permit, or in the laboratory in the Emergency Operations Facility (EOF). Measurements will be performed by either germanimum type detectors or portable multi-channel analyzers.

Question No.

480.7 (6.2.1) Provide the following information in accordance with Table 6-1 of Regulatory Guide 1.70: containment design temperature and service water temperature used in containment analysis.

Response The containment peak temperature analysis results in a peak containment temperature of 367.0°F for an 8.78 ft^2 MSLB at 102% power as shown in FSAR Table 6.2.1-2. The plant design basis includes the most limiting single failure which is the loss of a single cooling train.

The component cooling water temperature utilized for the LOCA containment peak pressure-temperature analysis is 120°F and is provided in FSAR Table 6.2.1-5.

Question No.

480.8 (6.2.1) Provide the curve of energy removed by the containment spray system as a function of time along with the other energy removal mechanisms shown on Figure 6.2-11 for the DBA LOCA.

Response

Figure 6.2-11 presents the energy distribution inside the containment. The effects of containment spray system operation on the steam-air mixture are included in curve 2 of this figure. Including a curve of energy removed by the sprays is unnecessary since the sprays do not remove energy from the containment, but merely redistribute the energy from the steam-air mixture to the liquid phase in the sump. Energy is removed from the containment primarily through the operation of the Shutdown Cooling Heat Exchanger, which takes suction from the sump. Since the sump region energy reflects the operation of the containment spray system, curve 4 illustrates the heat removal capabilities of the combined spray-heat exchanger heat removal system.

Question No.

480.10 (6.2.2) Provide additional information on the net positive suction head (NPSH) analysis of the spray pumps, for both the injection and recirculation phases, in sufficient detail to justify the adequacy and conservatism of the analysis. Include the bases for obtaining the elevation pressure head (Pe) of 37.5 ft, the friction pressure loss (Pi) of 4 ft and the required NPSH of 12.5 ft.

Response

A Containment Spray Pump net positive suction head (NPSH) analysis has been performed for both the injection and recirculation modes. Calculations show that the recirculation mode is the governing case. The available NPSH for the injection mode (53.7 ft.) well exceeds the available NPSH during recirculation mode (33.5 ft.), primarily because of the large elevation head (63.4 ft.) available between the minimum RWST level and the Containment Spray Pump's first stage impeller. Subsection 6.2.2 of the FSAR details NPSH parameters for the limiting recirculation mode.

The available NPSH calculation utilizes the equation outlined in Subsection 6.2.2. The basis for each parameter in the NPSH equation (i.e., NPSH = Pa + Ps + Pe - Pi - Pv) is as follows:

a) The partial pressure of the containment air (Pa) together with the Containment Steam Pressure (Ps) are conservatively assumed to be equal to the sump water vapor pressure (Pv). This assumption is equivalent to the sump water being at saturated conditions. This assures that the actual available NPSH is always greater than or equal to the calculated available NPSH (33.5 ft.).

b) The elevation head (Pe = 37.5 ft.) is obtained from the elevation difference between the minimum containment water level (EL. 370.10 ft.) and the centerline elevation of the pump's first stage impeller (EL. 332.60 ft.). The minimum containment water level is based on the ECCS design water volume of the RWST (664,000 gallons) and the four safety injection tanks (57,600 total gallons) emptying into the Containment.

c) The friction head loss (Pi = 4 ft.) is calculated, using maximum operating flow through pipe lengths based on actual piping layouts from the Containment Sump to the Pump Suction. For the common suction header, the flow considered is the maximum recirculation flow for all three pumps (i.e., LPSI, HPSI and CS). In addition, the total head loss of 4 ft includes a 25 percent margin for piping degradation.

Question No.

480.10 (Cont'd) The required NPSH (12.5 ft.) at the pump's first stage impeller has been determined by vendor NPSH testing. The calculated available NPSH (33.5 ft.) has conservatively determined that sufficient suction head is available to preclude the possibility of cavitation.

Question No.

480.11 (6.2.2) Provide an analysis of the heat removal capability of the containment spray system. The analysis should include the degree of thermal equilibrium attained by the spray water.

Response

Thermal equilibrium is attained utilizing a containment spray pattern as shown on FSAR Figures 6.5-3 and 6.5-4. Each train has been located as high as practical in the upper portion of the containment dome. The spray nozzles are equally spaced along each header and their orientations are designed to provide maximum spray coverage for optimum heat removal. FSAR Figures 6.5-3 and 6.5-4 also detail the spray header configurations, nozzle spray distributions and the spray heights relative to internal structures.

The spray nozzles, which are of open throat design, break the flow into small droplets, which enhance the cooling effect of the containment atmosphere. As these droplets fall through the containment atmosphere they absorb heat until they reach the temperature of the containment air-steam mixture. In order that the spray droplets attain thermal equilibrium with the containment atmosphere during the fall, at least 112 ft. has been provided between the spray nozzles and the top of the steam generators. Each spray nozzle is designed for a flow of 15.2 gpm with a 40 psi pressure drop across the nozzle. These nozzles have a 3/8 inch spray orifice diameter and are not subject to clogging. The nozzles are designed to produce droplets of approximately 230 microns median diameter at rated system conditions (see FSAR Figure 6.5-7). Detailed spray nozzle parameters are given in FSAR Table 6.5.2-3.

Maximum heat removal capability is therefore attained through the optimization of the spray coverage by utilizing the most suitable header/nozzle orientation and atomization of the spray droplets. Additional information can be found in FSAR Subsections 6.2.1, 6.2.2, Appendix 6.2B, and 6.5.2.

Question No.

480.14 (6.2.3) Appendix 6.2A describes the computer code WATEMPT, used for calculating the shield building annulus transient. Provide additional information to clarify the following description in this Appendix:

a. Provide a more detailed discussion on how radiation heat is accounted for in the analysis. Provide the gray body radiation heat transfer equations used in the code and justify their use.

b. The fan curve on Figure 6.2-35 shows that for a static pressure greater than 28 inches W.G., there exist two possible CFM values. Explain how the code input table was developed to obtain a proper CFM value.

c. The dependency of the annulus volume on the containment wall temperature and differential pressure across the containment vessel is considered in the code. Describe how the containment vessel expansion and corresponding annulus volume change are accounted for in the analysis, and provide the equations describing this effect.

d. SRP 6.2.3 states that adiabatic boundary conditions should be assumed for the surface of the secondary containment structure exposed to the outside environment. Verify that this assumption has been used in the analysis.

e. SRP 6.2.3 states that no credit should be taken for secondary containment outleakage. Verify that the analysis complies with this guidance.

Response

a. For a more detailed discussion on how radiation is accounted for as well as the gray body radiation heat transfer equations used in the analyses, please refer to the proprietary description of the WATEMPT code. The proprietary code was also used to analyze the performance of SB annulus transients for St Lucie Unit 2 (Florida Power & Light Co.), and its approval by the staff was benchmarked via St Lucie Unit 2's Safety Evaluation Report (NUREG-0843).

b. Figure 6.2-35 shows the full range performance characteristics of the Shield Building Ventilation System fan.

Under accident conditions the fan will be operating at a CFM range as shown on Figure 6.2-35a extracted from the WATEMPT computer code utilized for the transient analysis. Therefore, in the event of a LOCA the fan can draw only one possible air flow at one specific static pressure value. FSAR Subsection 6.2.3.3.1 will be amended to clarify the above concern.

Response

480.14 (Cont'd)

c. For the equations that describe how the containment vessel expansion and corresponding annulus volume change are accounted for in the analysis, please refer to the proprietary description of the WATEMPT code. This proprietary code was also used to analyze the performance of the SB annulus transient for St. Lucie Unit 2 (Florida Power & Light Co.) and its approval by the staff was benchmarked via St. Lucie Unit 2's Safety Evaluation Report (NUREG-0843).

d. It has been assumed, in accordance with ANSI Standard 56.4 that heat transfer due to free convection takes place between the concrete shield building and the outside environment. However, the amount of heat lost from the shield building is minimal, and is typically approximately three orders of magnitude less (1/1000th) than the amount of heat absorbed by the building.

e. The shield building annulus pressure response analysis does account for inleakage between the annulus and the outside. However, since the annulus is always at a negative gauge pressure, leakage is always into the annulus.

In the event of an SBVS train failure due to self-malfunction, or loss of emergency power after the train has been operating, the Decay Heat Removal Mode will be manually energized to open valves 2PV-B152SB or 2PV-B052SA and a minimum of 200 cfm of room air is drawn through the recently shutdown filter train to the annulus, where it can be processed by the operating SBVS air cleaning unit. The inoperative SBVS train is cooled by the reversed air flow through the train components. 1

6.2.3.3 Design Evaluation

6.2.3.3.1 Performance Requirements and Capabilities

Each of the two full-capacity, redundant fan-filter trains of the Shield Building Ventilation System have been designed to fulfill the performance requirements stated in the Design Bases, Subsection 6.2.3.1. Each subsystem is capable of maintaining the subatmospheric pressure in the annulus under the pressure and temperature transient conditions associated with the surge and reduction of annulus volume, due to containment vessel expansion and heat transfer through its wall.

The Shield Building annulus is maintained at minus 10 in. water gage below atmospheric pressure during normal operation. The pressure is low enough to prevent the annulus pressure from rising to minus one in. pressure in the period following a CIAS, when the Annulus Vacuum Maintenance System is deactivated and during the interim 30 seconds required for the SBVS to start and reach full operating speed. 1

The analysis of the functional capability of the SBVS to depressurize and maintain a subatmospheric pressure within the Shield Building annulus is performed with the worst long term LOCA: the double-ended suction leg slot with minimum safety injection break case, using the WATEMPT computer code as described in Appendix 6.2A. The analysis results include the following information: 1

a) Containment pressure and temperature as function of time (Figure 6.2-32, Sheets 3 and 4).

b) Annulus pressure and temperature as function of time (Figure 6.2-32, Sheets 1, 2 and 4).

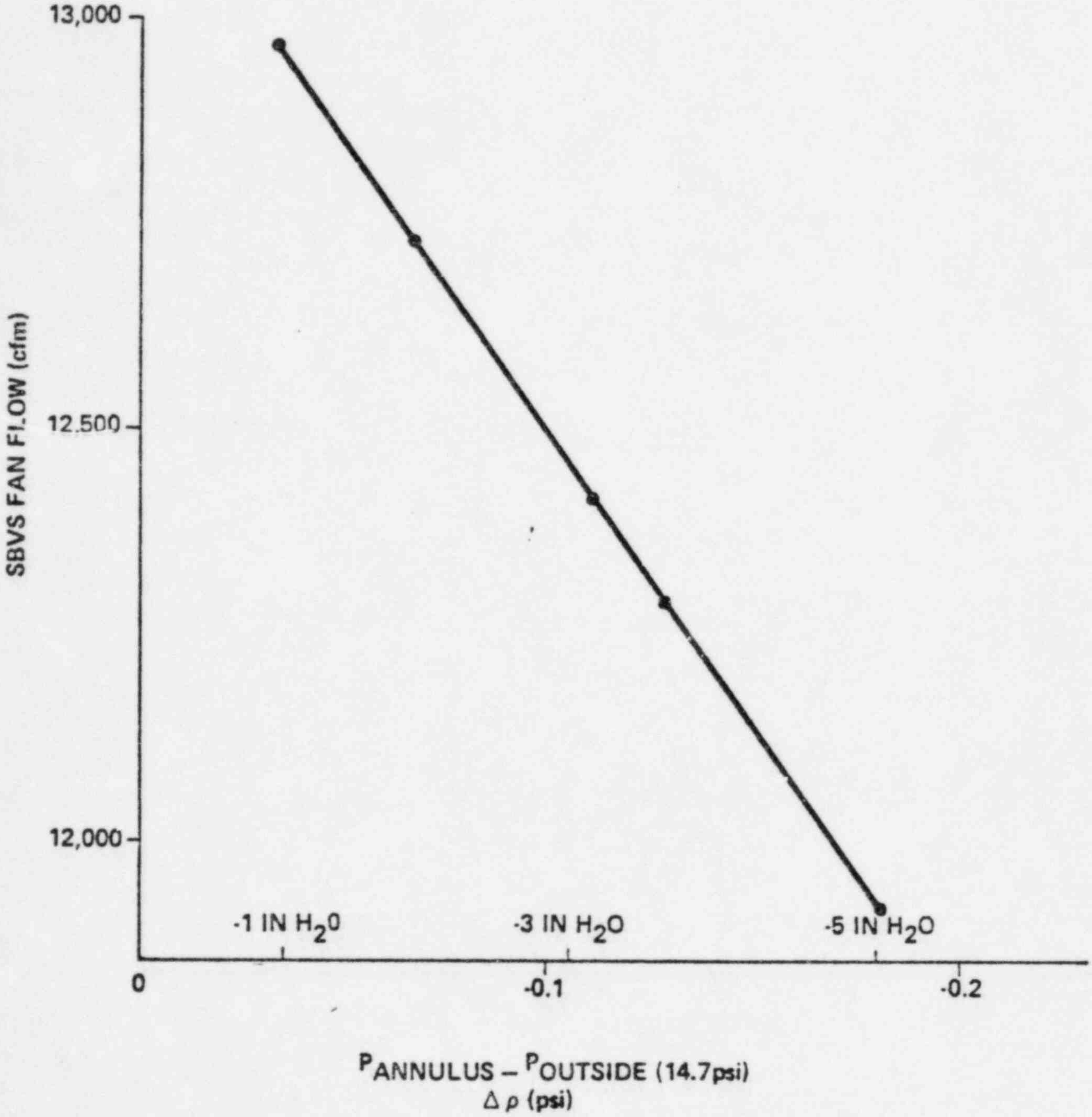
c) Containment vessel wall temperature gradient as a function of time and distance (Figure 6.2-33).

