Pacific Gas and Electric Company®

James R. Becker
Site Vice President

Diablo Canyon Power Plant
Mail Code 104/6
P. O. Box 56
Avila Beach, CA 93424

805.545.3462
Internal: 691.3462
Fax: 805.545.6445

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PG&E Letter DCL-11-124

U.S. Nuclear Regulatory Commission
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10 CFR 50.90

Diablo Canyon Units 1 and 2
Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Standard Review Plan Comparison Tables for License Amendment Request 11-05, "Evaluation Process for New Seismic Information and Clarifying the Diablo Canyon Power Plant Safe Shutdown Earthquake"

References:

1) PG&E Letter DCL-11-097, "License Amendment Request 11-05, 'Evaluation Process for New Seismic Information and Clarifying the Diablo Canyon Power Plant Safe Shutdown Earthquake,'" dated October 20, 2011

2) NRC letter, "Summary of June 20, 2011, Pre-licensing Meeting with Pacific Gas and Electric Company on Proposed License Amendment for a New Seismic and Design Evaluation Process (TAC Nos. ME5033 and ME 5034)," dated July 29, 2011

In Pacific Gas and Electric Company (PG&E) Letter DCL-11-097 (Reference 1), PG&E submitted a license amendment request (LAR) to: (1) clearly define an evaluation process for newly identified seismic information and incorporate ongoing commitments associated with the Long Term Seismic Program (LTSP) into the Final Safety Analysis Report Update; and (2) clarify, consistent with the NRC Supplemental Safety Evaluation Report 7, that the 1977 Hosgri earthquake is the equivalent of Diablo Canon Power Plant's safe shutdown earthquake, as defined in 10 CFR 100, Appendix A.

Prior to submitting DCL-11-097, the NRC Staff conducted the last of four pre-licensing public meetings (Reference 2) with PG&E on June 20, 2011. The Staff requested that:

> *...the amendment needed to describe where the methodologies and acceptance limits used in the evaluation of structures and components for the HE are deviating from the applicable provisions in the Standard Review Plan (SRP).*

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...a table providing the deviations from the SRP for the HE should be provided with this LAR.

PG&E had a follow-up call with the Staff on June 29, 2011, to discuss inclusion of SRP comparison tables. Diablo Canyon Power Plant (DCPP) was not licensed pursuant to 10 CFR 100 and is not by this submission committing to any part of 10 CFR 100. PG&E prepared the comparison tables provided as Enclosure 1 to this letter only to respond to the NRC Staff request. The information included in the comparison tables is not a part of DCL-11-097, nor is it meant to or is necessary to, support the LAR.

PG&E makes no regulatory commitments (as defined by NEI 99-04) in this letter.

If you have any questions or require additional information, please contact Mr. Tom Baldwin at (805) 545-4720.

Sincerely,

James R. Becker
Site Vice President

mjrm/4557
Enclosure
cc: Diablo Distribution
cc/enc: Elmo E. Collins, Regional Administrator, NRC Region IV
Michael S. Peck, NRC Senior Resident Inspector
Alan B. Wang, NRR Project Manager,

Standard Review Plan Comparison Tables for License Amendment Request 11-05, "Evaluation Process for New Seismic Information and Clarifying the Diablo Canyon Power Plant Safe Shutdown Earthquake"

In support of the NRC review of License Amendment Request 11-05 (Reference 1), the NRC Staff requested (Reference 2) that PG&E provide a comparison with the latest version of applicable sections of NUREG-0800, "Standard Review Plan (SRP) for Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition."

The information provided in the attachments identifies key areas where the Diablo Canyon Power Plant (DCPP) Hosgri design and licensing information appears to differ from the current SRP criteria applicable to a safe shutdown earthquake based on comparisons made by knowledgeable PG&E personnel and contractors. The attachments are based on review of the current licensing and design bases documents, including but not limited to the Final Safety Analysis Report, Design Criteria Memoranda (DCM[1]), and other proprietary documents controlled by Westinghouse[2]. The information provided is not a comprehensive design and licensing basis verification, as the SRP criteria are not the DCPP design and licensing basis, nor are they proposed to be established as the DCPP design and licensing basis.

Please note that DCPP is not a SRP committed plant and the information provided does not denote compliance with SRP requirements, nor does it represent a commitment to any specific requirements. The purpose for this information is to assist the NRC Staff with their review of the proposed LAR.

Below is a table of the attachments for this letter, "Table of Attachments," which shows the Enclosure Attachment number, the SRP Section number, and the Section/Subsection Description. In many cases, either the first paragraph of the

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[1] A DCM is a document which is designed to contain a summary of the major design bases of selected plant systems, structures, components and topics. It summarizes the various required functions and regulatory issues that affect the design bases and how DCPP has designed its systems, structures, components and topics to meet those requirements. The DCM document is designed to provide a single starting point for identifying and understanding the major design bases of selected plant systems, structures, components and topics.

[2] Information provided by Westinghouse was not independently reviewed or audited by PG&E.

SRP acceptance criteria is quoted or the section is summarized due to the amount of information in the SRP sections.

Table of Attachments

Attachment	SRP Section	Rev.	Section / Subsection Description
1	2.5.1	4	Basic Geology & Seismic Information
2	2.5.2	4	Vibratory Ground Motion
3	2.5.3	4	Surface Faulting
4	3.2.1	2	Seismic Classification
5	3.7.1	3	Seismic Design Parameters
6	3.7.2	3	Seismic System Analysis – Containment Exterior and Interior Structure
7	3.7.2	3	Seismic System Analysis – Auxiliary Building
8	3.7.2	3	Seismic System Analysis – Turbine Building
9	3.7.2	3	Seismic System Analysis – Intake Structure
10	3.7.3	3	Seismic Subsystem Analysis – Containment Annulus Structure
11	3.7.3	3	Seismic Subsystem Analysis – Containment Polar Crane
12	3.7.3	3	Seismic Subsystem Analysis – Containment Pipeway Structure
13	3.7.3	3	Seismic Subsystem Analysis – Fuel Handling Building Steel Superstructure
14	3.7.3	3	Seismic Subsystem Analysis – Outdoor Water Storage Tanks (OWST's)
15	3.7.3	3	Seismic Subsystem Analysis – Architectural Platforms
16	3.7.3	3	Seismic Subsystem Analysis – Containment Plant Vent
17	3.7.3	3	Seismic Subsystem Analysis – Buried Auxiliary Saltwater (ASW) Piping
18	3.7.3	3	Seismic Subsystem Analysis – Buried Vital Electrical Conduits
19	3.7.3	3	Seismic Subsystem Analysis – Fuel Handling Building (FHB) Crane
20	3.8.1	3	Concrete Containment
21	3.8.3	3	Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure
22	3.8.3	3	Concrete and Steel Internal Structures for Concrete Containment – Annulus Structure
23	3.8.4	3	Other Seismic Category 1 Structures – Outdoor Water Storage Tanks (OWST's)
24	3.8.4	3	Other Seismic Category 1 Structures – Auxiliary Building
25	3.8.4	3	Other Seismic Category 1 Structures – Containment Plant Vent
26	3.8.4	3	Other Seismic Category 1 Structures – Fuel Handling Building Steel Superstructure (FHBSS)
27	3.8.4	3	Other Seismic Category 1 Structures – Turbine Building

28	3.8.4	3	Other Seismic Category 1 Structures – Intake Structure
29	3.8.4	3	Other Seismic Category 1 Structures – Masonry Walls
30	3.8.4	3	Other Seismic Category 1 Structures – Spent Fuel Racks
31	3.8.4	3	Other Seismic Category 1 Structures – Pipeway Structure
32	3.8.4	3	Other Seismic Category 1 Structures – Containment Polar Crane
33	3.8.4	3	Other Seismic Category 1 Structures - Fuel Handling Building (FHB) Crane
34	3.8.5	3	Foundations – Containment Exterior Structure
35	3.8.5	3	Foundations – Auxiliary Building
36	3.8.5	3	Foundations – Turbine Building
37	3.8.5	3	Foundations – Intake Structure
38	3.8.5	3	Foundations – Outdoor Water Storage Tank (OWST)
39	3.9.1	3	Special Topics for Mechanical Components – Mechanical Equipment (Westinghouse) - Fuel Assembly
40	3.9.1	3	Special Topics for Mechanical Components - Mechanical Equipment (Westinghouse) - Pressurizer
41	3.9.1	3	Special Topics for Mechanical Components - Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
42	3.9.2	3	Dynamic Testing and Analysis of SSCs. – Piping, Reactor Coolant Loop (RCL)
43	3.9.2	3	Dynamic Testing and Analysis of SSCs. – Piping, non-Reactor Coolant Loop (non-RCL)
44	3.9.2	3	Dynamic Testing and Analysis of SSCs – Pipe Supports, non-Reactor Coolant Loop (non-RCL)
45	3.9.2	3	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Fuel Assembly
46	3.9.2	3	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Pressurizer
47	3.9.2	3	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
48	3.9.2	3	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Reactor Internals and Reactor Vessel
49	3.9.2	3	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Steam Generator
50	3.9.2	3	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (non-RCS)

51	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Piping Supports, non-Reactor Coolant Loop (non-RCL)
52	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Piping, non-Reactor Coolant Loop (non-RCL)
53	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures. – Piping, Reactor Coolant Loop (RCL)
54	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures - Mechanical Equipment (Non-RCS)
55	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Mechanical Equipment (Westinghouse) - Fuel Assembly
56	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures - Mechanical Equipment (Westinghouse) - NSSS Primary Equipment Supports (PES)
57	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures - Mechanical Equipment (Westinghouse) - Pressurizer
58	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures - Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
59	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures - Mechanical Equipment (Westinghouse) - Reactor Vessel
60	3.9.3	3	ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures - Mechanical Equipment (Westinghouse) - Steam Generator
61	3.10	3	Seismic and Dynamic Qualification of Mechanical and Electrical Equipment
62	3.12	3	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports - Pipe Supports, non- Reactor Coolant Loop (non-RCL).
63	3.12	3	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports – Piping, non-Reactor Coolant Loop (non-RCL)
64	3.12	3	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports – Piping, Reactor Coolant Loop (RCL)
65	5.4	2	Reactor Coolant System Component & Subcomponent Design - Piping, non-Reactor Coolant Loop (non-RCL)
66	5.4	2	Reactor Coolant System Component & Subcomponent Design – Piping, Reactor Coolant Loop (RCL)

References within the attachments include the following:

1. DCM T-1A, Containment Structure Exterior
2. DCM T-1B, Containment Structure Interior
3. DCM T-1D, Containment Structure – Liner
4. DCM T-1E, Pipeway Structure
5. DCM T-1F, Containment Plant Vent
6. DCM T-2, Auxiliary Building
7. DCM T-3, Structural Design of the Fuel Handling Building Steel Superstructure
8. DCM T-4, Structural Design of the Turbine Building
9. DCM T-5, Structural Design of the Intake Structure
10. DCM T-6, Seismic Analysis of Structures
11. DCM T-6, Seismic Analysis of Structures, Appendix A: Containment Structure
12. DCM T-6, Seismic Analysis of Structures, Appendix D: Intake Structure
13. DCM T-6, Seismic Analysis of Structures, Appendix E: Outdoor Water Storage Tanks
14. DCM T-8, Structural Design of Electrical Raceways and Class 1E Supports
15. DCM T-10. "Seismic Qualification of Equipment"