d) Containment vessel surface temperature as a function of time (Figure 6.2-34).

e) SBVS fan flow characteristics (Figure 6.2-35a), based on SBVS purge and recirculation flow rate as a function of fan differential pressure (Figure 6.2-35).

f) Shield Building wall surface temperature as a function of time (Figure 6.2-34a).

Q480.14



Q480.14

WASHINGTON PUBLIC POWER SUPPLY SYSTEM Nuclear Projects 3 & 5 FINAL SAFETY ANALYSIS REPORT	SBVS FAN FLOW CHARACTERISTICS VERSUS ANNULUS Δp	FIGURE 6.2-35a

Question No.

480.15 (6.2.4) Provide additional information to describe the conditions requiring containment isolation. This information is required in accordance with Section 6.2.4.1 of Regulatory Guide 1.70 (design bases for containment isolation system).

Response Automatic initiation of a Containment Isolation Actuation Signal (CIAS) occurs when a high containment pressure or low pressurizer pressure is detected, or when a safety Injection Actuation Signal (SIAS) is initiated. Manual initiation of CIAS is provided in the control room through push button controls. Refer to FSAR Subsection 7.3.1.1.2.1 for details regarding the Isolation Signal. Design Basis Events (DBE) requiring Containment Isolation are provided in Table 7.3-1.

The Reactor Building purge supply, Reactor Building purge exhaust, containment vent makeup and containment purge exhaust isolation valves, in addition to CIAS (automatic or manual initiation), are interlocked such that on receipt of a containment high radiation signal they will close.

FSAR Subsection 6.2.4.1.1 will be amended to incorporate the above response.

6.2.4 CONTAINMENT ISOLATION SYSTEM

The Containment Isolation System (CIS) prevents the release of radioactivity through containment mechanical penetrations following postulated accidents while, at the same time, allowing operation of the systems which mitigate the accident. The CIS performs this function by the use of passive and active isolation barriers.

6.2.4.1 Design Bases

6.2.4.1.1 Criteria and Governing Conditions for Isolation of Fluid Systems

Insert 1

Fluid systems penetrating the containment fall under one of three design categories discussed below. Table 6.2.4-1 identifies for each penetration the specific category.

6.2.4.1.1.1 Closed Systems Inside Containment

Systems which connect to the secondary side of the steam generators are closed systems inside containment. The secondary side of the steam generators and its attached systems are not open either to the containment atmosphere or to the Reactor Coolant Pressure Boundary (RCPB) during normal operation or post-LOCA and, thus, comprise a passive containment isolation barrier. The isolation valves for these lines meet the explicit requirements of GDC 54 and 57. The isolation valves are either automatically isolated by the Main Steam Isolation Signal (MSIS) or are normally-closed as discussed in Subsection 6.2.4.2.1.

6.2.4.1.1.2 Closed Systems Outside Containment

Engineered Safeguard Features (ESF) Systems open to the containment atmosphere or the RCPB are designed as closed systems outside containment. These systems become an extension of containment during an accident. The isolation valves for these systems meet the explicit requirements of GDC 54, 55 and 56 except that these normally-closed valves are opened either automatically or remote-manually when required in an accident. Closure is accomplished only by remote-manual actuation.

6.2.4.1.1.3 Open Systems

Systems not meeting the design bases of Subsections 6.2.4.1.1.1 or 6.2.4.1.1.2 fall into this category. In general this category consists of all non-essential and ESF-related systems which are not connected to the steam generators. This category relies on redundant containment isolation valves to prevent the release of radionuclides from the containment. The isolation valves meet the explicit requirements of GDC 54, 55 and 56 (as clarified by NUREG-0737 Item II.E.4.2) and conforms to CE interface requirements as described in CESSAR-F Subsection 5.1.4.F.1. The valves are either normally lock-closed or automatically closed by the containment isolation actuation signal (CIAS).

Q480.15

Question 480.15

INSERT 1

Automatic initiation of a Containment Isolation Actuation Signal (CIAS) occurs when a high containment pressure or low pressurizer pressure is detected, or when a Safety Injection Actuation Signal (SIAS) is initiated. Manual initiation of CIAS is provided in the control room through push button controls. Refer to FSAR Subsection 7.3.1.1.2.1 for details regarding the Isolation Signal. Design Basis Events (DBE) requiring Containment Isolation are provided in Table 7.3-1.

The Reactor Building purge supply, Reactor Building purge exhaust, containment vent makeup and containment purge exhaust isolation valves, in addition to CIAS (automatic or manual initiation), are interlocked such that on receipt of a containment high radiation signal they will close.

Question No.

480.16 (6.2.4) Provide the following information regarding the fluid system isolation provisions described in Table 6.2.4-1:

For Penetration Nos. 84, 86, and 87, provide the additional information identified in the table as "Later."

Response

The information identified in FSAR Table 6.2.4-1 as "Later" is not yet available because the system design has not been finalized. When the information becomes available, it will be provided in a future FSAR Amendment.

Question No.

480.22 (6.2.5) The combustible gas control system should be designed to facilitate periodic inservice inspections, operability testing and leak rate testing of the system components. Discuss the design provisions which will permit the above actions.

Response

The Combustible Gas Control System consists of the:

(a) Containment Hydrogen Analyzer
(b) Containment Hydrogen Recombiner
(c) Containment Hydrogen Purge System

1. Design provisions which will permit periodic inservice inspection are as follows:

   (a) All components of the Containment Hydrogen Analyzer System are accessible for periodic inspection and maintenance as shown on Figure 1.2-10.

   (b) All components of the Containment Hydrogen Recombiner System are accessible for periodic inspection and maintenance as shown on Figures 1.2-5 and 1.2-11.

   (c) All components of the Containment Hydrogen Purge System are accessible for periodic inspection and maintenance as shown on Figure 1.2-12.

2. Design provisions which will permit operability testing are as follows:

   - (a) Preoperational testing of the Combustible Gas Control System is conducted, as discussed in Section 14.2, during the final stages of plant construction prior to initial startup. These tests assure correct functioning of all components such as controls, instrumentation, alarm setpoints, fans, pumps, recombiners, piping and valves. System reference characteristics, such as pressure differentials and flow rates, are documented during the preoperational tests and are used as base points for measurements in subsequent operational tests. For further details see Subsections 14.2.12.2.28 and 14.2.12.2.32.

Question No.

480.25 (6.2.4) An interface requirement in CESSAR-F, Section 5.1.4, specifies that the containment spray system shall provide 4000 gpm per train at a head which can be set between 250-300 feet. Provide evidence which shows this interface requirement has been met.

Response

The Containment Spray System interface requirements indicated above have been specified in CESSAR-F Subsection 5.4.7, item P.3.a. and not in section 5.1.4 as stated in question.

The basis for this interface requirement is that during the Shutdown Cooling Mode when the Reactor Coolant Temperature is below 200F (typically 170F), the Containment Spray Pumps are realigned to provide additional Shutdown Cooling flow (see FSAR Subsection 9.2.10). Each Containment Spray pump has a design flow capacity of 5500 gpm at a head of 645 feet. Each Containment Spray System train (A and B) is provided with a flow control valve on the pump discharge (see Tag Nos. 2CS-F003SAR (SI-678) and 2CS-F004SBR (SI-679, on FSAR Figure 6.2-27). The flow control valve is used to throttle the Containment Spray pump to allow parallel operation with the Low Pressure Safety Injection pumps. This throttling process with the Low Pressure Safety Injection pumps. This throttling process provides the flow conditions required.

Question No.

492.1 According to SRP 4.4 (Section II.7) the design description and proposed procedures for use of the loose parts monitoring system (LPMS) should be consistent with the requirements of Regulatory Guide 1.133. You have provided much of the information in Section 4.4.6.1 of the FSAR. Indicate your compliance to the requirements of Regulatory Guide 1.333, including item C4J, on the training program for plant personnel that addresses operation of the system hardware and the purpose and implementation of the loose-part detection program.

Response The Loose Parts Monitoring System is in full compliance with the requirements of Regulatory Guide 1.133. FSAR Subsection 4.4.6.1 has been revised in accordance with SRP 4.4 (Section II.1) for consistency with the requirements of Regulatory Guide 1.133.

A Technical Specification for the Loose Parts Detection System will be developed in accordance with Position C.5 of Regulatory Guide 1.133.

Additionally, training will be provided to address technical specifications, purpose and operation of the system.

The FSAR will be changed to reflect this response.

4.3 NUCLEAR DESIGN

Refer to CESSAR-F Section 4.3.

4.4 THERMAL AND HYDRAULIC DESIGN

Refer to CESSAR-F Subsections 4.4.1 through 4.4.6. 1

Replace CESSAR-F Table 4.4-8 with Table 4.4-1 presented in this FSAR.

4.4.6.1 Loose Parts Detection System

The Loose Parts Detection System's (LPDS) primary purpose is the early detection of loose metallic parts in the primary system. The LPDS also functions to minimize radiation exposure to operating personnel by providing 1 for the early detection and general location of abnormal structural conditions. The LPDS is a non-safety-related system. The Loose Parts Detection System complies with the requirements of Regulatory Guide 1.133
Loose Parts in the primary system are detected by pairs of piezo-electric accelerometers. The sensors are strapped around the lines at their locations by mounting blocks. The sensors, placed to provide broad coverage, will be 1 located at each natural collection region, as indicated below:

a)	Hot leg nozzle adjacent to steam generator inlet plenum	4 Sensors
b)	Incore instrument nozzle located on the vessel bottom beam, adjacent to vessel inlet plenum	2 Sensors
c)	CEDM nozzle located on vessel head	2 Sensors

Each channel consists of a sensor, preamplifier, signal conditioner (filter) 1 and adjustable trip units for alarming and auto recording. In order to monitor the unfiltered signal of any one of the eight channels, the LPDS monitoring equipment includes a loud-speaker, volume control knob, audio amplifier and channel selector switch on the Loose Parts Detection Panel 1 (LPDP) in the Control Room. One on-line eight channel cassette, FM/direct tape recorders are used to automatically record all the channels simultaneously. Manual recording is automatically bypassed upon detection of loose parts by any one channel. For locating and determining the impact energy of a loose part, a loose part locator, with a printer is provided with the following features: 1

Location Accuracy:	Within a cubic meter
Printout:	Date Time in hours, minutes and seconds Lag time of each channel from the reference channel Peak impact energy

Q492.1

Channel checks, which is the qualitative assessment of channel behavior during operation by observation, is performed by turning the channel selector knob and listening for anything unusual. The channel function test is performed by injecting a simulated signal as close to the sensor as possible to verify operability including alarm and trip functions. Background noise is filtered out on startup by setting the individual sensors alert level high enough to preclude nuisance alarms. 1

Insert "A"

By having remote indication, recording, resetting, testing and calibration in the Control Room, the radiation exposure to operating personnel is minimized.

The anticipated major sources of external and internal extraneous noise are from those signals induced by normal hydraulic, mechanical and electrical background noises and large amplitude electrical transients (pump and control valve operation, etc.). Noise rejection capability is accomplished through the following: 1

a) Electrical isolation of the sensors from the plant structure.

b) Loose part detection is at a high frequency that is above the plant background noise spectrum.

c) Methods previously described to increase signal-to-noise ratio.

d) Double-shielding of sensor to preamplifier cable through use of coaxial cable in either a cable tray or conduit.

e) Preamplifier placed as close as practical to the sensor.

f) Single-point grounding at the cabinet is used.

g) For prevention of nuisance alarms, the LPDS has provision for temporarily bypassing the monitoring of loose parts (ie. Control rod stepping during plant maneuver). 1

There are means for detecting a loose part other than the LPDS. Any unusual change in the indications or an alarm of the primary coolant parameters such as pressure or flow might indicate a loose part. If the control rod position indicator shows that a rod is not in position, a loose part may exist. Other parameters include: high reactor coolant leg temperature (caused by steam generator tube blockage), zero reactor coolant flow and pressure (caused by a broken reactor coolant pump impeller) and low power level (caused by all the above). 1

Sensors and preamplifiers located inside the containment and the LPD Panel located in the Control Room are qualified by testing to verify the functional operability following an Operating Basis Earthquake (OBE). The input motion, equivalent to 1.1 times the sum-of-the-absolute values of an OBE, is applied. 1

Q 492.1

Question 492.1
INSERT A

The alert level signal is a digital signal indicating an impact. This signal is derived by comparing a delta (Δ) signal (analog) with the background output (analog). The background signal is a long-term average rms value taken over a time period. The delta signal is an output signal that is the short-term rms value of the amplified signal minus the background signal. To indicate an alert, the delta signal voltage must exceed the background voltage multiplied by a factor of "K". For steady nonfluctuating signals, the deta signal is at 0 volts, and a sudden increase or burst of signals will cause the delta signal level to go positive. The parameter "K" is controlled for each channel by potentiometers that are accessed at the LPDP. This accessibility therefore allows the performance of channel calibration. For operator convenience, a momentary contact toggle switch is provided on the panel. When this switch is depressed to the "BKGND" position the background signal voltage (+rms) is sent to a digital voltmeter on the CPDP. Similarly, when this switch is depressed to the "THRESHOLD" position, a voltage (-rms) equal to the alert level times the background level is sent to the meter. This monitoring capability gives the operator a means to check the background level and the alert level from the panel front.

The design bases analysis, list and locations of display instrumentation for the LPDS is found in Section 7.6.

4.5 REACTOR MATERIALS

Refer to CESSAR-F Section 4.5.

4.6 FUNCTIONAL DESIGN OF REACTIVITY CONTROL SYSTEMS

Refer to CESSAR-F Section 4.6.

Refer to Sections 3.5 and 3.6 for protection against missiles and pipe breaks respectively.

Figures 1.2-3 through 1.2-22 show the general arrangement (including separation provisions) of the major components of the reactivity control systems (CRDS, CVCS and SIS). 1

4A APPENDIX 4A

Refer to CESSAR-F Appendix 4A.

4B APPENDIX 4B

Refer to CESSAR-F Appendix 4B.

4C APPENDIX 4C

Refer to CESSAR-F Appendix 4C.

A Technical Specification for the Loose Parts Detection System will be developed to reflect system requirements.

Q492.1

Question No.

Question No.

630.4 Provide a training program for mitigating core damage as described in Item II.B.4 of NUREG-0737 in accordance with the guidance as specified in Enclosure 3 of H. R. Denton's letter dated March 28, 1980. Provide a listing of those individuals and their qualifications who must participate in the training program and provide a schedule for that training as related to the presently-scheduled fuel load date.

Response

Training in the subject area of Enclosure 3 of H. R. Denton's letter, dated March 28, 1980 as applicable to WNP-3, will be provided. Training will be provided in the systems lectures or a separate course may be provided. Training was scheduled to be provided during the summer of 1984. This schedule will be updated following resumption of construction activities at WNP-3. Participants will be the shift manager and senior operator candidates.

Question No.

630.5 Discuss the program which will provide the training to Reactor Operators and Senior Reactor Operators in the following areas: (SRP References 13.2.1, I.B.I, and II.1.b).

(a) Recognition of emergency conditions.

(b) Classification of observed emergency conditions in accordance with the Emergency Classification System.

(c) Notification of emergency to offsite authorities.

(d) Recommendation of protective actions to offsite authorities.

(e) Direction of station staff to take protective actions.

Response

(a) The program for training licensed operators will include simulator training. The simulator is an excellent tool to teach recognition of emergency conditions.

(b) through (e) See Section 13.3.2 of FSAR.

b) Demonstrations of how to control individual systems and the integrated plant;

c) Practice of normal and emergency plant operations, including response to malfunctions by the license candidates; and

recognition of emergency conditions

d) Exercises during which the license candidates operate the simulator without instructor assistance and receive evaluation on ability to safely and efficiently operate the plant.

Simulator sessions will include all of the control manipulations identified in Subsection 13.2.3.1. Simulator examinations will evaluate the candidates ability to:

a) Manipulate the controls in a safe and competent manner;

b) Predict instrument response and use the instrumentation available;

c) Follow the facility procedures;

d) Understand alarms and annunciators and take proper action; and

e) Communicate properly.

Onsite Experience (26 weeks)

Training in the form of practical work assignments at the WNP-3 will be provided for approximately 26 weeks. Work assignments may include: plant operating procedure preparation and verification, preoperational testing of plant systems, participation in hot functional testing program, preparing and providing instruction on plant systems. Emphasis shall be on the license candidate gaining thorough knowledge of WNP-3. Some of this experience will be gained in the Control Room of the plant.

The plant operating staff will be heavily involved in reviewing, preparing for and conducting the preoperational tests, hot functional tests, low power physics and escalation to power test programs. Most of the low power physics and escalation to power testing will be performed during simulator training prior to actual test performance.

Senior Operators and Shift Managers Duties (1-3 weeks)

Senior Operators and Shift Managers will have instruction in the following subjects relating to their duties:

a) Leadership

b) Communication

c) Motivation of Personnel

d) Problem Analysis

e) Decision Analysis

Q630.5

Question No.

630.6 Discuss the certifications completed pursuant to Sections 55.10(a)(6) and 55.33a(4) and (5) of 10CFR Part 55. Provide the title of the individual who will certify the eligibility of individuals for licensing or renewal of license. Enclosure I of H. R. Denton's March 28, 1980 letter Section A.3.

Response

Certification of those items identified in Sections 55.10(a)(6), 55.33a(4), and (5) of 10 CFR Part 55 shall be made by the Plant Manager. (Item 1 and Item A3, Page 13.2-18).

f) Command responsibility and limits

g) Administrative requirements for the particular SRO position.

License Review Training (4 weeks)

A comprehensive examination is given to the license candidates to determine their knowledge of the plant (written examination) and ability to safely operate (simulator examination). Based on the results of the examination, review training and/or individual tutoring may be provided. Instruction on plant design and operating problems at similar plants will be provided.

Training Program Evaluation

The performance of employees participating in the Cold License Training Program are monitored and evaluated throughout the program. Frequent examinations are given to license candidates in order to determine the effectiveness of the training and the knowledge of the trainees. Records will be maintained on an individual basis. In the event the scheduled fuel loading date is substantially delayed, the cold license candidates will continue to maintain proficiency through participation in training similar in scope to the retraining program described in (Section 13.2.3.1).

Training Schedule

The training schedule for license operator candidates is based upon three training groups. The three groups include initial license candidates and replacements. The schedule for the three groups is shown on Figure 13.2-2. 2

At the time of FSAR submittal the first group was in training and had completed the following courses:

COURSE	APPROXIMATE CONTACT HOURS
Pre-Calculus Math (Math 103, 105)	90
Trigonometry	25
Chemistry	45
Calculus I, II, III	135
General Physics I, II, III	135
Fluid Mechanics	45
Material Science	45

insert 1 →

Q630.9

Question No.

Q630.9

Insert 1

Training programs for Senior Operators and Shift Manager consist of the following:

	Weeks Cold	Weeks Hot
Academic Fundamentals	20	19
Plant Systems	9	9
Observation	4	
Simulator	10	5
Onsite Experience	26	
Control Room Experience		12
SO/SM Duties	1	1
Review	4	
	74	46

Question No.

630.10 Provide a commitment to comply with the following TMI-related requirements as specified in Item I.A.2.1 of NUREG-0737:

(a) As an operating license Applicant, WNP-3 is not subject to the one-year experience requirements for cold license SRO candidates. However, after one year of station operation, we will require WNP-3 to comply with the one-year experience requirement for hot license SRO Applicants.

(b) The requirement for three months onshift experience for Control Room operators and SRO candidates as an extra person on shift is not required for cold license candidates and, hence, is not applicable to WNP-3. However, we will require WNP-3 to comply with this requirement for hot license candidates after three months of station operation.

(c) The criteria for requiring a licensed individual to participate in accelerated requalification shall be modified to be consistent with the new passing grade for issuance of a license; 80 percent overall and 70 percent each category.

Response

(a) Experience requirements for license operators will be indicated in a future FSAR Amendment.

(b) See FSAR Section 13.2.4.2 (Operating Practice-Control Room Experience).

(c) See Item 1, FSAR Page 13.2-18 (Item C.2).

Question No.

630.11 With regard to the fire brigade training program, provide additional discussion of the drills and records in accordance with the guidance outlined in NUREG-0800, Standard Review Plan Sections 13.2.2, II.6.a(iii) and (iv).

Response

See FSAR Section 13.2.2.9, Subsection C. Additional information is as follows.

- o At least one drill per year shall be performed on a "backshift".
- o Randomly selected unannounced drills will be evaluated by corporate staff or others who do not work for the Plant Manager.
- o Records shall be maintained for at least 3 years.

b) Practice

Practice sessions will be held for fire brigade members on the proper method of fighting various types of fires. These sessions will provide brigade members with practice in extinguishing actual fires, except in the case of energized cables. Practice sessions may be conducted at a remote facility. These practice sessions will be provided at about one year intervals.

Practice sessions will be conducted that require fire brigade members to don protective equipment, including emergency breathing apparatus. These practice sessions need not include fire fighting. These practice sessions should be provided at about one year intervals.

c) Drills

Fire brigade drills will be performed in the plant so that a fire brigade can practice as a team. Drills will include the following:

1) The simulated use of equipment for the various situations and types of fires which could reasonably occur in safety-related areas.

2) Conformance, where possible, to the established plant fire fighting plans.

3) Operating fire fighting equipment where practical. This would also include self-contained breathing apparatus, communication equipment and portable and/or installed ventilation equipment.

4) The drills will be performed at regular intervals, but not to exceed three months average for each fire brigade. The minimum number of fire brigade drills conducted within a period of six months shall be equal to the number of operating shifts at the station. Each individual member of the fire brigade shall participate in at least two drills per year. At least one drill per year for each fire brigade shall be unannounced & and at least one drill per year will be performed on a backshift,

5) Periodically (at least annually), these drills should include offsite fire department personnel. These drills should also conform with the facility plan for coordination with offsite fire departments.

6) The drills will be preplanned to establish the training objectives of the drills. The drills will be critiqued to determine how well the training objectives have been met. At a minimum, the critique will assess:

(a) Fire alarm effectiveness, response time, selection, placement and use of equipment:

(b) The leader's direction of the effort and each member's response.

Randomly selected unannounced drills will be evaluated by corporate staff or others who do not work for the plant manager.

7) Records shall be maintained for at least 3 years.

Q630.11

Question No.