16. DCM T-14, Seismically Induced Systems Interactions
17. DCM T-24, Design Criteria for DCPP Instrumentation and Control
18. DCM T-28, Design Class I Outdoor Water Storage Tanks and Class 'S' Piping Vaults
19. DCM T-31, Safety-Related Masonry Walls
20. DCM S-42B, APPENDIX A -Containment Polar Crane
21. DCM S-42B, Fuel Handling Cranes & Storage Racks
22. DCM S-42B, APPENDIX C - Fuel Handling Building Crane
23. DCM S-42B, APPENDIX E -Fuel Storage Racks
24. DCM S-9A, Appendix A - Containment Recirculation Sump & Strainer Function - RG 1.82 Evaluation
25. DCM S-17B, Auxiliary Saltwater System
26. DCM C-17, Hosgri Earthquake Response Spectra
27. DCM C-49, Class I and Class IIA Architectural Platforms
28. DCM C-63, Diablo Canyon Units 1 & 2 - Concrete Embedded Plates
29. Q-List, Classification of Structures, Systems, and Components for Diablo Canyon Power Plant Units 1 and 2

Other References:

1. PG&E Letter DCL-11-097, "License Amendment Request 11-05, 'Evaluation Process for New Seismic Information and Clarifying the Diablo Canyon Power Plant Safe Shutdown Earthquake,'" dated October 20, 2011

2. NRC letter, "Summary of June 20, 2011, Pre-licensing Meeting with Pacific Gas and Electric Company on Proposed License Amendment for a New Seismic and Design Evaluation Process (TAC Nos. ME5033 and ME 5034)," dated July 29, 2011

DCL-11-124 Acronym Glossary

ASIC	-	American Institute of Steel Construction
AOR	-	Analysis of Record
ASW	-	auxiliary saltwater
CAP	-	Corrective Action Program
CFR	-	Code of Federal Regulations
CFD	-	computational flow dynamics
CRDM	-	control rod drive mechanism
CST	-	condensate storage tank
DCM	-	Design Criteria Memoranda
DCPP	-	Diablo Canyon Power Plant
DE	-	design earthquake
DDE	-	double design earthquake
FHB	-	fuel handling building
FHBSS	-	fuel handling building steel superstructure
FSAR	-	Final Safety Analysis Report
FSARU	-	Final Safety Analysis Report Update
FWTT	-	fire water and transfer tank
GDC	-	general design criteria
GMRS	-	Ground Motion Response Spectra
HE	-	Hosgri Earthquake
HELB	-	high-energy line break
IE	-	Information and Enforcement
IEEE	-	Institute of Electrical and Electronics Engineers
IHA	-	integrated head assembly
ksf	-	kips per square foot
LOCA	-	loss-of-coolant accident
NSSS	-	Nuclear Steam Supply System
OBE	-	Operating Basis Earthquake
OL	-	Operating License
OLA	-	Operating License Application
OWST	-	outdoor water storage tank
PES	-	primary equipment supports
PSD	-	Power Spectral Density
QA	-	Quality Assurance
RCL	-	reactor coolant loop
RCP	-	reactor coolant pump
RCS	-	reactor coolant system
RESM	-	Reactor Equipment System Model
RG	-	Regulatory Guide
RVHVS	-	reactor vessel head vent system
RVLIS	-	reactor vessel level instrumentation system
RWST	-	refueling water storage tank
SFP	-	spent fuel pool
SRP	-	Standard Review Plan
SRSS	-	square root of the sum of the squares
SSC	-	structures, systems, and components
SSE	-	Safe Shutdown Earthquake
SSI	-	soil-structure interaction
USAS	-	USA Standard

SRP 2.5.1	**Basic Geologic & Seismic Information**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Regional Geology In meeting requirements of GDC 2 in Appendix A of 10 CFR Part 50, 10 CFR 52.17, and 10 CFR 100.23, SAR Section 2.5.1.1 will be considered acceptable if a complete and documented discussion....	FSAR Section 2.5.1.1 (Basic Geologic and Seismic Information - Regional Geology) provides a general overview of the regional geology. Details of the comparison with the SRP Acceptance Criteria are provided below, based on the RG's and CFR Acceptance Criteria listed in the SRP.
II.2. Site Geology In meeting requirements of GDC 2 in Appendix A of 10 CFR Part 50, 10 CFR 52.17, 10 CFR 100.23, and regulatory positions presented in Regulatory Guides 1.165, 1.132, 1.138, 1.198, 1.208 and 4.7, SAR Section 2.5.1.2 will be considered acceptable if it contains......	FSAR Section 2.5.1.2 (Basic Geologic and Seismic Information - Site Geology) provides a general overview of the regional geology. Details of the comparison with the SRP acceptance criteria are provided below, based on the RG's and CFR acceptance criteria listed in the SRP.
II.1. and II.2. (continued) - Reg. Guide 1.132, "Site Investigation for Foundations of Nuclear Power Plants" This RG provides general guidance and recommendations for conducting subsurface investigations.	The FSAR Section 2.5.1.2.6.1 states that the borings were conducted at or near the intersection of the Unit 1 exploratory trenches. FSAR Figure 2.5-11 shows the boring locations, but does not provide a high level of detail. RG 1.132 (Appendix C) sets the boring spacing under large structures every 30 meters. The DCPP design/licensing basis does not require that borings meet this spacing. The shear wave velocity (Vs) profile is the key parameter for the site amplification for computing the ground motions. The velocity profile has been characterized by downhole measurements at DCPP.
II.1. and II.2. (continued) - Reg. Guide 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites"	This RG applies to liquefaction at soil sites. DCPP is a rock site.

SRP 2.5.1	**Basic Geologic & Seismic Information**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. and II.2. (continued) - Reg. Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations"	This RG applies to site selection. The location of DCPP has already been established and DCPP is an operating plant.
II.1. and II.2. (continued) - Reg. Guide 1.206, "Combined License Applications for Nuclear Power Plants - LWR Edition"	This RG applies to Combined License Applications. DCPP has already been licensed.
II.1. and II.2. (continued) - 10CFR100.23, "Geologic and Seismic Siting Criteria"	This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permit applications for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the OLA's were submitted in 1973 for both units.

SRP 2.5.2	**Vibratory Ground Motion**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. 2.5.2.1 Seismicity To meet the requirements of 10 CFR 100.23, this subsection is accepted when the complete historical record of earthquakes in the region is listed...	This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permit applications for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the OLA's were submitted in 1973 for both units.
II.2. 2.5.2.2 Geologic and Tectonic Characteristics of Site and Region Seismic sources identified and characterized by Lawrence Livermore National Laboratory (LLNL) and the Electric Power Research Institute (EPRI) were used for studies...	This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permit applications for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the OLA's were submitted in 1973 for both units.
II.3. 2.5.2.3 Correlation of Earthquake Activity with Seismic Sources To meet the requirements in 10 CFR 100.23, acceptance of this subsection is based on the...	This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permit applications for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the OLA's were submitted in 1973 for both units.
II.4. 2.5.2.4 Probabilistic Seismic Hazard Analysis and Controlling Earthquakes For CEUS sites relying on LLNL or EPRI methods and databases, the staff...	This SRP acceptance criteria applies to seismic designs based on probabilistic seismic hazards analysis. DCPP's seismic design is based on the deterministic method. This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permit applications for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the OLA's were submitted in 1973 for both units.

SRP 2.5.2	Vibratory Ground Motion
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. <u>2.5.2.5 Seismic Wave Transmission Characteristics of the Site</u> In the PSHA procedure described in Regulatory Guide 1.165...	This SRP acceptance criteria applies to seismic designs based on probabilistic seismic hazards analysis. DCPP's seismic design is based on the deterministic method. This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permit applications for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the OLA's were submitted in 1973 for both units.
II.6. <u>2.5.2.6 Ground Motion Response Spectra</u> In this subsection, the staff reviews the applicant's procedure to determine GMRS. If the applicant uses the reference probability approach, the GMRS is considered acceptable if they meet Regulatory Position 4 of and Appendix F of Regulatory Guide 1.165. If the applicant uses the performance-based approach, the GMRS are considered acceptable if they meet Regulatory Position 5 of Regulatory Guide 1.208.	DCPP's seismic design is based on the deterministic method, not a probabilistic seismic hazards analysis. Details of the comparison with the SRP acceptance criteria is provided below, based on the RG's and CFR acceptance criteria listed in the SRP.
II.6. (continued) - Reg. Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations"	This RG applies to site selection. The location of DCPP has already been established and DCPP is an operating plant.
II.6. (continued) - Reg. Guide 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants" This RG provides a standard deterministic spectral shape, which is to be scaled for the peak ground acceleration at the site.	This RG applies to seismic designs based on a standard spectral shape. DCPP uses a site-specific spectrum for the 1977 HE.

SRP 2.5.2	**Vibratory Ground Motion**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.6. (continued) - Reg. Guide 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion" This RG describes the methodology for conducting a probabilistic seismic hazard analysis and selecting a hazard level for a design spectrum	This SRP acceptance criteria applies to seismic designs based on probabilistic seismic hazards analysis. DCPP's seismic design is based on the deterministic method.
II.6. (continued) - Reg. Guide 1.208, "A Performance Based Approach to Define Site-Specific Earthquake Ground Motion" - <u>Horizontal</u>: This RG describes an updated methodology for developing a horizontal design spectrum based on a probabilistic methods and risk methods for the horizontal component.	This SRP acceptance criteria applies to seismic designs based on probabilistic seismic hazards analysis. DCPP's seismic design is based on the deterministic method.
II.6. (continued) - Reg. Guide 1.208, "A Performance Based Approach to Define Site-Specific Earthquake Ground Motion" - <u>Vertical</u>: Section 5.2 of this RG requires that the vertical design spectrum be computed using the most up to date V/H ratio model that is appropriate for the site.	The vertical design spectrum for the 1977 HE is 2/3 of the horizontal design spectrum.

SRP 2.5.2	**Vibratory Ground Motion**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.6. (continued) - Reg. Guide 1.206, "Combined License Applications for Nuclear Power Plants - LWR Edition"	This RG applies to Combined License Applications. DCPP has already been licensed.
II.6. (continued) In addition, Section V.(a).2 requires that the Operating Basis Earthquake OBE) be at least one-half of the Safe Shutdown Earthquake (SSE).	If the 1977 HE (peak ground acceleration of 0.75 g) is equated to the SSE, the Design Earthquake (peak ground acceleration of 0.20 g), which is equated to the OBE, is less than one-half of the SSE.
II.6. (continued) - 10CFR100.23, "Geologic and Seismic Siting Criteria"	This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permit applications for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the OLA's were submitted in 1973 for both units.

SRP 2.5.3	**Surface Faulting**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Geologic, Seismic, and Geophysical Investigations Requirements of GDC 2 in Appendix A of 10 CFR Part 50, 10 CFR 52.17, and 10 CFR 100.23... through II.8. Potential for Surface Tectonic Deformation at the Site Location To meet the requirements of GDC2 in Appendix Aof 10 CFR Part 50, 10 CFR 52.17, and 10 CFR 100.23...	FSAR Section 2.5.3 (Surface Faulting) provides a general overview of the geologic studies performed at DCCP for the identification of potential surface faulting. Details of the comparison with the SRP acceptance criteria are provided below, based on the RG's and CFR acceptance criteria listed in the SRP.
II.1. through II.8. (continued) - Reg. Guide 1.132, "Site Investigation for Foundations of Nuclear Power Plants" This RG does not provide any guidance for the identification of surface faulting.	This RG is not applicable to surface faulting.
II.1. through II.8. (continued) - Reg. Guide 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites" This RG does not provide any guidance for the identification of surface faulting.	This RG is not applicable to surface faulting.