640.1 FSAR Subsection 14.2.4.2.2 states that certain tests may be waived or rescheduled at the discretion of the plant manager if WNP-3 is found to behave in an acceptable manner relative to the lead CESSAR Standard Design Plant. Because your operating license will be conditioned to require NRC prior approval of major changes to the Initial Test Program, you should either identify those preoperational or startup tests (or applicable portions) listed in FSAR Subsection 14.2.12 or CESSAR Chapter 14 which are subject to being waived or rescheduled, or delete the statement. In addition, for each test subject to change, reference the source of the acceptance criteria (not required for the criteria provided in CESSAR FSAR Chapter 14 Table 14.2-7) which will be used to determine if WNP-3 is behaving in an acceptable manner relative to the lead CESSAR Standard Design Plant.

Response The WNP-3 FSAR will be revised to delete the last sentence of Section 14.2.4.2.2 as shown and add test acceptance criteria.

14.2.4.2.2 Startup Test Scheduling and Sequencing

Scheduling and sequencing of testing during startup is performed under the direction of the Plant Manager.

The test sequence and individual Startup Test Procedure identify hold points for data review and authorization to proceed and establishes the general plant condition for each group of tests.

Those tests which are deemed necessary to ensure the safe operation of the plant will be conducted at all incremental power plateaus during Power Ascension Physics Testing (PAPT). These tests will be identified in the PAPT program procedure and will include such tests as verification of negative power coefficient or reactivity and steady state core performance including calorimetric NI calibrations. Certain other tests may be waived at intermediate power levels or rescheduled to a higher power level if WNP-3 is found to behave in an acceptable manner relative to the lead CESSAR Standard Design plant (CESSAR-F, Chapter 14) and any test results obtained at lower power levels are found to be acceptable. ~~Tests may be waived or rescheduled at the discretion of the Plant Manager.~~ Acceptance criteria to waive or reschedule tests (other than criteria in CESSAR Table 14.2.7) will be developed after the Palo Verde (PVNGS testing is completed. 2

14.2.4.2.3 Startup Test Performance

Before starting each test, the assigned test engineer will review the test procedure to assure that prerequisite activities or conditions have been satisfied as described in Subsection 14.2.4.3.

The test will be stopped or curtailed if it cannot be performed safely or in accordance with the approved test procedure. Required test procedure deviations or changes may be effected in accordance with a "Test Change Notice" as described in Subsection 14.2.4.4.

Should apparent deviations of test results from performance requirements or acceptance criteria be revealed, or should other anomalies develop, the plant will be placed in a safe condition and relevant test data reviewed by the test engineer and Shift Manager. If the apparent discrepancy or anomaly is substantiated, the situation will be reviewed by the Plant Operations Committee to ascertain if a plant safety question is involved. Control of any identified nonconformance or noncompliance will be in accordance with the plant administrative procedures.

Evaluation of the effect of the discrepancy or anomaly on plant safety will be performed at the appropriate level of review and appropriate corrective action will be taken before resumption of the test or test conditions at which the problem was revealed.

At the completion of an entire test procedure, the test engineer will assemble all of the data and supporting information, nonconformance documentation and test results evaluations for review by the Plant Operating Committee. Any data reduction or analysis required will be done as soon after the data is available as is practical so that the results of the analysis may be included in the completed test package.

Test records will be maintained as described in Subsection 14.2.6.

Q 640-1

Question No.

640.2 (14.2.7) Regulatory Guide 1.70 (Standard Format and Contents of Safety Analysis Reports for Nuclear Power Plants) states that in FSAR Subsection 14.2.7 the applicant is to list all those regulatory guides applicable to the initial test program, and if the regulatory guidance is not to be followed, describe specific alternative methods along with justification for their use.

1. Modify your exception to Regulatory Guide 1.68 (Initial Test Program for Water Cooled Power Reactors, Appendix A.1.c) to ensure that response time testing of Reactor Protection and Engineered Safety Feature instrumentation systems accounts for process-to-sensor delay. If the input signal is injected downstream of the sensor, ensure that referenceable technical justification for the conservatively assumed delay time from the sensor to that point is provided and is applied to the determination of the instrument response time (See CESSAR response to Question 640.12 and ISA-dS67.06 for guidance).

2. Modify your exception to Regulatory Guide 1.68 (Appendix A.1.h.(1).(c)) to ensure that Emergency Core Cooling System pumps will be operated at a sufficient number of flowrate and discharge pressure conditions to provide:

   a. Assurance that system flow rates during all modes of operaton are equal to or in excess of design;

   b. The minimum and maximum possible flow conditions are within acceptable limits for sustained operation of the pumps.

3. Delete your exception to Regulatory Guide 1.68 (Appendix A.4.p and a.5.t) and include test descriptions in FSAR Subsection 14.2.12 that provide for demonstration of the operability of pressurizer relief valves; main steam line relief valves; atmospheric steam dump valves; turbine bypass valves; and turbine stop, intercept, and control valves. Such a demonstration should include response times, relieving capacities, setpoints, and reset pressures. Open and reclosure setpoints for all relief valves should be checked at temperature. Where relief valves are not tested in situ with the process fluid, testing should be conducted to verify that discharge piping is clear and will not choke flow or produce back-pressure affecting set-reset pressures of valves. When referencing bench tests instead of performing installed capacity checks, technical justification must be submitted.

Question No.

640.2

(NOTE: This item is not applicable to ASME Code safety valves subject to ASME Section XI preservice tests).

Response

1) The last sentence of FSAR Section 14.2.7.1(a) will be revised to modify the exception to Regulatory Guide 1.68 and add a statement concerning ISA - ds 67.07.

2) CESSAR-F Section 6.3.2.5.b, 14.2.12.1.22 and 14.2.12.1.23 provide the assurance requested in item 2(b) of Question 640.2. The exception to Regulatory Guide 1.68 was taken because of CE system 80 design features which preclude runout flow conditions and pump damage due to violation of NPSH requirements. Nothing in the FSAR exception waives the Regulatory Guide requirement to demonstrate pump/system injection at the required flow rate and pressure or in any way prevent the assurance requested.

3) The Supply System will continue to take exception to in-place testing of main steam and pressurizer relief code safety valves. WNP-3 valves are ASME Code Stamped which provides sufficient evidence of lifting pressure, relieving capacity and reset pressure. Setpoints of relief and safety valves will be checked in accordance with plant inspection program procedures. These will be available for NRC review.

Atmospheric steam dump valves are tested as part of testing shutdown from outside the Control Room and will be conducted as part of CESSAR-F 14.2.12.5 please refer to CESSAR-F Subsection 14.2.12.1.3 for "Pressurizer Safety Valve Test", FSAR revised Subsection 14.2.12.2.21 for Main Steam Valve testing CESSAR-F, Subsection 14.2.12.1.32 for Steam Bypass Control System, CESSAR-F subsection 14.2.12.5.19 for Steam Bypass Valve Capacity Test, and FSAR Subsection 14.2.12.9.8 titled "Digital Electro Hyraulic (DEH) Turbine Control" which will demonstrate poper function of turbine controlling valves (Attachment 1).

Question No.

640.2

ATTACHMENT 1

14.2.12.9.8

(PT-82C) Digtal Electro Hydraulic (DEH) Turbine Control

1.0 Objective

To Demonstrate the ability of the DEH system to operate the turbine within its design limits.

2.0 Prerequistes

2.1 Construction activities are complete.

2.2 System flushing has been completed with system restored.

2.3 Support systems are available

2.4 Instrument calibration and component testing is complete.

2.5 Test equipment calibrated and available.

3.0 Test Method

3.1 test signals will be injected into the system to Demonstrate that control devices respond as required.

3.2 Demonstrate that control devices fail to their failed position on loss of DEH pressure.

4.0 Acceptance Criteria

4.1 Verify the DEH system will regulate turbine controlling devices so that the turbine can be started, operated and shutdown within the design criteria.

4.2 Verify that all turbine controlling valves close on loss of DEH pressure.

14.2.6.3 Types of Documents and Records Requiring Test Record File Retention

Documentation and records that will be maintained within test and startup program files are:

a) Test and Startup Program records as specified by ANSI N45-2.9.

b) All records and documents as specified by the Startup Manager.

Other records, documents, correspondence, etc., may be maintained at the discretion and approval of the Startup Superintendent, provided their access requirements do not comprise the security of the mandatory files.

14.2.7 CONFORMANCE OF TEST PROGRAMS WITH REGULATORY GUIDES

14.2.7.1 Conformance with Regulatory Guide 1.68

The WNP-3/5 Test and Startup Program generally conforms to the requirements of Regulatory Guide 1.68, Revision 2, "Initial Test Program for Water-Cooled Power Reactors," August, 1978, except where specifically noted otherwise. This Regulatory Guide has been reviewed by the Supply System for applicability or individual items in the guide to WNP-3/5 and its systems. Exceptions to the testing required by this guide have been specifically addressed and are discussed below. The Startup Test Program is consistent with CESSAR-F Subsection 14.2.7.

a) Appendix A, Section 1, item "c" requires that the response time of each of the Reactor Protection System and Engineered Safety Feature Actuation System channels, including sensors be tested. Except for a very few cases, it is not feasible to perturb the variable to the extent necessary to obtain response time of the sensors and associated hardware. Regulatory Guide 1.68 references Regulatory Guide 1.118 as providing a test criterion acceptable for pre-operational testing of protection channels, including sensors. Regulatory Guide 1.118 references IEEE 338. These references do provide a means of testing sensors with the latest industry standards ~~, with one exception. This exception is Resistance Temperature Detectors (RTDs).~~ and ISA-dS 67.07 shall be consulted for guidance in determining test methods and requirements.

b) Appendix A, Section 1, item "h (1) (c)" requires that the operability of the Emergency Core Cooling System be demonstrated under design system runout conditions. This requirement imposes an undue hazard on ECCS pump operation. The ability of these systems to provide flow to the reactor core in excess of that needed to terminate loss of coolant accidents as defined in 10CFR50.46 will be demonstrated.

c) Appendix A, Section 4, item "p" requires a "demonstration of the operability of pressurizer and main steam relief valves at rated temperature," and Appendix A, Section 5, item "t" requires verification

Q640.2

14.2.12.2.21 MAIN STEAM SAFETY AND ISOLATION VALVES

1.0 Objective

To demonstrate the operability of the Main Steam Safety and Isolation Valves.

2.0 Prerequisites

2.1 Installation is complete.

2.2 Instrumentation calibration and component testing are complete.

2.3 Test equipment and instrumentation available and calibrated.

3.0 Test Method

3.1 Demonstrate operation of the MSIVs.

3.2 Determine closing time of the MSIVs and the MSIV Bypass valves.

3.3 Using a lifting device, increase the lifting force on the main steam safety valves until the valve simmers.

4.0 Acceptance Criteria

4.1 Verify proper operation of the MSIVs.

4.2 Verify that the closing time of the MSIVs and the MSIV Bypass valves is within the specified tolerances.

4.3 Verify main steam safety valve set points.

Q640.2

<u>Question No.</u>

640.3 Modify FSAR Subsection 14.2.11 to conform to Regulatory Guide 1.68 (Appendix B) such that copies of all test procedure will be available (not just in normal cases as stated in FSAR Subsection 14.2.11) for examination by the NRC regional personnel approximately 60 days prior to the scheduled performance of the preoperational tests, and that not less than 60 days prior to the scheduled fuel loading date, copies of procedures for fuel loading, initial startup testing, and supporting activities will be available. Drafts of these procedures should be made available as early as practical. Exceptions to the 60 day criterion are subject to the approval of the NRC Region 5 Administrator.

<u>Response</u> The WNP-3 test program will schedule copies of test procedures to be made available for examination by the NRC Region V personnel at least 60 days prior to the scheduled test performance. Drafts of all tests requiring Test Working Group approval will be made available as early as practical.

FSAR Section 14.2.11 will be amended to conform explicitly to R.G. 1.68 App. B as it pertains to Scheduling of Test Procedure review and approval.

14.2.10.2 Precritical Tests and Initial Criticality

Refer to CESSAR-F Subsection 14.2.10.2 for a description of initial criticality.

14.2.11 TEST PROGRAM SCHEDULE

Provision, acceptance and system lineup testing on each unit will commence approximately 24 months before fuel loading. The first preoperational test will occur at least 12 months before fuel load. Scheduling of test program activities is accomplished through a project computer program having the test program integrated with construction completion activities. The preoperational test schedule is depicted on Figures 14.2-2a and 2b.

Preoperational and pre-core hot functional testing are the controlling path for about 16 months. An additional six months are devoted to fuel loading, post-core hot functionals, low power physics, and power ascension testing.

The scheduling of individual tests or test sequences is made to ensure that systems and components that are to prevent or mitigate the consequences of postulated accidents are tested prior to fuel loading. Tests that require a substantial core power level for proper performance are performed at the lowest power level commensurate with obtaining acceptable test data. Safety-related systems are tested to provide reasonable assurance that they operate satisfactorily when required, prior to exceeding 25 percent of rated thermal power.

Testing will commence when construction has turned over testable portions of systems. Test procedures will contain a list of prerequisites which will enumerate which tests must be completed and approved prior to the start of a particular test. The use of prerequisites in test procedures ensures that the safety of the plant is not dependent on the performance of untested systems.

Test procedures are ~~normally~~ scheduled to be approved and available for review by NRC inspectors at least 60 days prior to their scheduled performance date, ~~or~~ and for fuel loading and startup test procedures at least ~~90~~ 60 days prior with draft procedures being made available as early as practical.

Q640.3

Question No.

640.4 (14.2.12) Modify the acceptance criteria provided in FSAR Subsection 14.2.12 such that for all tests subject to FSAR Chapter 17 Quality Assurance Program requirements include specific acceptance criteria or a discussion of the sources for the acceptance criteria to be used when test procedures are prepared. This information is necessary for the NRC inspectors who review tests procedures and evaluate test results. The test description should provide "traceability" to acceptance criteria sources such as: other FSAR Subsections, Technical Specifications, topical reports, vendor-furnished test specifications, and/or accident analysis assumptions.

Response Test acceptance criteria will be identified by precedure writers and reviewed by the Test Working Group (TWG). Membership of TWG shall be as described in Section 14.2.2.3. Review of test procedures and acceptance cirteria will be as described in Section 14.2.3.2. Objectives and acceptance criteria are provided by Combustion Engineering Co. (CE) thru test guides/procedures or thru the Architect Engineer's (Ebasco) in the form of test acceptance criteria.

All procedures provided to NRC Region II inspectors for review will contain a section with acceptance criteria and a reference section for source information. Procedures will be made available for review in a timely manner as indicated in response to Question 640.3.

Question No.

640.5 Modify FSAR Subsection 14.2.12.2.29 (Containment Spray System) to state that testing will be conducted to verify that paths for the airflow test of containment spray nozzles overlap the water-flow test paths of the pumps to demonstrate that there is no blockage in the flow path.

Response Subsection 14.2.12.2.29 (Containment Spray System) will be revised to include verification of paths for airflow test of containment spray nozzles overlap the water-flow test paths of the pumps to demonstrate freedom of obstruction from the water tested paths through the nozzles.

14.2.12.2.29 CONTAINMENT SPRAY SYSTEM

1.0 Objective

To functionally check the operation of the Containment Spray System including Iodine Removal Subsystem, pump performance and that the spray nozzles are free from obstruction.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Instrument calibration and component testing is complete.

2.3 Test equipment and instrumentation available and calibrated.

2.4 Support systems available.

3.0 Test Method

3.1 Demonstrate pump recirculation flow to the refueling water tank.

3.2 Demonstrate pump performance.

3.3 Air will be used to demonstrate that the nozzles are not plugged. Air flow-path is to overlap the water-flow test paths of the pumps.

3.4 Demonstrate the flow path from the Chemical Storage Tank to the pump suctions.

3.5 Demonstrate manual and automatic system control.

4.0 Acceptance ~~Test~~ Criteria

4.1 Verify pump performance.

4.2 Verify that the ~~nozzles are clear.~~ discharge lines and nozzles from the water tested paths through the nozzles are free of obstructions.

4.3 Verify the flow path from the Chemical Storage Tank to the pump suction.

Q640.5

Question No.

640.6 (14.2.12) Modify FSAR Subsection 14.2.12.5.1 (Natural Circulation Test) to include a description of the required training and to commit to providing that training for each licensed operator. NUREG-0694, "TMI Related Requirements for New Operating Licenses," Item I.G.1, requires applicants to perform "a special low power testing program approved by NRC to be conducted at power levels greater than 5% for the purposes of providing meaningful technical information beyond that obtained in the normal startup test program and to provide supplemental training". To comply with this requirement, the natural circulation tests must fulfill the following training objective:

Training -- Each licensed reactor operator (RO and SRO who performs RO or SRO duties, respectively) should participate in the initiation, maintenance, and recovery from the natural circulation mode. Operators should be able to recognize when natural circulation has been stabilized and should be able to control saturation margin, RCS pressure, and heat removal rate without exceeding specified operating limits.

Since tests will have been performed at a comparable prototype plant in accordance with CESSAR Subsection 14.2.12.5.1 (Natural Circulation Test), they need be repeated only to the extent necessary to accomplish the above training objectives. Test data should be utilized as feedback for simulator verification/update.

Response The test description of FSAR 14.2.12.5.1 Natural Circulation Testing will be modified to reflect that it is a special training exercise as well as a test. Training objectives will include the operators ability to recognize natural circulation stabilization and ability to control saturation margin, RCS pressure and heat removal.

14.2.12.5.1 NATURAL CIRCULATION TEST

1.0 Objective

train operators in recognizing natural circulation and controlling the plant during

1.1 To ~~evaluate~~ natural circulation flow conditions. 1

2.0 Prerequisites

2.1 The reactor has been operated at powers and times sufficient to provide adequate decay heat (determined later).

2.2 OR The NSSS has been heated to hot standby temperatures using the reactor core or reactor coolant pumps.

2.3 Licensed reactor operators are present at various times during the tests to observe major evolutions and actions taken.

3.0 Test Method

3.1 The reactor coolant pumps are tripped.

3.2 The plant is tripped.

3.3 Steam is drawn from the steam generators, and pressurizer pressure is controlled as necessary.

3.4 Plant parameters indicative of natural circulation conditions are monitored.

4.0 Acceptance Criteria

4.1 Stable natural circulation conditions are established, controlled and recovered from.

4.2 All licensed operators participate.

Q 640.6

Question No.

640.7 (14.2.12) Modify FSAR Subsection 14.2.12.2.30 (Auxiliary Feedwater System) to include the following testing:

1. A 48-hour endurance test on all Auxiliary Feed Water (AFW) system pumps, is such a test or continuous period of operation has not been accomplished to date (to comply with Standard Review Plan Section 14.4.9). Following the 48-hour pump run, the pumps should be shut down the cooled down and then restarted and run for one hours. (Letter to all CE System OL applicants form NRC - D. F. Ross, Dated March 10, 1980).

2. To verify conformance with Item GS-5 of the above referenced letter, the AFW system should be tested for capability to start and operate for two hours under simulated loss of all AC power conditions.

Test acceptance criteria for the above tests should include demonstrating that the pumps remain within design limits with respect to bearing/bearing oil temperatures and vibration, both normal and backup water supply source flowpaths are verified, and that pump room ambient conditions (temperature, humidity) do not exceed environmental qualification limits for safety-related equipment in the room.

Response FSAR Section 14.2.12.2.30 will be revised to include pump and driver endurance testing and demonstration of system operability under a simulated loss of all AC power condition.

14.2.12.2.30 AUXILIARY FEEDWATER SYSTEM

1.0 Objective

To demonstrate the ability of the Auxiliary Feedwater System to supply sufficient feedwater to the Steam Generators for design emergency conditions.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Instrument calibration and component testing is complete.

2.3 Test equipment and instrumentation available and calibrated.

2.4 Support systems available.

3.0 Test Method

3.1 Demonstrate automatic and manual controls.

3.2 Demonstrate pump performance.

3.3 Demonstrate turbine performance.

3.4 Demonstrate capability to cross-connect headers.

3.5 (see below)
3.6 (see below)

4.0 Acceptance Criteria

4.1 Verify that the Auxiliary Feed Pumps provide the required flow to the Steam Generators.

4.2 (see below)
4.3 (see below)

3.5 Demonstrate pump and driver endurance

3.6 Demonstrate system operability on simultaneous loss of all AC power

4.2 Verify that the auxilliary feed pumps can be operated for a period of 48 hours hours then shutdown, cooled down and restarted and run for one hour without bearing oil temperatures, vibrations or pump room ambient conditions exceeding design limits.

4.3 Verify that the Auxiliary feedwater system will start and ~~two~~ operate for two hours on a simulated loss of all AC Power Conditions.

Q 640.7

Question No.

640.8 (14.2.12) Modify FSAR Subsection 14.2.12.2.23 (ECCS Area Ventilation) to provide assurance that the emergency ventilation systems are capabile of maintaining all ECCS equipment within their design temperature range with the equipment operating in a manner that will produce the maximum heat load in the compartment. if it is not practical to produce maximum heat loads in a compartment, describe the methods that will be used to develop acceptance criteira that verify design heat removal capability of the emergency ventilation systems.

Response Testing will not be done with maximum area heat loads as this is not practible. Data taken during the ECCS Area Ventilation test will be extrapolated to verify design heat removal capability. Criteria for evaluation of test data will be based on ASHRE standards and included in the test procedure.

Question No.

640.9 (14.2.12) Modify FSAR Subsection 14.2.12.2.16.3.3 to include a description of the test(s) that will be performed to ensure conformance to Regulatory Guide 1.95, Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release (i.e., testing of control room leakage, testing of monitors, alarms).

Response: FSAR Section 14.2.12.2.16.3.3 will be modified to read:

...including verification of features necessary to assure conformance to Regulatory Guide 1.95.

FSAR Section 14.2.12.2.16.4 will be modified to read:

4.5 Verify leakage rates and automatic features meet requirements of Regulatory Guide 1.95.

14.2.12.2.16 CONTROL ROOM HEATING, VENTILATION AND AIR CONDITIONING

1.0 Objective

To demonstrate proper operation of the Control Room Heating, Ventilation and Air Conditioning (HVAC) System to maintain a habitable condition for personnel and an adequate environmental condition for equipment.

2.0 Prerequisites

2.1 Control Room construction is complete.

2.2 Control Room HVAC system construction is complete.

2.3 System component testing and instrument calibration is complete.

2.4 Support systems are complete.

2.5 Test equipment is properly calibrated and available.

3.0 Test Method

3.1 Demonstrate operation of the equipment.

3.2 Demonstrate operation of the automatic system.

3.3 Demonstrate the system's ability to isolate and maintain the habitability of the Control Room, including verification of features necessary to assure conformance to Reg. Guide 1.95.

3.4 Perform filter testing.

4.0 Acceptance Criteria

4.1 Verify proper operation of the equipment.

4.2 Verify design air flows.

4.3 Verify that with the system isolated habitability can be maintained.

4.4 Verify filter effectiveness.

4.5 Verify leakage rates and automatic features meet requirements of Reg. Guide 1.95

Q640.9

Question No.

640.10 (14.2.12)	Modify and expand FSAR Subsection 14.2.12.2.12 (Loss of Instrument Air) to conform to regulatory position C.8 of Regulatory Guide 1.68.3 (Preoperational Testing of Instrument and Control Air Systems).
Response	FSAR Section 14.2.12.2.12 "Loss of Instrument Air" will be revised as shown on the attached in response to this Question.

14.2.12.2.12 LOSS OF INSTRUMENT AIR

1.0 Objective

To demonstrate proper operation of air operated valves serviced by the Instrument Air System.

2.0 Prerequisites

2.1 Safety-related system valves serviced by the Instrument Air System are operable.

2.2 Instrument Air System operating.

3.0 Test Method

3.1 Place each ~~valve~~ component to be tested in ~~a position opposite to its failed position.~~ its normal operating position

3.2 ~~Isolate Instrument Air to the valves to be tested and vent the header.~~

3.3 Verify that the valves move to the failed position.

3.4 Re-establish Instrument Air to the valves and verify the valves return to their original position.

4.0 Acceptance Criteria

4.1 Verify that the valves tested move to the failed position upon loss of Instrument Air.

4.2 Verify that the indication of valves tested is the actual position.

4.3 Evaluate the list of safety-related system failed valve position to verify that their failed position will render a safe condition of the plant.