SRP 2.5.3	**Surface Faulting**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. through II.8. (continued) - Reg. Guide 1.206, "Combined License Applications for Nuclear Power Plants - LWR Edition"	This RG applies to Combined License Applications. DCPP has already been licensed.
II.1. through II.8. (continued) - 10 CFR100, Appendix A, "Seismic and Geologic Siting Criteria for Nuclear Power Plants" This appendix provides general requirements for the development of the deterministic earthquakes for a nuclear power plant and requires the identification of surface faulting.	The FSAR is generally consistent with the requirements of this RG, but the recently-discovered Shoreline Fault is not included.
II.1. through II.8. (continued) - 10 CFR 100.23, "Geologic and Seismic Siting Criteria"	This regulation applies to construction permit or OLA's for nuclear power plants submitted on or after January 10, 1997. The construction permits for DCPP were submitted in 1967 (Unit 1) and 1968 (Unit 2), and the full power OL's for DCPP were issued in 1984 (Unit 2) and 1985 (Unit 2).

3.2.1	Seismic Classification
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. To meet the requirements of GDC 2, 10 CFR Part 100, Appendix A, and 10 CFR Part 50, Appendix S regarding seismic design classification are met by using guidance provided in RG 1.29 "Seismic Design Classification." This guide describes an acceptable method of identifying and classifying those plant features that should be designed to withstand the effects of the SSE.	FSARU Section 3.2.1 describes the seismic classification of SSC'c. DCPP meets the requirements of 1967 GDC 2, 10 CFR 100, Appendix A, and Safety Guide 29. The classification of specific SSC's are provided in the DCPP Q-List[1].
II.1. (continued) RG 1.151, "Instrument Sensing Lines," provides guidance with regard to seismic design requirements and classification of safety-related instrumentation sensing lines.	The DCPP Q-List, Section 2.2.3.3, indicates that the technical and quality assurance requirements for each instrument class are provided in DCM T-24. Instrumentation serving post-accident monitoring functions are further classified in accordance with RG 1.97.
II.1. (continued) RG 1.189, "Fire Protection for Nuclear Power Plants," provides guidance used to establish the design requirements of fire protection to meet the requirements of GDC 2 as it relates to designing these SSCs to withstand earthquakes. This guide identifies portions of fire protection SSCs requiring some level of seismic design consideration.	Per the DCPP Q-List, QA Classification "G" is applied to portions of the fire protection system, which require application of a quality program as described in Appendix A to NRC Branch Technical Position APCSB 9.5-1.

[1] PG&E Q-list, "Classification of Structures, Systems, and Components for Diablo Canyon Power Plant Units 1 and 2"

SRP 3.7.1	Seismic Design Parameters
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Design Ground Motion	See discussion below
II.1.A. Design Response Spectra The site-specific GMRS reviewed under SRP Section 2.5.2 are determined in the free-field on the ground surface. For sites with soil layers near the surface...	The 1977 HE evaluation of DCPP is based on deterministic spectra. The site specific GMRS described in the SRP is based on a probabilistic approach for a hazard level of 1E-4 for the hazard at DCPP.
II.1.B. Design Time Histories The SSE and OBE design ground motion time histories can be either real time histories or artificial time histories.	Hosgri Report, Section 4.1.1 states that the design ground motion time histories were developed by an iterative procedure to match the smooth spectra[1], which corresponds to an artificial time history. This is consistent with Section 4.3.1.5.2 of DCM T-6, which states that the 1977 HE time histories are artificial.
II.1.B. (continued) To be acceptable, the time histories should consist of three mutually orthogonal directions which are statistically independent.	A set of individual horizontal time histories is provided for each major structure (the same time history to be applied in each horizontal direction) and a single vertical time history is provided to be used for all major structures[2] (see FSARU Figures 3.7-4G through 3.7-4M). Since the same horizontal time history is applicable for both horizontal directions, they are not statistically independent.
II.1.B. (continued) Artificial time histories which are not based on seed recorded time histories should not be used.	The Hosgri Report, Section 4.1.1 states that the time histories were developed by an iterative procedure to match the smooth spectra (a method of generating artificial time histories), but does not indicate if a seed recorded time history was used.

1 Separate horizontal time histories are provided for (a) free-field, (b) containment, (c) auxiliary building, (d) intake structure, and (e) turbine building due to impact of Tau-filtering on the ground motion spectral shape (different for the Blume and Newmark Hosgri response spectra). A single vertical time history is provided for all buildings, since Tau-filtering is not applicable to vertical ground motion.

2 Same as previous footnote

SRP 3.7.1	Seismic Design Parameters
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.B. (continued) For linear structural analyses, the total duration of the artificial ground motion time histories should be long enough such that adequate representation of the Fourier components at low frequency is included in the time history.	A total time duration of 24 seconds was used for the Hosgri ground motion time histories with approximately 10 seconds of strong motion (FSARU Figures 3.7-4G through 3.7-4M). The Fourier components at low frequencies are not addressed.
II.1.B. (continued) For nonlinear structural analysis problems, multiple sets of ground motion time histories should be used to represent the design ground motion.	The dynamic analyses of all structures with foundations subjected to ground motion (i.e., containment, auxiliary building, intake structure, turbine building, and outdoor water storage tanks) are based on linear structural analysis methods.
II.1.B. (continued) <u>Option 1: Single Set of Time Histories</u> - to be considered acceptable, the response spectra generated from the artificial time history to be used as input on the free-field should satisfy the enveloping requirements for either Approach 1 or Approach 2. - <u>Approach 1</u> - must envelop for all damping valued used in seismic analysis; frequency interval must be sufficiently small; no more than five points may fall more than 10% below target; must meet certain Power Spectral Density (PSD) requirements (see Appendix A to SRP 3.7.1) - <u>Approach 2</u> - achieve a mean-based fit to the target response spectra at 5% damping and additional requirements.	Per FSARU Section 3.7.1.2, only a single set of time histories is used for the evaluation of each plant structure (separate set for Blume and Newmark Response Spectra). The time histories are shown in FSAR Figures 3.7-4G through 3.7-4M and their fit to the 7% damped target response spectra is shown in FSARU Figures 3.7-4N through 3.7-4T). FSARU Section 3.7.1.2 does not indicate the criteria used for the generation of the time histories or their fitting to the target response spectra. DCM T-6, Section 4.3.1.5.2 indicates that the time histories were generated to fit the 7% damped target spectra. The adequacy of the frequency interval is not addressed in the DCPP design/licensing basis, and the plots of the fit of the time histories to the target spectra (FSARU Figures 3.7-4N through 3.7-4T) indicate that more than five points fall below the target spectra. The development of a PSD for the time histories is not addressed in the DCPP design/licensing basis.

SRP 3.7.1	Seismic Design Parameters
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.B. (continued) Option 2: Multiple Sets of Time Histories	Multiple sets of ground motion time histories are not employed in the seismic analysis of DCPP structures.
II.2. Percentage of Critical Damping Damping values used for the analysis of Seismic Category I SSCs are considered acceptable if they are in accordance with Reg. Guide 1.61	The damping for applicable to the HE evaluation of Design Class I SSCs (and the Design Class II turbine building and intake structure) are defined in FSARU Section 3.7.1.3. All values are in accordance with RG 1.61, Revision 0 (October 1973) except as follows: • Mechanical Components (PG&E Purchased): 4% instead of 3% • Vital Piping (except RCL): ASME Code Case N-411 instead of 2% for small bore - 3% for large bore • Reactor Coolant Loop: 4% instead of 3% (higher value based on WCAP-7921-AR, Westinghouse Electric Corporation, "Damping Values for Nuclear Power Plant Components," May 1974) • Replacement Steam Generators: 4% instead of 3% (higher value based on WCAP-7921-AR, Westinghouse Electric Corporation, "Damping Values for Nuclear Power Plant Components," May 1974) • Integrated Head Assembly: 6.85% instead of 4% (per DCPP License Amendments 208/210) • Control Rod Drive Mechanisms: 5% instead of 3% (per DCPP License Amendments 207/209)

SRP 3.7.1	Seismic Design Parameters
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. (continued) In addition, a demonstration of the correlation between stress levels and damping values will be required and reviewed for compliance with Reg. Guide 1.61.	The DCPP design/licensing basis does not include a requirement to check the stress levels in SSC's to validate the damping values.
II.2. (continued) The material soil damping for foundation soils must be based on validated values...	DCPP is a rock site, so the Hosgri seismic analyses of the major structures (containments, auxiliary building, turbine building, intake structure, refueling water storage tanks, condensate storage tanks, and firewater and transfer tank) are based on fixed-base models.
II.3. <u>Supporting Media for Seismic Category I Structures</u> To be acceptable, the description of supporting media for each Category I structure must include foundation embedment depth, depth of soil over bedrock...	DCPP is a rock site and all safety-related structures are founded on rock, without intervening soil layers.

SRP 3.7.2	Seismic System Analysis - Containment Exterior and Interior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.<u>Seismic Analysis Methods</u> The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately in SSC-specific sections of the FSARU. The SRP comparison review documented herein is limited to the containment exterior and Interior Structure.
II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	FSARU Section 3.7.2.1.7.1 indicates the number of mass points (nodes) used in the axisymmetric models and FSARU Figure 3.7-5D shows the number of mass points used for the vertical model of the containment interior structure. The DCPP design/licensing basis does not include specific requirements for this subject.
II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
II.1.A.vi. Consideration of maximum relative displacements between adjacent supports of seismic Category I SSCs	Relative displacements between adjacent supports are not applicable because the containment exterior and Interior concrete structures are supported on a continuous basemat foundation, which is founded on the bedrock.
II.1.A.vii. Inclusion of significant effects such as piping interactions, externally applied structural restraints, hydrodynamic (both mass and stiffness effects) loads, and nonlinear responses.	The DCPP design/licensing basis does not address the evaluation of the containment structure for hydrodynamic loads associated with sloshing of water inside the containment.

SRP 3.7.2	**Seismic System Analysis - Containment Exterior and Interior Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.B. Equivalent Static Load Method An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.1, the containment structure is evaluated using a dynamic analysis.
II.21. Natural Frequencies and Responses - To be acceptable, the following information should be provided:	See below
II.2.A. A summary of the modal masses, effective masses, natural frequencies, mode shapes, modal and total responses for the Category I structures, including the containment structure, or a summary of the total responses if the method of direct integration is used.	The FSARU provides the following modal information associated with the Hosgri analysis of the containment exterior structure: - Table 3.7-8A: Periods of vibration & participation factors - Table 3.7-8B: Maximum absolute accelerations - Table 3.7-8C: Maximum displacements The FSARU provides the following modal information associated with the Hosgri analysis of the containment interior structure: - Table 3.7-8G: Maximum absolute accelerations and displacements
II.2.C. For the multiple time history analysis option, procedures used to account for uncertainties, etc.	DCPP does not use the multiple time history option of the Hosgri seismic analyses of the containment exterior or interior structures.
II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below
II.3.B. Decoupling Criteria for Subsystems - SRP Section 3.7.2 provides guidance for the decoupling of systems and subsystems.	The containment structure is a “seismic system.”

SRP 3.7.2	Seismic System Analysis - Containment Exterior and Interior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the containment structure are based on both lumped-mass stick models (to account for accidental torsion and vertical response of the interior concrete) and an axisymmetric finite element model (to account for global behavior).
II.3.C.i. Lumped-Mass Stick Models	See discussion below.
II.3.C.i (continued) - For selecting an adequate number of discrete mass degrees of freedom in the dynamic modeling, the acceptance criteria given in Subsection II.1.a.iv of this SRP section is acceptable.	FSARU Section 3.7.2.1.7.1 indicates the number of mass points (nodes) used in the lumped-mass stick models. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	FSARU Section 3.7.2.1.7.1 indicates that the finite element model of the exterior shell and interior concrete uses four degree-of-freedom axisymmetric shell elements, which are appropriate for this type of structure (FSARU Figures 3.7-5a and 3.7-7). Details of the theoretical formulation of the element are not provided.
II.3.C.ii (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The DCPP design/licensing basis does not address the effects of element size, shape, or aspect ratio on the solution accuracy. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The DCPP design/licensing basis does not address the effects of mesh refinement on the solution results. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.

SRP 3.7.2	Seismic System Analysis - Containment Exterior and Interior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	The DCPP design/licensing basis does not address the method of consideration of local regions of the containment structure.
II.3.D. Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models - In addition to the structural mass, the following masses should be included:	See discussions below.
II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The DCPP design/licensing basis does not address the inclusion of miscellaneous dead loads in the dynamic analyses of the containment structure.
II.3.D (continued) - Mass equivalent to 25% of design live load	FSARU Section 3.8.1.3.1.2 indicates that "Live loads consist of temporary equipment loads and a uniform load to account for the miscellaneous temporary loadings that may be placed on the structure." FSARU Section 3.8.1.3.2.2 indicates that live loads are not included in the load combinations which include the HE.
II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to its location, snow loading is not considered in DCPP's design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Containment Exterior and Interior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.E. Special Consideration for Dynamic Modeling of Structures - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	The DCPP design/licensing basis does not describe the usage of separate structural models used for the detailed design analysis of the containment structure.
II.4. Soil Structure Interaction - A complete SSI analysis should account for all effects due to kinematic and inertial interaction for surface or embedded structures.... (See SRP for specific requirements.)	Soil-structure interaction is not included in the Hosgri evaluation of DCPP. Per FSARU Section 3.7.1.5, all Design Class I plant structures (including the containment structures) are founded on rock or concrete fill over rock. An average shear wave velocity of 3600 feet per second (fps) is reported in DCM T-6, Section 4.3.3.2.4. Per FSARU Section 3.7.2.1.7.1, the model used for the Hosgri evaluation of the containment structure is fixed-base (soil is not modeled). Per FSARU Section 3.7.1.2, the horizontal free-field input ground motion for the Hosgri evaluation has been reduced to account for the presence of the containment's large foundation. This reduction is derived by spatial averaging of the accelerations across the foundation by the Tau-filtering procedure.
II.5. Development of In-Structure Response Spectra - RG 1.122 describes methods generally acceptable by the staff for the development of in-structure response spectra. The topics addressed are:	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.122.

SRP 3.7.2	Seismic System Analysis - Containment Exterior and Interior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5.A. SRSS combination of the three in-structure response spectra in a given direction developed from separate analyses of the three directions of input motion. SRSS is not applicable if the three directions of input motion are applied simultaneously in a single analysis.	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.B. Frequency increments for calculation of spectral accelerations	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.C. Spectrum smoothing and broadening to account for uncertainty.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
II.5. (continued) The guidance of RG 1.122 is augmented as follows:	See discussion below.
II.5. The guidance of RG 1.122 is augmented as follows: (1) SRSS combination applies to all cases where the three directions of input motion are analyzed separately. There is no longer a distinction between symmetric and unsymmetrical structures	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5. The guidance of RG 1.122 is augmented as follows (continued): (2) The 3 Hz freq. incr. in the last row of RG 1.122, Table 1 applies to the highest frequency of interest.	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.

SRP 3.7.2	**Seismic System Analysis - Containment Exterior and Interior Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. The guidance of RG 1.122 is augmented as follows (continued): (3a) When a single set of three artificial time histories is used as input, the in-structure response spectra are smoothed and broadened in accordance RG 1.122	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
5. The guidance of RG 1.122 is augmented as follows (continued): (3b) When multiple sets of three time histories, derived from actual earthquake records, are used.	DCPP uses a single set of input time histories.
II.7. <u>Combination of Modal Responses</u> -	See discussion below.
II.7.A <u>Response Spectrum Analysis</u> RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when <u>response spectrum method of analysis</u> is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.
II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable <u>modal combination methods</u>	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the containment exterior or interior structures.

SRP 3.7.2	Seismic System Analysis - Containment Exterior and Interior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets"). The details of this program are described in the PG&E report, "Description of the Systems Interaction Program for Seismically Induced Events," dated August 1980 and the ongoing implementation is governed by DCM T-14. - The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.2	Seismic System Analysis - Containment Exterior and Interior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
equivalent to that for a Cat I SSC.	
II.9. <u>Effects of Parameter Variation of Floor Response Spectra</u> - consideration should be given in the analysis to the effects of floor response spectra (e.g., peak width) of expected variations of structural properties, damping values, soil properties, and SSI.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side to account for "variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections." FSARU Section 3.7.1.5 indicates that all Design Class I structures are founded on rock or concrete fill. FSARU Section 3.7.2.1.7.1 indicates that the Hosgri seismic analyses of the Design Class I structures are based on fixed-base models (i.e., the consideration of soil properties and SSI is not required). Variations in damping values are not addressed in the DCPP design/licensing basis.
II.9. (continued) In addition, for concrete structures, the effect of potential concrete cracking on the structural stiffness should be specifically addressed.	The FSARU does not discuss the method for the determination of the section properties used for the determination of the stiffness of concrete structures. FSARU Section 3.7.2.1.7.1 indicates that variations in "material sections" were considered in the widening of the response spectra. The consideration of the effect of potential concrete cracking is not addressed in the DCPP design/licensing basis.
II.12. <u>Comparison of Responses</u> - If both the time history analysis method and the response spectrum analysis method are used to analyze an SSC, the peak responses obtained from these two methods should be compared, to demonstrate approximate equivalency between the two methods.	FSARU Section 3.7.2.11 states "time-history analyses only are performed for Design Class I structures. Response spectrum analyses are not performed because time-history produces spectra that represent reasonably the criteria response spectra." The comparison of responses calculated by the two different methods is not addressed in the DCPP design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Auxiliary Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the consistency review for SRP Section 3.7.2 will be performed individually, for the major SSC's addressed in FSARU Section 3.7.2.
II.1.A. Dynamic Analysis Methods (cont'd) II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	FSARU Section 3.7.2.1.7.1 indicates the number of mass points (nodes) used in the stick models are illustrated in FSARU Figure 3.7-13. One lumped mass is located at each floor level, with is generally adequate for the modeling of multi-story buildings. The DCPP design/licensing basis does not include specific requirements for this subject.
II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
II.1.A.vi. Consideration of maximum relative displacements between adjacent supports of seismic Category I SSCs	Relative displacements between adjacent supports are not applicable because the auxiliary building is supported on a continuous basemat foundation, which is founded on the bedrock.

[1] The auxiliary building includes the control room, the fan rooms, and the SFP's (fuel handling area of the auxiliary building). The area above the SFP's is enclosed by the FHBSS, which is supported on the reinforced concrete auxiliary building. The scope of this SRP review is limited to the auxiliary building; the seismic analyses of the FHBSS are addressed separately.

SRP 3.7.2	Seismic System Analysis - Auxiliary Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.A.vii. Inclusion of significant effects such as piping interactions, externally applied structural restraints, hydrodynamic (both mass and stiffness effects) loads, and nonlinear responses.	The DCPP design/licensing basis does not address the evaluation of the auxiliary building for hydrodynamic loads. Loading due to the sloshing of the water in the SFP's was not considered.
II.1.B. <u>Equivalent Static Load Method</u> An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.1, the global seismic loading for the auxiliary building is determined through the use of dynamic analyses; however, as indicated in DCM T-6, Appendix B, the forces in the individual structural elements (e.g., walls and slabs) are determined by the application of the global dynamic loads to a detailed three-dimension finite element model of the building, using the Equivalent Static Load Method.
II.1.B.i. Justification is provided that the system can be realistically represented by a simple model and the method produces conservative results in terms of responses.	The equivalent static accelerations applied to the static model are based on the results of the simplified dynamic analyses of the building. Justification for this approach is not provided.
II.1.B.ii. The simplified static analysis method accounts for the relative motion between all points of support.	The auxiliary building is supported on a continuous basemat foundation, which is supported on the bedrock.
II.2. <u>Natural Frequencies and Responses</u> - To be acceptable, the following information should be provided:	See below.
II.2.A. A summary of the modal masses, effective masses, natural frequencies, mode shapes, modal and total responses for the Category I structures, including the containment structure, or a summary of the total responses if the method of direct integration is used.	The FSARU provides the following modal information associated with the Hosgri analysis of the auxiliary building: - <u>Table 3.7-10</u>: Horizontal periods & participation factors - <u>Table 3.7-11</u>: Vertical periods & participation factors - <u>Table 3.7-17 & -18</u>: Maximum accelerations - <u>Table 3.7-19 & -20</u>: Maximum displacements

SRP 3.7.2	**Seismic System Analysis - Auxiliary Building**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C. For the multiple time history analysis option, procedures used to account for uncertainties, etc.	DCPP does not use the multiple time-history option of the Hosgri seismic analyses of the auxiliary building.
II.3. <u>Procedures Used for Analytical Modeling</u> To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
II.3.B. <u>Decoupling Criteria for Subsystems</u> - SRP Section 3.7.2 provides guidance for the decoupling of systems and subsystems.	The auxiliary structure is a "seismic system."
II.3.C. <u>Modeling of Structures</u> - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the auxiliary building are based on lumped-mass stick models (two horizontal and one vertical). See FSARU Figure 3.7-13. In addition, finite element models are used to capture the vertical response of flexible floor slabs. See FSARU Figure 3.7-13A.
II.3.C.i. <u>Lumped-Mass Stick Models</u>	See discussion below.
II.3.C.i (continued) - For selecting an adequate number of discrete mass degrees of freedom in the dynamic modeling, the acceptance criteria given in Subsection II.1.a.iv of this SRP section is acceptable.	FSARU Section 3.7.2.1.7.1 describes the number of mass points used in the stick models, which are shown in Figure 3.7-13. Each mass point corresponds to a floor of the building. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.

SRP 3.7.2	**Seismic System Analysis - Auxiliary Building**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.C.ii. <u>Finite Element Models</u> - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	As indicated in FSARU Section 3.7.2.1.7.1, finite element models are used to capture the vertical response of flexible floor slabs, based on plate elements. See FSARU Figure 3.7-13A. Details of the theoretical formulation of the element are not provided.
II.3.C.ii (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The FSARU does not address the effects of element size, shape, or aspect ratio on the solution accuracy. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The DCPP design/licensing basis does not address the effects of mesh refinement on the solution results. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure…	The DCPP design/licensing basis does not address the method of consideration of local regions of the auxiliary building.
II.3.D. <u>Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models</u> - In addition to the structural mass, the following masses should be included:	See discussions below.