3.2 Isolate Instrument Air to as many branches as practicable and vent the Instrument Air header to simulate a sudden pipe break.

3.5 Repeat ~~s~~ test 3.1 thru 3.4 above but isolate the instrument air system and vent the system slowly to simulate a gradual ~~sol~~ loss of pressure.

Q640.10

Question No.

640.11 (14.2.12)

1. Modify FSAR Subsection 14.2.12.2.18 (Diesel Generators and Auxiliary Systems) to include a demonstration of diesel starting ability (design number of diesel starts) with the design minimum quantity of starting air available.

2. FSAR Subsection 14.2.7.10 (Conformance to Regulatory Guide 1.108 - Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants) states that the WNP-3 test program generally conforms to the requirements of Regulatory Guide 1.108. List and provide appropriate technical justification for any tests described in Regulatory Guide 1.108, part C.2.a (1-9) which will not be performed as part of the Diesel Generator and Auxiliary Systems preoperational test or as prerequisite to the test.

3. Modify FSAR Subsection 14.2.12.2.18 (Diesel Generator and Auxiliary Systems) and/or FSAR Subsection 14.2.12.2.17 (Component Cooling Water) to include testing to ensure the satisfactory operability of all check valves in the flow path of cooling water for the diesel generators from the intake to the discharge (see IE Bulletin No. 83-03: Check Valve Failures in Raw Water Cooling Systems of Diesel Generators).

Response

1. The demonstration of the ability of the starting air system to start the Diesel a minimum number of times with the design minimum quantity of air available was carried out successfully, and witnessed, at the manufacturers shop.

2. Table 1.8-1 of the WNP-3 FSAR provides a commitment to Regulatory Guide 1.108, Rev. 1 with no exceptions.

3. The component cooling water system piping to the Diesel Generators has no check valves. The Diesel coolers are isolated by automatic isolation valves. When a Diesel Generator start signal is received, the automatic isolation valve opens. FSAR Subsection 14.2.12.2.18 will be revised to address the requirements for testing of these isolation valves.

14.2.12.2.18 DIESEL GENERATORS AND AUXILIARY SYSTEMS

1.0 Objective

The purpose of this test is to demonstrate that the Diesel Generators are properly installed adequately sized and perform their intended function.

2.0 Prerequisites

2.1 Construction is complete on the Diesel Generators and auxiliary equipment.

2.2 Construction is complete on all support systems.

2.3 Instrument calibration and component testing is complete.

2.4 Test instrumentation is available and calibrated.

3.0 Test Method

3.1 Demonstrate the alarm and safety features.

3.2 Demonstrate that each unit can carry design load and is capable of load rejection.

3.3 Demonstrate that each unit is capable of starting and loading within specifications.

3.4 Demonstrate that each unit is capable of carrying full load while maintaining operating parameters within design limits.

3.5 Demonstrate that the Fuel Oil Transfer System meets the requirements for specified fuel availability.

3.6 Demonstrate proper operation of automatic opening of the cooling water isolation valves

4.0 Acceptance Criteria

4.1 Verify that all alarms and safety features operate as designed.

4.2 Verify that each unit can carry the design load and is capable of load rejection.

4.3 Verify that each unit is capable of starting and loading within the design specifications.

4.4 Verify that each unit is capable of carrying full load while maintaining operating parameters within design limits.

4.5 Verify that the Fuel Oil Transfer System meets the requirements for the specified fuel availability.

Q640.11

Question No.

640.12 (14.2.12)

1. Modify existing or provide new test abstracts which address the test requirements listed in Regulatory Guide 1.41 (Preoperational Testing of Redundant On-Site Electric Power Systems to Verify Proper Load Group Assignments), Positions C.1 and C.3. This should include a modification of FSAR Subsection 14.2.12.2.4 (Essential 125VDC) to incorporate testing to verify that at the minimum design battery voltage, required Class IE systems can be started and operated.

2. Modify FSAR Subsection; 14.2.12.2.1.3.3 (Standby Transformers ST2A and ST2B) to demonstrate the proper operation of transformer cooling under rated load or describe how data from testing under available load will be used to verify cooling capability under design loading.

Response

1. With respect to verification of Load Group assignments the following will be added to FSAR Section 14.2.12.2.4.4.5:

> "To insure independence of Essential 125VDC power sources monitor redundant dc buses and related loads not under test to verify absence of voltage at these buses."

The Supply System does not agree that Regulatory Guide 1.41 recommends testing to verify that Class IE Systems can be started and operated at minimum design battery voltage.

However, we do feel that reasonable assurance can be achieved by verifying that equipment has been specified and procured to operate at the minimum Design DC voltage.

Accordingly, the following will be added to Section 14.2.12.2.4.3.6:

> "Verify individual equipment specifications require DC loads to start and operate at minimum design level voltage."

and Section 14.2.12.4.4.6:

> "Design DC low voltage limit is within the specified operating parameters for individual DC load groups."

2. The Supply System can find no requirement for testing the cooling capability (FA/FO/FOA) of these transformers under design loading conditions.

These Transformers were tested at the factory by the Manufacturer in accordance with industry standards. Following installation, the Contractor tested the functional operability of thermal relays (OPEN/CLOSE) at their preset temperature values. During Startup testing, the correct functional operation (OFF/ON, correct direction of rotation, etc) of oil pumps and cooling pumps will be verified, prior to Transformer Energization.

14.2.12.2.4 ESSENTIAL 125V DC

1.0 Objective

To demonstrate that the 125V dc System provides reliable power for the safe shutdown of the Plant and to verify that the four power sources are separate from each other.

2.0 Prerequisites

2.1 Construction completed on components to be tested.

2.2 Meters and relays calibrated.

2.3 Batteries fully charged and electrolyte at its normal height and proper specific gravity.

2.4 Loads available for a battery capacity test.

2.5 Battery Room ventilation available.

2.6 Appropriate ac and dc power available.

2.7 Construction complete on safety-related equipment that is supplied by the battery to perform an integrated system test.

2.8 Component testing completed.

3.0 Test Method

3.1 Battery and charger performance will be verified in all modes.

3.2 Alarms and tripping devices will be tested.

3.3 Transfer devices will be tested.

3.4 The battery capacity will be measured during a discharge test with the chargers disconnected.

3.5 The ground detectors will be checked.

3.6 Verify individual equipment specifications require DC loads to start and operate at minimum Design level Voltage.

Q640.12

4.0 ACCEPTANCE CRITERIA

4.1 That any three of the four, or selective two out of four batteries (A-SA and C-SC or B-SB and D-SD) can supply sufficient Class IE dc power to achieve safe reactor shutdown.

4.2 That the eight hour load profile verifies design.

4.3 That when the chargers are carrying normal steady state dc loads during any mode of plant operation they can simultaneously recharge the battery from 1.75 volts to 2.25 volts per cell within seven hours.

4.4 In the case of failure of one of the two chargers, the remaining charger is capable of carrying the normal dc load and recharging the battery within 17.25 hours.

4.5 To insure indepence of essential 125VDC powersources monitor redundant DC buses and related loads not under test to verify absence of voltage at these buses.

4.6 Design DC voltage limit is within the specified operating parameters for the individual DC load groups.

Q640.12

Question No.

640.13 (14.2.12) FSAR Subsection 8.3.2.1.2 (Class IE batteries) states that the batteries shall be capable of supplying power to safely shutdown the station and/or limit the consequences of a design base accident without recharging for a period of 8 hours. Modify FSAR Subsection 14.2.12.2.2.4.3 (Emergency Lighting) to demonstrate the emergency lighting system capability to function for 8 hours in accordance with FSAR Section 9.5.3.1.3.

Response

1. Modify FSAR paragraph 14.2.12.2.2.4.3 to read as follows:

   "Upon loss of offsite power, illumination in the Control Room and remote shutdown room shall be provided automatically by the DC Emergency Lighting System powered by Class IE batteries. Automatic transfer to the Emergency AC Lighting System shall occur during the sequential loading (Load Group) of the standby diesel generators".

2. Add new FSAR paragraph 14.2.12.2.2.4.4:

   "In plant areas other than the Control Room and remote shutdown room, the DC Emergency Lighting System shall, upon loss of normal lighting, provide illumination for a minimum of eight (8) hours from self-contained storage battery lighting fixtures."

14.2.12.2.2 EMERGENCY LIGHTING

1.0 Objective

To demonstrate the transfer capability from normal lighting to emergency lighting, and verify the adequacy of the lighting provided.

2.0 Prerequisites

2.1 Construction activities completed on the items to be tested.

2.2 The normal lighting and emergency lighting systems are operational.

3.0 Test Method

3.1 Emergency lighting transfer capability shall be tested by de-energizing the applicable lighting circuits.

3.2 Performance of the lighting fixtures shall be monitored to verify their functional capability.

3.3 Lighting intensity levels in the Control Room shall be measured.

4.0 Acceptance Criteria

4.1 Upon the loss of normal lighting the emergency lighting system shall be energized automatically.

4.2 The lighting level in the Control Room shall be 125 foot-candles with Emergency ac Lighting.

4.3 ~~The emergency dc lighting system shall be capable of supplying adequate lighting for 10 seconds until the diesel generators are operating.~~ Upon loss of offsite power, illumination in the Control Room and remote shutdown shall be provided automatically by the DC Emergency Lighting System powered by Class 1E batteries. Automatic transfer to the Emergency AC Lighting System shall occur during the sequential loading of the stand-by diesel generators.

4.4 In plant areas other than the control room and remote shutdown room the DC Emergency Lighting System shall, upon loss of normal lighting, provide illumination for a minimum of eight (8) hours from self-contained storage battery lighting fixtures.

Q640.13

Question No.

640.14 Our review of your test program description disclosed that the operability of several of the systems and components listed in Regulatory Guide 1.68 (Revision 2) Appendix A may not be adequately demonstrated by your initial test program. Expand FSAR 14.2.12 to address the following items:

NOTE: Inclusion of a test description in FSAR Chapter 14 does not necessarily imply that the test becomes subject to FSAR Chapter 17 Quality Assurance Program controls. Certain tests to be performed prior to fuel loading to verify system operability may be referred to as "acceptance tests" to distinguish them from "preopertional tests" subject to FSAR Chapter 17 test control.

Preoperational Testing

1.e(7) Main condenser hotwell level control system.

1.e(8) Condensate system.

1.e.(10) Feedwater heater and drain systems.

1.e.(12) Condenser air evacuation system.

1.f(1) Station service water system.

1.f(2) Cooling towers and associated auxiliaries.

1.h.(10) Ultimate heat sink.

1.j(5) Reactor coolant system leak detection systems.

1.j(6) Loose parts monitoring systems.

1.j(7) Leak detection systems used to detect failures in ECCS and containment recirculating spray systems located outside containment.

1.j(16) Hotwell level control systems.

1.j(22) Expand the preoperational test phase such that the following instrumentation used to track the course of postulated accidents is tested:

a) containment wide range pressure indicators.

b) containment sump level monitors.

c) humidity monitors.

Question No.

640.14 (Cont'd)

1.j(25) Process computers.

1.k(2) Personnel monitors and radiation survey instrument tests.

1.k(3) Laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations.

1.k(4) HEPA filter and charcoal adsorber efficiency and in-place leak tests. Modify the appropriate test abstracts to ensure that testing in accordance with Regulatory Guide 1.52 (Design, Testing, and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants), Positions C.5.a - C.5.d, and Regulatory Guide 1.140 (Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants), Positions C.5.a - C.5.d, is accomplished.

1.l(4) Isolation features for steam generator blowdown.

1.l(7) Modify FSAR Subsection 14.2.12.2.22 (Radioactive Water Systems) to include demonstration of the isolation features for liquid radwaste effluent systems.

1.m(1) Spent fuel pit cooling system tests, including the teting of antisiphon devices, high radiation alarms, and low water level alarms.

1.m(3) Operability and leak tests of sectionalizing devices and drains and leak tests of gaskets or bellows in the refueling canal and fuel storage pool.