SRP 3.7.2	Seismic System Analysis - Auxiliary Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The DCPP design/licensing basis does not address the inclusion of miscellaneous dead loads in the dynamic analyses of the auxiliary building. The dead load, as defined in FSARU Section 3.8.2.3.1.1, includes the weight of permanent equipment.
II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to its location, snow loading is not considered in DCPP's design/licensing basis.
II.4. <u>Soil Structure Interaction</u> - A complete SSI analysis should account for all effects due to kinematic and inertial interaction for surface or embedded structures. See SRP for specific requirements.	Per FSARU Section 3.7.1.5, all Design Class I plant structures (including the auxiliary building) are founded on rock or concrete fill. An average shear wave velocity of 3600 feet per second is reported in DCM T-6, Section 4.3.3.2.4. Per FSARU Section 3.7.2.1.7.1, the model used for the Hosgri evaluation of the auxiliary building is fixed-base (soil is not modeled). Per FSARU Section 3.7.1.2, the horizontal free-field input ground motion for the Hosgri evaluation has been reduced to account for the presence of the auxiliary building's large foundation. This reduction is derived by spatial averaging of the accelerations across the foundation by the Tau-filtering procedure.
II.5. <u>Development of In-Structure Response Spectra</u> - RG 1.122 describes methods generally acceptable by the staff for the development of in-structure response spectra. The topics addressed are:	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.122.

SRP 3.7.2	**Seismic System Analysis - Auxiliary Building**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5.A. SRSS combination of the three in-structure response spectra in a given direction developed from separate analyses of the three directions of input motion. SRSS is not applicable if the three directions of input motion are applied simultaneously in a single analysis.	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.B. Frequency increments for calculation of spectral accelerations	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.C. Spectrum smoothing and broadening to account for uncertainty.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
II.5. (continued) The guidance of RG 1.122 is augmented as follows:	See discussion below.
II.5. The guidance of RG 1.122 is augmented as follows: (1) SRSS combination applies to all cases where the three directions of input motion are analyzed separately. There is no longer a distinction between symmetric and unsymmetrical structures	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.

SRP 3.7.2	**Seismic System Analysis - Auxiliary Building[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. The guidance of RG 1.122 is augmented as follows (continued): (2) The 3 Hz freq. incr. in the last row of RG 1.122, Table 1 applies to the highest frequency of interest.	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5. The guidance of RG 1.122 is augmented as follows (continued): (3a) When a single set of three artificial time histories is used as input, the in-structure response spectra are smoothed and broadened in accordance RG 1.122	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
5. The guidance of RG 1.122 is augmented as follows (continued): (3b) When multiple sets of three time histories, derived from actual earthquake records, are used.	DCPP uses a single set of input time histories.
II.7. Combination of Modal Responses -	See discussion below.

SRP 3.7.2	Seismic System Analysis - Auxiliary Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.
II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the auxiliary building.
II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Auxiliary Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is equivalent to that	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined to as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets"). The details of this program are described in the PG&E report, "Description of the Systems Interaction Program for Seismically Induced Events," dated August 1980, and the ongoing implementation is governed by DCM T-14. - The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.2	Seismic System Analysis - Auxiliary Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
for a Cat I SSC.	
II.9. Effects of Parameter Variation of Floor Response Spectra - consideration should be given in the analysis to the effects of floor response spectra (e.g., peak width) of expected variations of structural properties, damping values, soil properties, and SSI.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side to account for "variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections." FSARU Section 3.7.1.5 indicates that all Design Class I structures are founded on rock or concrete fill. FSARU Section 3.7.2.1.7.1 indicates that the Hosgri seismic analyses of the Design Class I structures are based on fixed-base models (i.e., the consideration of soil properties and SSI is not required). Variations in damping values are not addressed.
II.9. (continued) In addition, for concrete structures, the effect of potential concrete cracking on the structural stiffness should be specifically addressed.	The FSARU does not discuss the method for the determination of the section properties used for the determination of the stiffness of concrete structures. FSARU Section 3.7.2.1.7.1 indicates that variations in "material sections" were considered in the widening of the response spectra. The consideration of the effect of potential concrete cracking is not addressed in the DCPP design/licensing basis.
II.12. Comparison of Responses - If both the time history analysis method and the response spectrum analysis method are used to analyze an SSC, the peak responses obtained from these two methods should be compared, to demonstrate approximate equivalency between the two methods.	FSARU Section 3.7.2.11 states "time-history analyses only are performed for Design Class I structures. Response spectrum analyses are not performed because time-history produces spectra that represent reasonably the criteria response spectra." The comparison of responses calculated by the two different methods is not addressed in the DCPP design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's[2]: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the consistency review for SRP Section 3.7.2 will be performed individually, for the major SSC's addressed in FSARU Section 3.7.2.
II.1.A. Dynamic Analysis Methods (cont'd) II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
II.1.A.vi. Consideration of maximum relative displacements between adjacent supports of seismic Category I SSCs	Relative displacements between adjacent supports is not applicable because the turbine building is supported on a continuous basemat foundation, which is supported on the bedrock.

1 The turbine building is a Design Class II structure except for areas containing or supporting safety-related equipment (e.g., emergency diesel generators, vital 4.16 kV switchgear, and vital component cooling water heat exchangers), which are Design Class I (Reference Q-List, Section I.C.1.1 and Note S-66). As a result, this building is required to be seismically qualified for the loading associated with the HE. Therefore, the turbine building is effectively a Seismic Category I Structure and SRP Section 3.7.2 is applicable for this comparison.

2 The turbine building is assumed to be equivalent to a Seismic Category I structure in this SRP review.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.B. Equivalent Static Load Method An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.2, the turbine building is evaluated using a dynamic analysis.
II.2. Natural Frequencies and Responses - To be acceptable, the following information should be provided:	See below.
II.2.A. A summary of the modal masses, effective masses, natural frequencies, mode shapes, modal and total responses for the Category I structures, including the containment structure, or a summary of the total responses if the method of direct integration is used.	The FSARU provides the following modal information associated with the Hosgri analyses of the turbine building: - Table 3.7-23A: Horizontal frequencies & participation factors - Table 3.7-23B: Vertical frequencies & participation factors - Table 3.7-23C: Maximum accelerations - Table 3.7-23D: Maximum displacements
II.2.C. For the multiple time history analysis option, procedures used to account for uncertainties, etc.	DCPP does not use the multiple time history option of the Hosgri seismic analyses of the turbine building.
II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
II.3.B. Decoupling Criteria for Subsystems - SRP Section 3.7.2 provides guidance for the decoupling of systems and subsystems.	Since the turbine structure is a "seismic system."

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the turbine building are based on several finite element models (two horizontal and four vertical). See FSARU Figures 3.7-15C through 3.7-15F.
II.3.C.i. Lumped-Mass Stick Models	Lumped-mass stick models not used for turbine building.
II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	As indicated in FSARU Section 3.7.2.1.7.2, various finite element models are used to capture the response of the turbine building, based on beam, truss, plane-stress, and plate elements. See FSARU Figures 3.7-15C through 3.7-15F. The theoretical formulation of the elements is not provided.
II.3.C.ii (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The FSARU does not address the effects of element size, shape, or aspect ratio on the solution accuracy. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The FSARU does not address the effects of mesh refinement on the solution results. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure…	There are no "local regions" of the turbine building that require special consideration.
II.3.D. <u>Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models</u> - In addition to the structural mass, the following masses should be included:	See discussions below.
II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The FSARU does not address the inclusion of miscellaneous dead loads in the dynamic analyses of the turbine building. The dead load, as defined in FSARU Section 3.8.5.1.3.1.1, includes the weight of permanent attachments and permanent equipment.
II.3.D (continued) - Mass equivalent to 25% of design live load	FSARU Section 3.8.5.1.3.1.2 indicates that "Live loads consist of any actual live loads acting on the element considered." FSARU Section 3.8.5.1.3.2.2 indicates that live loads are included in the load combinations, which include the HE. However, DCM T-4, Section 4.3.4.2 indicates that the live load combined with Hosgri seismic loads is limited to that present during "abnormal conditions." A review of supporting analyses indicates that zero live load is considered in combination with the Hosgri seismic loads.
II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to its location, snow loading is not considered in DCPP's design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.E. Special Consideration for Dynamic Modeling of Structures - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	The turbine building does not utilize separate models for the detailed design analysis of load combinations.
II.4. Soil Structure Interaction - A complete SSI analysis should account for all effects due to kinematic and inertial interaction for surface or embedded structures. See SRP for specific requirements.	Per FSARU Section 3.7.1.5, all Design Class I plant structures are founded on rock or concrete fill[3]. An average shear wave velocity of 3600 feet per second is reported in DCM T-6, Section 4.3.3.2.4. Per FSARU Section 3.7.2.1.7.2, the model used for the Hosgri evaluation of the turbine building is fixed-base (soil is not modeled). Per FSARU Section 3.7.1.2, the horizontal free-field input ground motion for the Hosgri evaluation has been reduced to account for the presence of the turbine building's large foundation. This reduction is derived by spatial averaging of the accelerations across the foundation by the Tau-filtering procedure.

3 Even though the turbine building is not a Design Class I structure, the underlying rock is the same.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Development of In-Structure Response Spectra - RG 1.122 describes methods generally acceptable by the staff for the development of in-structure response spectra. The topics addressed are:	The following provides a comparison of the DCPP design/licensing basis and the requirements of RG 1.122.
II.5.A. SRSS combination of the three in-structure response spectra in a given direction developed from separate analyses of the three directions of input motion. SRSS is not applicable if the three directions of input motion are applied simultaneously in a single analysis.	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.B. Frequency increments for calculation of spectral accelerations	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.C. Spectrum smoothing and broadening to account for uncertainty.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
II.5. (continued) The guidance of RG 1.122 is augmented as follows:	See discussion below.