1.m(6) Irradiated fuel pool or building ventilation system tests.

1.n(2) Closed loop cooling water system.

1.n(7) Fire protection systems. Modify FSAR Subsection 14.2.12.2.9 (Fire Protection) to include demonstration of fire protection systems in addition to water; e.g., Halon, Carbon Dioxide, AFFF.

Question No.

640.14 (Cont'd)

1.n(9) Vent and drain systems for contaminated or potentially contaminated systems serving essential areas, e.g., spaces housing diesel generators, essential electrical equipment, and essential pumps.

1.n(13) Communications Systems - Expand FSAR Subsection 14.2.12.2.15 (Communications) to include all communicaions systems, see requirements given in 10 CFR 50 Appendix E.IV.E, IE Bulletin No. 80-15, Generic Letter 82-33, and Branch Technical Position CMEB 9.5-1 Position C.5.g.(4).

1.n(14)(e) Heating, cooling, and ventilation systems serving reactor auxiliary buildings, reactor bulding, and turbine building.

1.n(16) Cooling and heating systems for the refueling water storage tank.

1.n(18) Heat tracing and freeze protection systems.

Low Power Testing

4.f. Neutron and gamma radiation surveys.

4.j. Demonstration of the capability of primary containment ventilation system to maintain the containment environment and important components in the containment within design limits with the reactor coolant system at rated temperature and with the minimum availability of ventilation system components for which the system is designed to operate.

4.n. Demonstration of the operability of control room computer system.

Power Ascension Tests

5.n. Obtain baseline data for reactor coolant system loose parts monitoring system, if not previously done.

5.r. Verify by review and evaluation of printouts and/or cathode ray tube (CRT) displays that the control room process computer is receiving correct inputs from process variable, and validate that performance calculations performed by the computer are correct at 25%, 50%, 75% and 100% power.

Question No.

640.14 (Cont'd)

5.w. Provide a preoperational test description to test containment penetration coolers. On those penetrations where coolers are not used, provide a startup test description that will demonstrate that concrete temperatures surrounding hot penetrations do not exceed design limits.

5.x. Demonstrate adequate beginning-of-life performance margins for auxiliary systems required to support the operation of engineered safety features or to maintain the environment in spaces that house engineered safety features to provide assurance that the engineered safety features will be capable of performing their design functions over the range of design capability of operable components in these auxiliary systems at 50% and 100% power.

5.b.b Conduct neutron and gamma radiation surveys to establish the adequacy of shielding and to identify high radiation zones as defined in 10CRF 20, "Standards for Protection Against Radiation" at 50% and 100% power.

<u>Response</u> The following addresses items referred to in the text of NRC Question 640.14.

640.14 (14.2.12) <u>Preoperational Testing</u>

1.e(7) and 1.j(16)	See new test abstract Subsection 14.2.12.9.1 for "Low Pressure Condensate" which includes main condenser hotwell level control system.
1.e(8)	See new test abstract Subsection 14.2.12.9.2 for "High Pressure Condensate." In combination with Subsection 14.2.12.9.1, the condensate system is complete.
1.e(10)	See new test abstract Subsections 14.2.12.9.3 and 14.2.12.9.4 titled "Heater Drain Pumps - Initial Operation" and "Heater Drains and Vents".
1.e(12)	See new test abstract Subsection 14.2.12.9.5 titled "Air Evacuation".
1.f(1) and 1.f(2)	See new test abstract Subsection 14.2.12.9.6 titled "Circulating Water".
1.h(10)	See revised Subsection 14.2.12.2.17 titled "Component Cooling Water".
1.j(5)	There is no one system used for Reactor Coolant Leak Detection. Leakage is monitored and measured by a combination of systems. The leakage monitoring features will be tested within the conduct of their individual system testing.
1j(7)	There is no specific leak detection system to monitor ECCS and containment recirculating spray systems located outside containment, this monitoring will be done by the monitoring of various portions of different systems, and those portions will be tested with their respective system.
1.j(6)	See new test abstract Subsection 14.2.12.2.39 titled "Loose Parts Monitor".
1.j(16)	See item 1.e(7)
1.j(22)	Items a, b and c will be tested within the conduct of their individual system lineup testing.
1.j(25)	See new test abstract Subsection 14.2.12.2.40 titled Process Computers".

Q640.14

Response (Cont'd)

1.k(2)	See new Subsection 14.2.12.2.41 "Personnel Monitor and Survey Instruments".
1.k(3)	See new Subsection 14.2.12.2.42 "Laboratory Equipment".
1.k(4)	HEPA filter and charcoal adsorber efficiency and in-place leak tests are covered by "Test Method" items found in abstract Subsections of 14.2.12.2 Ventilation Systems. Individual test procedures which will be submitted to the NRC at least 60 days prior to performance of the tests will expand the abstracts to "Demonstrate proper operation of filtration systems" to satisfy Reg. Guides 1.52 and 1.140.
1.1(4)	See new test abstract Subsection 14.2.12.9.7 titled "Steam Generator Blowdown".
1.1(7)	See revised Subsection 14.2.12.2.22 titled "Radioactive Waste Systems".
1.m(1) and 1.m(3)	See revised Subsection 14.2.12.2.24 titled "Fuel Pool Cooling and Cleanup".
1.m(6)	See new test abstract Subsection 14.2.12.2.43 titled "Fuel Building HVAC".
1.n(2) and 1.n(7)	See revised Subsection 14.2.12.2.9 titled "Fire Protection".
1.n(9)	Vents and drains for various contaminated or potentially contaminated systems will be tested with their respective systems.
1.n(13)	See revised Subsection 14.2.12.2.15 titled "Communications".
1.n(14)(e)	See new test abstracts 14.2.12.2.44 titled "RAB Main Ventilation", 14.2.12.2.46 titled "Reactor Cavity Cooling Fans", 14.2.12.2.47 titled "CEDM Cooling Fans", and 14.2.12.9.8 titled "Turbine Building Ventilation".
1.n(16)	The refueling water storage tank (RWT) has no cooling system and is heated using electric heaters which will be tested using an individual component test.

Q640.14

Response (Cont'd)

1.n(18) Heat tracing and freeze protection systems will be tested in conjunction with the systems protected. Boric Acid and Caustic systems requiring heat tracing will have heat tracing component tested prior to system solution fill.

Low Power Testing

4.f See CESSAR-F Subsection 14.2.12.4.1.

4.j See new test abstracts Subsection 14.2.12.2.45, 14.2.12.2.46 and 14.2.12.2.47. Testing will be done with reactor at full temperature and pressure

4.n See new test abstract Subsection 14.2.12.2.40.

Power Ascension Tests

5.n See new test abstract Subsection 14.2.12.2.39.

5.r These items will be tested under CESSAR-F Subsection 14.2.12.5.15 test abstract titled "Intercomparison of PPS, Core Protection Calculator (CPC) and PMS Inputs". Power levels at which tests will be performed are Standard CE levels of 20, 50, 80 and 100%.

5.w Penetration room coolers will be tested under new test abstract Subsection 14.2.12.2.44 titled "RAB Main Ventilation", and 14.2.12.5.2 titled "Containment Penetrations Temperature Survey".

5.x See response to Question 640.8.

5.b.b See CESSAR-F Subsection 14.2.12.5.10.

The FSAR will be amended as shown to reflect this response to NRC Question 640.14.

Question 640.14
Response to
Items 1.e(7) & 1.e(8)

14.2.12.9.1 Low Pressure Condensate

1.0 Objective

To demonstrate the proper operation of the low pressure condensate system including hotwell level control.

2.0 Prerequisites

2.1 Construction activities complete.

2.2 Component testing and instrumentation calibration are complete.

2.3 Support Systems available.

2.4 Test equipment and instrumentation available and calibrated.

3.0 Test Method

3.1 Demonstrate system flow requirements.

3.2 Demonstrate hotwell level control by varying hotwell level through its range and observing control valves.

3.3 Demonstrate equipment operation.

3.4 Demonstrate minimum flow requirements.

4.0 Acceptance Criteria

4.1 Verify hotwell level can be maintained automatically.

4.2 Verify system flow and pressure requirements are met.

Question 640.14
Response to
Item 1.e(8)

14.2.12.9.2 High Pressure Condensate
AT-42C

1.0 Objective

To demonstrate the proper operation of the high pressure condensate system.

2.0 Prerequisites

Same as prereqs on page 1.

3.0 Test Method

3.1 Demonstrate system flow requirements to supply high pressure condensate to the suction of the feedwater pumps.

3.2 Demonstrate minimum flow requirements.

4.0 Acceptance Criteria

4.1 Verify system flow and pressure requirements are met.

Question 640.14
Response to
Item 1.e(10)

14.2.12.9.3 Heater Drain Pumps - Initial Operation
AT-57-1

1.0 Objective

To demonstrate the proper operation of the heater drain pumps.

2.0 Prerequisites

Same as page 1.

3.0 Test Method

3.1 Demonstrate that the heater drain pumps, through flow verification, meet minimum flow characteristics.

3.2 Demonstrate that minimum flow requirements are met by proper operation of minimum flow valves.

4.0 Acceptance Criteria

4.1 Verify that the heater drain pumps meet design pressure and flow characteristics meet design.

Question 640.14
Response to
Item 1.e(10)

14.2.12.9.4 Heater Drains and Vents
AT-57-2

1.0 Objective

To demonstrate the proper operation of the feedwater heater level control system.

2.0 Prerequisites

Same as page 1.

3.0 Test Method

3.1 Demonstrate feedwater heater level control valves operate to maintain heater levels in their normal band.

3.2 Demonstrate equipment operation.

4.0 Acceptance Criteria

4.1 Verify feedwater heater levels are maintained within their normal band.

Question 640.14
Response to
Item 1.e(12)

14.2.12.9.5 Air Evacuation
AT-84

1.0 Objective

To demonstrate the capability of the condenser air evacuation system to pull and maintain a condenser vacuum.

2.0 Prerequisites

Same as page 1.

3.0 Test Method

3.1 Demonstrate that the air evacuation system will pull and maintain a condenser vacuum with the condenser being in a normal operating lineup.

3.2 Demonstrate equipment operation.

4.0 Acceptance Criteria

4.1 Verify that the air evacuation system will pull and maintain a condenser vacuum under design requirements.

Question 640.14
Response to
Item 1.f(1) & (2)

14.2.12.9.6 Circulating Water
AT-26

1.0 Objective

To demonstrate the proper operation of the circulating water system including cooling tower.

2.0 Prerequisites

Same as page 1.

3.0 Test Method

3.1 Demonstrate equipment operation.

4.0 Acceptance Criteria

4.1 Verify nominal head and flow characteristics fc circulating and auxiliary circulating water pumps meet design.

4.2 Verify pump and dischrge valve interlocks function satisfactorily.

item 1h(1c)

14.2.12.2.17 COMPONENT COOLING WATER

1.0 Objective

To demonstrate capability of the Component Cooling Water System to provide cooling water to the various components, and the ability to dissipate heat through the dry cooling towers.

2.0 Prerequisites

2.1 Construction activities to the various systems requiring Component Cooling Water are complete.

2.2 Component Cooling Water System construction is complete.

2.3 Component testing and instrument calibration is complete.

2.4 Test equipment available and calibrated as required.

3.0 Test Method

3.1 Demonstrate adequate flow to components supplied with Component Cooling Water.

3.2 Demonstrate proper operation of surge tank controls.

3.3 Demonstrate that the non-essential header isolates from the essential header on an SIAS actuation.

3.4 Demonstrate operation of the Dry Cooling Tower fans.

4.0 Acceptance Criteria

4.1 Verify that Component Cooling Water flows meet design conditions.

4.2 Verify proper surge tank operation.

4.3 Verify that the non-essential header isolates on a SIAS.

4.4 Verify that the Component Cooling Water flow to each component meets design conditions.

4.5 Verify that the dry Cooling Tower fans operate automatically following a simulated LOCA with and without Loss of off site power.

Q640.14

Question 640.14
Response to
Item 1.j(6)

14.2.12.2.39 Loose Parts Monitor

1.0 Objective

To demonstrate the ability of the loose parts monitor system to detect, alarm and record unusual noises detected within the primary system.