SRP 3.7.2	**Seismic System Analysis - Turbine Building[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. The guidance of RG 1.122 is augmented as follows: (1) SRSS combination applies to all cases where the three directions of input motion are analyzed separately. There is no longer a distinction between symmetric and unsymmetrical structures	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5. The guidance of RG 1.122 is augmented as follows (continued): (2) The 3 Hz freq. incr. in the last row of RG 1.122, Table 1 applies to the highest frequency of interest.	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5. The guidance of RG 1.122 is augmented as follows (continued): (3a) When a single set of three artificial time histories is used as input, the in-structure response spectra are smoothed and broadened in accordance RG 1.122	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
5. The guidance of RG 1.122 is augmented as follows (continued): (3b) When multiple sets of three time histories, derived from actual earthquake records, are used.	DCPP uses a single set of input time histories.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7. Combination of Modal Responses -	See discussion below.
II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.
II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the turbine building.
II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7.B <u>Modal Superposition Time History Analysis Method</u> (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
II.8. <u>Interaction of Non-Category I and Category I SSCs</u> - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is equivalent to that	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined to as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets"). The details of this program are described in the PG&E report "Description of the Systems Interaction Program for Seismically Induced Events," August 1980 and the ongoing implementation is governed by DCM T-14. - The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.2	Seismic System Analysis - Turbine Building[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
for a Cat I SSC.	
II.9. Effects of Parameter Variation of Floor Response Spectra - consideration should be given in the analysis to the effects of floor response spectra (e.g., peak width) of expected variations of structural properties, damping values, soil properties, and SSI.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side to account for "variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections." FSARU Section 3.7.1.5 indicates that all Design Class I structures are founded on rock or concrete fill. FSARU Section 3.7.2.1.7.1 indicates that the Hosgri seismic analyses of the Design Class I structures are based on fixed-base models (i.e., the consideration of soil properties and SSI is not required). Variations in damping values are not addressed.
II.9. (continued) In addition, for concrete structures, the effect of potential concrete cracking on the structural stiffness should be specifically addressed.	The FSARU does not discuss the method for the determination of the section properties used for the determination of the stiffness of concrete structures. FSARU Section 3.7.2.1.7.1 indicates that variations in "material sections" was considered in the widening of the response spectra. The consideration of the effect of potential concrete cracking is not addressed.
II.12. Comparison of Responses - If both the time history analysis method and the response spectrum analysis method are used to analyze an SSC, the peak responses obtained from these two methods should be compared, to demonstrate approximate equivalency between the two methods.	FSARU Section 3.7.2.11 states "time-history analyses only are performed for Design Class I structures. Response spectrum analyses are not performed because time-history produces spectra that represent reasonably the criteria response spectra." The comparison of responses calculated by the two different methods is not addressed.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's[2]: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the consistency review for SRP Section 3.7.2 will be performed individually, for the major SSC's addressed in FSARU Section 3.7.2.
II.1.A. Dynamic Analysis Methods (cont'd) II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
II.1.A.vi. Consideration of maximum relative displacements between adjacent supports of seismic Category I SSCs	Relative displacements between adjacent supports is not applicable because the intake structure is supported on a continuous basemat foundation, which is supported on the bedrock.

1 The intake structure is a Design Class II structure, which contains or supports safety-related equipment (i.e., vital auxiliary saltwater pumps and piping) (Referance Q-List, Section I.D.1.1 and Note S-70). As a result, this building is required to be seismically qualified for the loading associated with the HE. Therefore, the intake structure is effectively a Seismic Category I structure and SRP Section 3.7.2 is applicable for this comparison.

2 The intake structure is assumed to be equivalent to a Seismic Category I structure in this SRP review.

SRP 3.7.2	**Seismic System Analysis - Intake Structure[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.A.vii. Inclusion of significant effects such as:	See discussion below
II.1.A.vii. (continued) - externally applied structural restraints	The intake structure is completely embedded in the ground and is not restrained by other structures.
II.1.A.vii. (continued) - hydrodynamic (both mass and stiffness effects) loads	The intake structure contains a large volume of water, and is subjected to hydrodynamic loads. FSARU Section 3.7.2.1.7.2 indicates that the mass of the water is included, but does not address the impact of the stiffness of the water.
II.1.B. <u>Equivalent Static Load Method</u> An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.2, the intake structure is evaluated using a dynamic analysis.
II.2. <u>Natural Frequencies and Responses</u> - To be acceptable, the following information should be provided:	See below
II.2.A. A summary of the modal masses, effective masses, natural frequencies, mode shapes, modal and total responses for the Category I structures, including the containment structure, or a summary of the total responses if the method of direct integration is used.	The FSARU provides the following modal information associated with the Hosgri analyses of the intake structure: - <u>Table 3.7-23G</u>: Horizontal and vertical frequencies & participation factors - <u>Table 3.7-23H</u>: Maximum displacements & accelerations
II.2.C. For the multiple time history analysis option, procedures used to account for uncertainties, etc.	DCPP does not use the multiple time history option of the Hosgri seismic analyses of the intake structure.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the intake structure are based on two finite element models. See FSARU Figures 3.7-15H and 3.7-15I.
II.3.C.i. Lumped-Mass Stick Models	Lumped-mass stick models not used for Intake Structure.
II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	As indicated in FSARU Section 3.7.2.1.7.2, two finite element models are used to capture the response of the Intake Structure, based on flat-plate and three-dimensional solid elements. See FSARU Figure Nos. 3.7-15H and 3.7-15I. The theoretical formulation of the plane-stress and shell elements is not provided.
II.3.C.ii (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The FSARU does not address the effects of element size, shape, or aspect ratio on the solution accuracy. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criteria in the selection of the mass points.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The FSARU does not address the effects of mesh refinement on the solution results. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criteria in the selection of the mass points.
II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	There are no "local regions" of the intake structure that require special consideration.
II.3.D. Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models - In addition to the structural mass, the following masses should be included:	See discussions below.
II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The FSARU does not address the inclusion of miscellaneous dead loads in the dynamic analyses of the intake structure. The dead load, as defined in FSARU Section 3.8.5.2.3, includes the weight of equipment.
II.3.D (continued) - Mass equivalent to 25% of design live load	FSARU Section 3.8.5.2.3 indicates that live loads are included with the HE loads, but does not indicate if these loads are included in the dynamic analysis.
II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to its location, snow loading is not considered in DCPP's design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.E. Special Consideration for Dynamic Modeling of Structures - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	The intake structure does not utilize separate models for the detailed design analysis of load combinations.
II.4. Soil Structure Interaction - A complete SSI analysis should account for all effects due to kinematic and inertial interaction for surface or embedded structures. See SRP for specific requirements.	Per FSARU Section 3.7.1.5, all Design Class I plant structures are founded on rock or concrete fill[3]. An average shear wave velocity of 3600 feet per second is reported in DCM T-6, Section 4.3.3.2.4. Per FSARU Section 3.7.2.1.7.2, the model used for the Hosgri evaluation of the intake structure is fixed-base (soil is not modeled). Per FSARU Section 3.7.1.2, the horizontal free-field input ground motion for the Hosgri evaluation has been reduced to account for the presence of the intake structure's large foundation. This reduction is derived by spatial averaging of the accelerations across the foundation by the Tau-filtering procedure.

3 Even though the intake structure is not a Design Class I structure, the underlying rock is the same as that for Design Class I structures.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Development of In-Structure Response Spectra - RG 1.122 describes methods generally acceptable by the staff for the development of in-structure response spectra. The topics addressed are:	The following provides a comparison of the DCPP design/licensing basis and the requirements of RG 1.122.
II.5.A. SRSS combination of the three in-structure response spectra in a given direction developed from separate analyses of the three directions of input motion. SRSS is not applicable if the three directions of input motion are applied simultaneously in a single analysis.	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.B. Frequency increments for calculation of spectral accelerations	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5.C. Spectrum smoothing and broadening to account for uncertainty.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
II.5. (continued) The guidance of RG 1.122 is augmented as follows:	See discussion below.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. The guidance of RG 1.122 is augmented as follows: (1) SRSS combination applies to all cases where the three directions of input motion are analyzed separately. There is no longer a distinction between symmetric and unsymmetrical structures	The combination method for the directions of input motion in the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5. The guidance of RG 1.122 is augmented as follows (continued): (2) The 3 Hz freq. incr. in the last row of RG 1.122, Table 1 applies to the highest frequency of interest.	The set of frequencies used for the generation of in-structure response spectra is not addressed in the DCPP design/licensing basis.
II.5. The guidance of RG 1.122 is augmented as follows (continued): (3a) When a single set of three artificial time histories is used as input, the in-structure response spectra are smoothed and broadened in accordance RG 1.122	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side.
5. The guidance of RG 1.122 is augmented as follows (continued): (3b) When multiple sets of three time histories, derived from actual earthquake records, are used.	DCPP uses a single set of input time histories.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7. Combination of Modal Responses -	See discussion below.
II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.
II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the intake structure.
II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7.B <u>Modal Superposition Time History Analysis Method</u> (continued) *In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.*	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
II.8. <u>Interaction of Non-Category I and Category I SSCs</u> - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets"). The details of this program are described in the PG&E report "Description of the Systems Interaction Program for Seismically Induced Events," August 1980 and the ongoing implementation is governed by DCM T-14. - The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which are a subset of Design Class I SSC's.

SRP 3.7.2	Seismic System Analysis - Intake Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
margin of safety is equivalent to that for a Cat I SSC.	
II.9. <u>Effects of Parameter Variation of Floor Response Spectra</u> - consideration should be given in the analysis to the effects of floor response spectra (e.g., peak width) of expected variations of structural properties, damping values, soil properties, and SSI.	FSARU Section 3.7.2.1.7.1 indicates that the Hosgri in-structure response spectra are widened (broadened) by 5% on the low period side and 15% on the high period side to account for "variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections." FSARU Section 3.7.1.5 indicates that all Design Class I structures are founded on rock or concrete fill. FSARU Section 3.7.2.1.7.1 indicates that the Hosgri seismic analyses of the Design Class I structures are based on fixed-base models (i.e., the consideration of soil properties and SSI is not required). Variations in damping values are not addressed.
II.9. (continued) In addition, for concrete structures, the effect of potential concrete cracking on the structural stiffness should be specifically addressed.	The FSARU does not discuss the method for the determination of the section properties used for the determination of the stiffness of concrete structures. FSARU Section 3.7.2.1.7.1 indicates that variations in "material sections" were considered in the widening of the response spectra. The consideration of the effect of potential concrete cracking is not addressed.
II.12. <u>Comparison of Responses</u> - If both the time history analysis method and the response spectrum analysis method are used to analyze an SSC, the peak responses obtained from these two methods should be compared, to demonstrate approximate equivalency between the two methods.	FSARU Section 3.7.2.11 states "time-history analyses only are performed for Design Class I structures. Response spectrum analyses are not performed because time-history produces spectra that represent reasonably the criteria response spectra." The comparison of responses calculated by the two different methods is not addressed.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Annulus Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The acceptance criteria provided in SRP Section 3.7.2, subsection II.1, are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the SRP comparison for SRP Section 3.7.3 is being performed individually, for the major SSC's.
3.7.2.II.1.A. Dynamic Analysis Methods (cont'd) 3.7.2.II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	FSARU Section 3.7.2.1.7.1 indicates the number of mass points (nodes) used in the axisymmetric model of the containment interior structure, but does not indicate the number of mass points used in the annulus frame models used to determine vertical response. The DCPP design/licensing basis does not include a specific requirement for the determination of the adequacy of the number of discrete mass points.

1 The containment annulus structure is supported from the outer perimeter of the containment interior structure (on the "Crane Wall") and the top surface of the containment concrete foundation mat. The scope of this SRP review is limited to the containment annulus structure, the seismic analyses of the containment interior and exterior structures are addressed separately. Since the containment annulus structure is completely inside the containment structure, and entirely supported by the containment structure, it is classified as a subsystem for the purposes of this review.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Annulus Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
3.7.2.II.1.A.vii. Inclusion of significant effects such as piping interactions, externally applied structural restraints, hydrodynamic (both mass and stiffness effects) loads, and nonlinear responses.	The DCPP design/licensing basis does not address the evaluation of the containment annulus structure for hydrodynamic loads. The dynamic analyses of the containment annulus structure are based on linear elastic methods, so nonlinear response is not applicable.
3.7.2.II.1.B. Equivalent Static Load Method An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.1, the containment annulus structure is evaluated using a dynamic analysis.
II.3 Procedures Used for Analytical Modeling The acceptance criteria provided in SRP Section 3.7.2, subsection II.3 are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Annulus Structure**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.3 3.7.2.II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
3.7.2.II.3.B. Decoupling Criteria for Subsystems - It can be shown, in general, that frequencies of systems and subsystems have a negligible effect on the error due to decoupling. It can be shown that the mass ratio... SRP Section 3.7.2, subsection II.3.B provides guidance for the decoupling of systems and subsystems.	Coupling between the annulus structure and the containment interior structure is considered in the seismic analysis of the annulus structure.
3.7.2.II.3.C. Modeling of structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the containment annulus structure are based on several models: - Horizontal Analyses: Modeled with the containment interior concrete structure. See SRP 3.7.2 review associated with the containment structure for comparison. - Vertical Analyses: Lumped mass stick models of individual radial frames (FSARU Figure 3.7-5E). The modeling associated with the horizontal Hosgri analyses of the annulus structure is addressed with that for the containment interior concrete structure. Accordingly, the response in this section addresses only the models used for the vertical analysis of the annulus structure.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Annulus Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C.i. Lumped-Mass Stick Models	This discussion applies to the frame models used for the vertical Hosgri analysis of the annulus structure framing.
3.7.2.II.3.C.i (continued) - The eccentricities between the centroid, the center of rigidity, and the center of mass should be included in the seismic model.	The lumped mass stick models of individual radial frames are only used for vertical analyses and do not address eccentricities.
3.7.2.II.3.C.i (continued) - For selecting an adequate number of discrete mass degrees of freedom in the dynamic modeling, the acceptance criteria given in Subsection II.1.a.iv of this SRP section is acceptable.	FSARU Figure 3.7-5E pictorially shows the number of mass points (nodes) used in the frame models. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
3.7.2.II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	The DCPP design/licensing basis does not address the method of consideration of local regions of the containment annulus structure.
3.7.2.II.3.D. Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models - In addition to the structural mass, the following masses should be included:	See discussions below.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Annulus Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The DCPP design/licensing basis does not discuss the inclusion of miscellaneous dead loads in the dynamic analyses of the containment annulus structure.
3.7.2.II.3.D (continued) - Mass equivalent to 25% of design live load	FSARU Section 3.8.1.3.1.2 indicates that "Live loads consist of temporary equipment loads and a uniform load to account for the miscellaneous temporary loadings that may be placed on the structure." FSARU Section 3.8.1.3.2.2 indicates that live loads are not included in the load combinations which include the HE.
3.7.2.II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to its location, snow loading is not considered in DCPP's design/licensing basis.
3.7.2.II.3.E. <u>Special Consideration for Dynamic Modeling of Structures</u> - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	The DCPP design/licensing basis does not describe the usage of separate structural models used for the detailed design analysis of the containment annulus structure.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Annulus Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7. Combination of Modal Responses The acceptance criteria provided in SRP Section 3.7.2, subsection II.7, are applicable.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.7. Combination of Modal Responses 3.7.2.II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.
3.7.2.II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the annulus structure.
3.7.2.II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Annulus Structure[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
II.8. Interaction of Other Systems with Seismic Category I Systems. To be acceptable, each non-seismic Category I system should be designed to be isolated from any seismic Category I system... The acceptance criteria provided in SRP Section 3.7.2, subsection II.8, are applicable to all seismic Category I SSCs at the system and subsystem level.	See discussion below.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Annulus Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is equivalent to that for a Cat I SSC.	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets")*. The details of this program are described in the PG&E report, "Description of the Systems Interaction Program for Seismically Induced Events," dated August 1980 and the ongoing implementation is governed by DCM T-14. * the set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Annulus Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.11. Torsional Effects of Eccentric Masses For seismic Category I subsystems, when the torsional effects of an eccentric mass is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for judging the significance will be reviewed on a case-by-case basis.	The annulus structure includes various eccentric masses associated with major equipment (e.g., containment fan coolers). The methods used to consider the effects of eccentric masses on the seismic response of this structure are not described in the DCPP design/licensing basis.
II.12. Seismic Category I Buried Piping, Conduits, and Tunnels. For seismic category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis.	Not applicable to the containment annulus structure.
II.13. Methods for Seismic Analysis of Seismic Category I Concrete Dams. For the seismic analysis of all seismic Category I concrete dams...	Not applicable to the containment annulus structure.
II.14. Methods for Seismic Analysis of Above-Ground Tanks. Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	Not applicable to the containment annulus structure.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Polar Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The acceptance criteria provided in SRP Section 3.7.2, subsection II.1, are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSCs: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the SRP comparison review for SRP Section 3.7.3 is being performed individually, for the major SSC's.
3.7.2.II.1.A. Dynamic Analysis Methods (cont'd) 3.7.2.II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	FSARU Figure 3.7-7A illustrates the number of mass points (nodes) used in the model of the containment polar crane. The adequacy of the number of points is not addressed in the DCPP design/licensing basis.

[1] The containment polar crane is a 200 ton overhead gantry crane, supported from a circular crane rail at 140 foot elevation on the containment interior concrete structure. The crane rail is on the top of the "crane wall", which defines the boundary between the containment interior concrete structure and the containment steel annulus structure.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Polar Crane[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The Hosgri evaluation of the polar crane is based on nonlinear time history analyses.
3.7.2.II.1.A.vi. Consideration of maximum relative displacements between adjacent supports of seismic Category I SSCs	The polar crane is only supported from the crane rail (140 foot elevation on the containment interior concrete).
3.7.21II.1.B. <u>Equivalent Static Load Method</u> An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.1, the polar crane is evaluated using a dynamic analysis.
II.3 <u>Procedures Used for Analytical Modeling</u> The acceptance criteria provided in SRP Section 3.7.2, subsection II.3 are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.

SRP 3.7.3	***Seismic Subsystem Analysis - Containment Polar Crane***[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.3 3.7.2.II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, *and damping characteristics of the* structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
3.7.2.II.3.B. Decoupling Criteria for Subsystems - It can be shown, in general, that frequencies of systems and subsystems have a negligible effect on the error due to decoupling. It can be shown that the mass ratio... SRP Section 3.7.2, subsection II.3.B provides guidance for the decoupling of systems and subsystems.	The seismic analysis of the polar crane is decoupled from the containment interior structure. The DCPP design/licensing basis does not address the decoupling criteria.
3.7.2.II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the containment polar crane (FSARU Figure 3.7-7A) are based on a finite element model comprised of beam elements, tension-only truss elements (to represent the wire rope), compression-only gap elements (to represent the wheels), and lumped masses. This is conceptually similar to a "lumped-mass stick model."
3.7.2.II.3.C.i. Lumped-Mass Stick Models	See discussion below.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Polar Crane**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C.i (continued) - For selecting an adequate number of discrete mass degrees of freedom in the dynamic modeling, the acceptance criteria given in Subsection II.1.a.iv of this SRP section is acceptable.	FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
3.7.2.II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	Finite element models are not used for the polar crane.
3.7.2.II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	The DCPP design/licensing basis does not address the method of consideration of local regions of the containment polar crane.
3.7.2.II.3.D. Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models - In addition to the structural mass, the following masses should be included:	See discussions below.
3.7.2.II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	There is a very limited amount of minor equipment attached to the polar crane.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Polar Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to its location, snow loading is not considered in DCPP's design/licensing basis.
3.7.2.II.3.E. Special Consideration for Dynamic Modeling of Structures - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	The DCPP design/licensing basis does not describe the usage of separate structural models used for the detailed design analysis of the polar crane.
II.4. Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment should preferably be selected to be less than 1/2 of more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if equipment is adequately designed for applicable loads.	The DCPP design/licensing basis does not include requirements for the frequency of subsystems relative to the supporting structure. The polar crane has been designed for the seismic loading developed from the Hosgri seismic analysis of the containment interior structure, which is the support for the polar crane.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Polar Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.7. Combination of Modal Responses The acceptance criteria provided in SRP Section 3.7.2, subsection II.7, are applicable.	The seismic analysis of the polar crane is based on nonlinear time history analyses.
II.8. Interaction of Other Systems with Seismic Category I Systems. To be acceptable, each non-seismic Category I system should be designed to be isolated from any seismic Category I system.... The acceptance criteria provided in SRP Section 3.7.2, subsection II.8, are applicable to all seismic Category I SSCs at the system and subsystem level.	See discussion below.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Polar Crane**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is equivalent to that for a Cat I SSC.	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets")*. The details of this program are described in the PG&E report "Description of the Systems Interaction Program for Seismically Induced Events," August 1980 and the ongoing implementation is governed by DCM T-14. * The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Polar Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.9. Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motion of the primary structure or structures at each of the support points may be quite different. A conservative and acceptable approach for analyzing...	The polar crane is entirely supported from the containment interior structure.
II.12. Seismic Category I Buried Piping, Conduits, and Tunnels. For seismic category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis.	Not applicable to the polar crane.
II.13. Methods for Seismic Analysis of Seismic Category I Concrete Dams. For the seismic analysis of all seismic Category I concrete dams...	Not applicable to the polar crane.
II.14. Methods for Seismic Analysis of Above-Ground Tanks. Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	Not applicable to the polar crane.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Pipeway Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. <u>Seismic Analysis Methods</u> The acceptance criteria provided in SRP Section 3.7.2, subsection II.1, are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.
<u>From SRP Section 3.7.2, subsection II.1</u>: 3.7.2.II.1. <u>Seismic Analysis Methods</u> The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the SRP comparison review for SRP Section 3.7.3 is being performed individually, for the major SSC's.
3.7.2.II.1.A. <u>Dynamic Analysis Methods (cont'd)</u> 3.7.2.II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	FSARU Section 3.7.2.1.7.1 does not discuss the number of mass points (nodes) used in the modeling of the pipeway structure, nor their adequacy. The DCPP design/licensing basis does not include a specific requirement to account for the determination of the adequacy of the number of discrete mass points.

1 The containment pipeway structure is supported from the outside of the containment exterior structure, the east wall of the turbine building, and several locations on the auxiliary building. The scope of this SRP comparison review is limited to the containment pipeway structure; the seismic analyses of the containment exterior structure, the turbine building, and the auxiliary building are addressed separately.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Pipeway Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
3.7.2.II.1.B. Equivalent Static Load Method An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.1, the Unit 2 Containment Pipeway Structure is evaluated using the Equivalent Static Method for the structural qualification.
3.7.2.II.1.B.i. Justification is provided that the system can be realistically represented by a simple model and the method produces conservative results in terms of responses.	The DCPP design/licensing basis does not provide specific justification for the use of the equivalent static method for the Unit 2 Pipeway Structure.
3.7.2.II.1.B.iii. A factor is 1.5 is applied to the peak spectral acceleration, unless a small factor is justified.	The DCPP design/licensing basis does not discuss the use of a spectral acceleration amplification factor for the equivalent static analysis of the Unit 2 Pipeway Structure, so the use of a factor of 1.5 is not specified.
II.3 Procedures Used for Analytical Modeling The acceptance criteria provided in SRP Section 3.7.2, subsection II.3 are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Pipeway Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.3 3.7.2.II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
3.7.2.II.3.B. Decoupling Criteria for Subsystems - It can be shown, in general, that frequencies of systems and subsystems have a negligible effect on the error due to decoupling. It can be shown that the mass ratio... SRP Section 3.7.2, subsection II.3.B provides guidance for the decoupling of systems and subsystems.	The pipeway structure is supported in the horizontal direction from the containment exterior structure and in the vertical direction from the containment exterior structure, the turbine building, and the auxiliary building. Coupling between the pipeway structure and the containment exterior structure is considered in the horizontal and vertical seismic analyses of the pipeway structure. Coupling between the pipeway structure and the turbine or auxiliary buildings is not considered in the vertical seismic analysis of the pipeway structure.
3.7.2.II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the containment pipeway structure are based on a coupled model representing the following: - Pipeway Framing: Finite elements (beams and trusses) - Containment Exterior Concrete: Lumped mass stick model - Main Steam and Feedwater Piping: Finite elements (beams) Note that the pipeway is also supported vertically by the auxiliary building and the turbine building. Oversized holes in the connections at these buildings prevent coupling in the horizontal direction.