2.0 Prerequisites

2.1 Construction activities completed.

2.2 Component testing and instrumentation calibration are complete.

2.3 Test equpment and instrumentation available and calibrated.

3.0 Test Method

3.1 Inject various strength test signals at the sound pickup devices.

3.2 Monitor system response to test signals.

4.0 Acceptance Criteria

4.1 Verify system detects, alarms and records whei triggered by sounds of various magnitudes.

Question 640.14
Response to
Item 1.j(25)

14.2.12.2.40 Process Computer

1.0 Objective

To verify that all system hardware is installed and operating properly, and that all system software responds correctly to external inputs, and provides proper outputs to the computer peripheral equipment.

2.0 Prerequisites

2.1 All construction activities are complete.

2.2 All required test instrumentation is calibrated and available.

2.3 Support systems required for the process computer are available.

3.0 Test Method

3.1 Test programs will be run to verify all required hardware functions.

3.2 Input signals will be applied and outputs verified.

3.3 Computer functional programs shall be verified using proper software and/or control panel inputs.

3.4 Alarm and indication functions shall be verified by the computer system instrumentation and/or the external test measurements.

4.0 Acceptance Criteria

4.1 Verify the process computer meets all design requirements.

Question 640.14
Response to
Item 1.k(2)

14.2.12.2.41 Personnel Monitor and Survey Instruments

Personnel monitoring and survey instruments are calibrated and operated in accordance with written, reviewed, and approved plant procedures. Where applicable, instruments are calibrated against NBS traceable radiation sources. Each calibrated instrument is tagged with a calibration label showing instrument type, serial number, calibration date and due date, and individual who performed the calibration. Instruments that do not meet the established acceptance criteria are tagged with a non-conforming label that shows the date and identifies the person who removed the instrument from service.

Question 640.14
Response to
Item 1.k(3)

14.2.12.2.42 Laboratory Equipment

Laboratory equipment used to analyze for radionuclides is calibrated and operated in accordance with written, reviewed, and approved plant procedures. Calibrations are performed with NBS-supplied or traceable standards. Laboratory counting equipment capabilities will be verified by successfully analyzing the NRC-supplied Laboratory Qualification Standards.

item 1 l(7)

14.2.12.2.22 RADIOACTIVE WASTE SYSTEMS

1.0 Objective

To demonstrate proper operation of the Solid and Liquid Waste and Floor Drain Systems.

2.0 Prerequisites

2.1 Construction activities complete.

2.2 Component testing and instrumentation calibration are completed.

2.3 Support systems available.

2.4 Test equipment and instrumentation available and calibrated.

3.0 Test Method

3.1 Demonstrate system flow paths.

3.2 Demonstrate manual and automatic controls.

3.3 Demonstrate equipment operation.

3.4 Demonstrate effluent isolation on a high activity signal.

4.0 Acceptance Criteria

4.1 Verify flow paths.

4.2 Verify equipment operation meets design specifications, to the extent practicable.

4.3 Verify System effluent isolates on a high activity level.

Q640.14

Question 640.14
Response to
Item 1.1(14)

14.2.12.9.7 Process Computer

1.0 Objective

To verify that all system hardware is installed and operating properly, and that all system software responds correctly to external inputs, and provides proper outputs to the computer peripheral equipment.

2.0 Prerequisites

2.1 All construction activities are complete.

2.2 All required test instrumentation is calibrated and available.

2.3 Support systems required for the process computer are available.

3.0 Test Method

3.1 Test programs will be run to verify all required hardware functions.

3.2 Input signals will be applied and outputs verified.

3.3 Computer functional programs shall be verified using proper software and/or control panel inputs.

3.4 Alarm and indication functions shall be verified by the computer system instrumentation and/or the external test measurements.

4.0 Acceptance Criteria

4.1 Verify the process computer meets all design requirements.

item 14m(1) 4 14m(3)

14.2.12.2.24 FUEL POOL COOLING AND CLEANUP

1.0 Objective

To demonstrate the ability of the Fuel Pool Cooling and Cleanup System to satisfy performance requirements.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Instrument calibration and component testing is completed.

2.3 Test equipment and instrumentation available and calibrated.

2.4 Support systems available.

2.5 Spent Fuel Pool and Reactor Vessel Cavity leak testing completed.

3.0 Test Method

3.1 Demonstrate system flow paths.

3.2 Demonstrate equipment operation including antisiphon protection, high radiation alarms and low water level alarms.

3.3 (see below)

4.0 Acceptance Criteria

4.1 Verify system flow paths.

4.2 Verify system equipment meets design specifications.

4.3 Verify system integrity.

3.3 Demonstrate operability and perform leak tests of gate and expandable seal sectionalizing devices in the spent fuel pool.

Q640.14

Question 640.14
Response to
Item 1.m(6)

14.2.12.2.43 FUEL BUILDING HVAC
(PT-61B)

1.0 Objective

To demonstrate the operation of the fuel building HVAC system.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Component testing and instrumentation calibration is complete.

2.3 Test equipment and instrumentation is available and properly calibrated.

2.4 Support systems available.

3.0 Test Method

3.1 Demonstrate automatic operation of system on a high activity level.

3.2 Demonstrate equipment operation.

3.3 Perform filter testing.

4.0 Acceptance Criteria

4.1 Verify system isolates and goes into a recirculation mode on a high activity level.

4.2 Verify system maintains proper design pressures within the fuel building.

items 1a(2)&(7)

14.2.12.2.9 FIRE PROTECTION

1.0 Objective

To demonstrate proper operation of the Fire Protection System in the detection, containment and extinguishing of fires in safety-related areas of the Plant.

2.0 Prerequisites

2.1 Construction is completed.

2.2 Component testing and instrumentation calibration is complete.

2.3 Test equipment and instrumentation available and properly calibrated.

2.4 Support systems available.

3.0 Test Method

3.1 Demonstrate the proper operation of the Fire Detection System.

3.2 Demonstrate the proper operation of the Fire Water System.

3.3 Demonstrate various flow paths.

3.4 Demonstrate operation of alarms, indicating instruments and status lights.

3.5 Demonstrate operation of chemical Fire protection systems

4.0 Acceptance Criteria

Verify that the system operates as designed.

Q 640.14

item 1n(13)

14.2.12.2.15 COMMUNICATIONS

1.0 Objective

To demonstrate ~~that communications between vital areas can be maintained.~~ the operation of offsite and onsite Communications systems.

2.0 Prerequisites

2.1 Construction on the Communications System is complete.

2.2 Plant equipment that contributes to ambient noise, to the extent practicable, is operating.

3.0 Test Method

3.1 Demonstrate the proper operations of the plant paging, phone, sound powered and fueling/refueling systems.

3.2 Demonstrate the proper operation of the fire and evacuation alarms.

3.3 Demonstrate the proper operation of two-way radio and microwave systems.

3.4 Demonstrate the proper operation of the "Hot Line" to the NRC

4.0 Acceptance Criteria

4.1 Verify that all phone and alarm systems operate correctly.

4.2 Verify, as applicable, backup power supplies operate properly.

Q 640.14

Question 640.14
Response to
Item 1.n(14)(e)

14.2.12.2.44 RAB MAIN VENTILATION (PT-47)

1.0 Objective

To demonstrate the operation of the RAB Main Ventilation System.

2.0 Prerequisites

2.1 Construction is complete.

2.2 System testing and instrument calibration is complete.

2.3 Support systems are available.

2.4 Test equipment is properly calibrated and available.

3.0 Test Method

3.1 Demonstrate operation of equipment.

3.2 Demonstrate operation of automatic operations.

3.3 Perform filter testing.

4.0 Acceptance Criteria

4.1 Verify proper operation of equipment.

4.2 Verify design flow rates.

4.3 Verify filter effectiveness.

4.4 Verify automatic isolation signals.

4.5 Verify the system will maintain equipment at design temperature.

Question 640.14
Response to
Item 4.j and 1.n(14)(e)

14.2.12.2.45 CONTAINMENT RECIRCULATION FANS

1.0 Objective

To demonstrate the Containment Recirculation units can maintain the containment atmosphere within design specification.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Component testing and instrument calibration is complete.

2.3 Test equipment and instrumentation available and properly calibrated.

2.4 Support systems are available.

2.5 The reactor is at full temperature and pressure.

3.0 Test Method

3.1 Demonstrate the system can maintain containment atmospheric temperature within design limits with minimum required equipment.

4.0 Acceptance Criteria

4.1 Verify system will maintain containment atmospheric design limits.

Question 640.14
Response to
Item 4.j and 1.n(14)(e)

14.2.12.2.46 REACTOR CAVITY COOLING FANS

1.0 Objective

To demonstrate the Reactor Cavity Cooling Fans can maintain equipment temperatures within the design limits.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Component testing and instrument calibration is complete.

2.3 Test equipment and instrumentation available and calibrated.

2.4 Support systems are available.

2.5 The reactor is at full temperature and pressure.

3.0 Test Method

3.1 Demonstrate the system can maintain equipment cooled by the Reactor Cavity Cooling Fans within design temperature limits.

4.0 Acceptance Criteria

4.1 Verify the system can maintain the design temperature for the designated equipment that it cools with minimum design fans operating.

Question 640.14
Response to
Item 4.j and 1.n(14)(e)

14.2.12.2.47 CEDM COOLING FANS

1.0 Objective

To demonstrate that the CEDM Cooling Fans will maintain the CEDM's within design temperature limits.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Component testing and instrumentation calibration is complete.

2.3 Test equipment and instrumentation is available and calibrated.

2.4 Support systems are available.

2.5 The reactor is at full temperature and pressure.

3.0 Test Method

3.1 Demonstrate the CEDM Cooling Fans can maintain the CEDM's within design temperature limits.

4.0 Acceptance Criteria

4.1 Verify the system can maintain the CEDM's within design temperature limits with minimum design CEDM fans operating.

Question 640.14
Response to
Item 4.n(14)(e)

14.2.12.9.8 TURBINE BUILDING VENTILATION

1.0 Objective

To demonstrate the Turbine Building ventilation system.

2.0 Prerequisites

2.1 Construction is complete.

2.2 Component testing and instrumentation calibration is complete.

2.3 Test equipment and instrumentation is available and properly calibrated.

2.4 Support systems are available.

3.0 Test Method

3.1 Demonstrate equipment operation.

3.2 Demonstrate flow rates.

4.0 Acceptance Criteria

4.1 Verify design flow rates.

4.2 Verify filtration systems.

Question 640.14
Response to
Item 5.w

14.2.12.5.2 CONTAINMENT PENETRATIONS TEMPERATURE SURVEY

1.0 Objective

To ensure that containment penetration concrete temperatures do not exceed maximum allowable design temperature.

2.0 Prerequisites

2.1 Reactor power is stable at desired level.

2.2 Test equipment is properly installed and calibrated.

3.0 Test Method

3.1 Temperatures will be taken next to containment penetrations that have hot process lines running through them.

4.0 Acceptance Criteria

4.1 Demonstrate that penetration concrete temperature does not exceed maximum allowable design temperature.

Question No.

640.15 (14.2.12) To help facilitate approval of changes to the Initial Test Program:

1. For portions of any preoperational tests (including review and approval of test results) which are intended to be conducted after fuel loading: (1) list each test; (2) state what portions of each test will be delayed until after fuel loading; (3) provide technical justification for delaying these portions; and (4) state when each test will be completed.

2. List and provide technical justification for any tests or portions of tests described in FSAR Chapter 14 which you believe should be excepted from the license condition requiring prior NRC notification of major test changes to tests intended to verify the proper design, construction, or performance of systems, structures, or components important to safety (fulfill GDC functions and/or are subject to 10 CFR 50 Appendix B QA requirements).

Response

1. By definition, as found in Subsection 14.2.1.2(b), preoperational tests are conducted prior to fuel loading. No tests within the preoperational test schedule are intended to be delayed for conduct beyond fuel loading.

2. There are no tests or portions of tests described in FSAR Chapter 14 which are believed to require exception "from a license condition requiring prior NRC notification of major test changes to tests intended to verify the proper design, construction, or performance of systems, structures or components important to safety".