SRP 3.7.3	***Seismic Subsystem Analysis - Containment Pipeway Structure*[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C.i. Lumped-Mass Stick Models	This discussion applies to the stick model used to represent the containment exterior concrete as part of the coupled model with the pipeway structure.
3.7.2.II.3.C.i (continued) - The eccentricities between the centroid, the center of rigidity, and the center of mass should be included in the seismic model.	The containment exterior concrete is an axisymmetric structure.
3.7.2.II.3.C.i (continued) - For selecting an adequate number of discrete mass degrees of freedom in the dynamic modeling, the acceptance criteria given in Subsection II.1.a.iv of this SRP section is acceptable.	The DCPP design/licensing basis does not discuss the number of mass points used in the model. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
3.7.2.II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	The discussion below applies to the beam/truss finite element model used to represent the pipeway framing and the main steam and feedwater piping.
3.7.2.II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	Refinement in mesh size is not addressed for the pipeway structure models in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Pipeway Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	The containment pipeway structure does not have local regions that would affect the results.
3.7.2.II.3.D. <u>Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models</u> - In addition to the structural mass, the following masses should be included:	See discussions below.
3.7.2.II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The DCPP design/licensing basis does not address the inclusion of miscellaneous dead loads in the dynamic analyses of the containment pipeway structure.
3.7.2.II.3.D (continued) - Mass equivalent to 25% of design live load	FSARU Section 3.8.6.3.1.2 indicates that live loads "are considered small in relative magnitude and, therefore, are considered negligible." FSARU Section 3.8.6.3.2.2 indicates that live loads are not included in the load combinations, which include the HE.
3.7.2.II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable.	Due to its location, snow loading is not considered in DCPP's design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Pipeway Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.E. Special Consideration for Dynamic Modeling of Structures - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	The DCPP design/licensing basis does not describe the usage of separate structural models used for the detailed design analysis of the containment pipeway structure.
II.4. Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment should preferably be selected to be less than 1/2 of more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if equipment is adequately designed for applicable loads.	The DCPP design/licensing basis does not include requirements for the selection of frequency of subsystems relative to the supporting structure.
II.7. Combination of Modal Responses The acceptance criteria provided in SRP Section 3.7.2, subsection II.7, are applicable.	See discussion below.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Pipeway Structure[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.7. Combination of Modal Responses 3.7.2.II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.
3.7.2.II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the pipeway structure.
3.7.2.II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Pipeway Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
3.7.2.II.8. Interaction of Other Systems with Seismic Category I Systems. To be acceptable, each non-seismic Category I system should be designed to be isolated from any seismic Category I system.... The acceptance criteria provided in SRP Section 3.7.2, subsection II.8, are applicable to all seismic Category I SSCs at the system and subsystem level.	See discussion below.

<table>
<tr><th>SRP 3.7.3</th><th>Seismic Subsystem Analysis - Containment Pipeway Structure[1]</th></tr>
<tr><th>SRP Acceptance Criteria</th><th>DCPP Design/Licensing Basis</th></tr>
<tr><td><u>From SRP Section 3.7.2, subsection II.1</u>:
3.7.2.II.8. <u>Interaction of Non-Category I and Category I SSCs</u> - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria:

A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC.

B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants.

C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is equivalent to that for a Cat I SSC.</td><td>FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets")*. The details of this program are described in the PG&E report "Description of the Systems Interaction Program for Seismically Induced Events," dated August 1980 and the ongoing implementation is governed by DCM T-14.

* The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.</td></tr>
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SRP 3.7.3	Seismic Subsystem Analysis - Containment Pipeway Structure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.9. Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motion of the primary structure or structures at each of the support points may be quite different. A conservative and acceptable approach for analyzing...	The pipeway structure is supported from the containment exterior structure (vertical and horizontal support), the auxiliary building (vertical support) and the turbine building (vertical support), the input motion at these locations is not the same. The differences in input motion are not addressed in the DCPP design/licensing basis.
II.11. Torsional Effects of Eccentric Masses For seismic Category I subsystems, when the torsional effects of an eccentric mass is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for judging the significance will be reviewed on a case-by-case basis.	There are no significant eccentric masses in the pipeway structure itself. The eccentric masses associated with valve operators would be captured in the piping reactions that are applied to the pipeway structure as a static load case.
II.12. Seismic Category I Buried Piping, Conduits, and Tunnels. For seismic category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis.	Not applicable to the containment pipeway structure.
II.13. Methods for Seismic Analysis of Seismic Category I Concrete Dams. For the seismic analysis of all seismic Category I concrete dams...	Not applicable to the containment pipeway structure.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Pipeway Structure**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.14. Methods for Seismic Analysis of Above-Ground Tanks. Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	Not applicable to the containment pipeway structure.

SRP 3.7.3	**Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The acceptance criteria provided in SRP Section 3.7.2, subsection II.1, are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the SRP comparison review for SRP Section 3.7.3 is addressed individually, for the major SSC's.
3.7.2.II.1.A. Dynamic Analysis Methods (cont'd) 3.7.2.II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	FSARU Section 3.7.2.1.7.1 does not indicate the number of mass points (nodes) used in the models, and this level of detail is not specified in FSARU Figure 3.7-13B. The adequacy of the number of points is not specifically addressed. The DCPP design/licensing basis does not include a specific requirement for the determination of the adequacy of the number of mass points.

1 The area above the SFP's is enclosed by the FHBSS, which is supported on the reinforced concrete auxiliary building. The scope of this SRP review is limited to the FHBSS, the seismic analyses of the auxiliary building are addressed separately.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
3.7.2.II.1.A.vi. Consideration of maximum relative displacements between adjacent supports of seismic Category I SSCs	The FHBSS is supported by a number of columns which are all attached to the concrete auxiliary building.
3.7.21II.1.B. Equivalent Static Load Method An equivalent static load method is acceptable if:	Per FSARU Section 3.7.2.1.7.1, the seismic response of the FHBSS is determined using two "partial" models of the structure. As indicated in DCM T-6, Appendix B, the forces in the individual structural elements (e.g., beams, columns, braces, roof trusses) are determined by the static application of the local accelerations, derived from the dynamic analyses of the partial models, to a three-dimensional finite element model of the entire building. This represents the use of the Equivalent Static Method.
3.7.2.II.1.B.ii. The simplified static analysis method accounts for the relative motion between all points of support.	The entire FHBSS is supported on top of the reinforced concrete auxiliary building.
II.3 Procedures Used for Analytical Modeling The acceptance criteria provided in SRP Section 3.7.2, subsection II.3 are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.3 3.7.2.II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
3.7.2.II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the FHBSS are based on two beam/truss element finite element models (two portions of the building are modeled). See FSARU Figure 3.7-13B.
3.7.2.II.3.C.i. Lumped-Mass Stick Models	Not applicable to the FHBSS.
3.7.2.II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	As indicated in FSARU Section 3.7.2.1.7.1, finite element models are used to capture the dynamic response of the FHBSS, based on beam and truss elements. See FSARU Figure 3.7-13B. Details of the theoretical formulation of the element are not provided in the DCPP design/licensing basis.
3.7.2.II.3.C.ii. Finite Element Models (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The DCPP design/licensing basis does not address the effects of element size, shape, or aspect ratio on the solution accuracy. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points. Beam and truss element are discretized based key points in the structure. The size, shape, and aspect ratios are not applicable to beam or truss elements.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The DCPP design/licensing basis does not address the effects of mesh refinement on the solution results. FSARU Section 3.7.2.3.1 indicates that "accurately defining the natural frequencies and mode shapes" is a criterion in the selection of the mass points.
3.7.2.II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	Consideration of the effects of local regions is not required because the FHBSS does not have any local regions that would affect the results and the modeling of this steel-framed structure has adequate details to capture the local response.
3.7.2.II.3.D. <u>Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models</u> - In addition to the structural mass, the following masses should be included:	See discussions below.
3.7.2.II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The DCPP design/licensing basis does not address the inclusion of miscellaneous dead loads in the dynamic analyses of the FHBSS. The dead load, as defined in FSARU Section 3.8.2.3.1.1, includes the weight of permanent equipment.
3.7.2.II.3.D (continued) - Mass equivalent to 25% of design live load	FSARU Section 3.8.2.3.1.2 indicates that "Live loads consist of temporary equipment loads and a uniform load to account for the miscellaneous temporary loadings that may be placed on the structure." FSARU Section 3.8.2.3.2.2 indicates that live loads are included in the load combinations which include the HE[2].
3.7.2.II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to its location, snow loading is not considered in DCPP's design/licensing basis.

[2] The FHBSS has no floor levels, the only horizontal surface on which live loads could be placed is the flat roof.

SRP 3.7.3	**Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4. Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment should preferably be selected to be less than 1/2 of more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if equipment is adequately designed for applicable loads.	The DCPP design/licensing basis does not includes requirements for the frequency of subsystems relative to the supporting structure. The FHBSS has been designed for the seismic loading developed from the Hosgri seismic analysis of the auxiliary building, which is the support for the FHBSS.
II.7. Combination of Modal Responses The acceptance criteria provided in SRP Section 3.7.2, subsection II.7, are applicable.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.7. Combination of Modal Responses 3.7.2.II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.

SRP 3.7.3	**Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure**[1]
SRP Acceptance Criteria	· **DCPP Design/Licensing Basis**
3.7.2.II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the FHBSS.
3.7.2.II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
3.7.2.II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
II.8. Interaction of Other Systems with Seismic Category I Systems. To be acceptable, each non-seismic Category I system should be designed to be isolated from any seismic Category I system.... The acceptance criteria provided in SRP Section 3.7.2, subsection II.8, are applicable to all seismic Category I SSCs at the system and subsystem level.	See discussion below.

SRP 3.7.3	**Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is equivalent to that for a Cat I SSC.	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets")*. The details of this program are described in the PG&E report "Description of the Systems Interaction Program for Seismically Induced Events," August 1980 and the ongoing implementation is governed by DCM T-14. * The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building Steel Superstructure[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.9. Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motion of the primary structure or structures at each of the support points may be quite different. A conservative and acceptable approach for analyzing...	The FHBSS is entirely supported from the auxiliary building.
II.12. Seismic Category I Buried Piping, Conduits, and Tunnels. For seismic category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis.	Not applicable to the FHBSS.
II.13. Methods for Seismic Analysis of Seismic Category I Concrete Dams. For the seismic analysis of all seismic Category I concrete dams...	Not applicable to the FHBSS.
II.14. Methods for Seismic Analysis of Above-Ground Tanks. Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	Not applicable to the FHBSS.

SRP 3.7.3	Seismic Subsystem Analysis - Outdoor Water Storage Tanks (OWST's)[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.14. Methods for Seismic Analysis of Above-Ground Tanks Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	
II.14.B. Fundamental Impulsive Mode of Vibration The fundamental natural horizontal impulsive mode of the fluid-tank system must be estimated giving due consideration to the flexibility of the supporting medium and to any uplifting tendencies for the tank. It is unacceptable to assume a rigid tank unless the assumption can be justified. The horizontal impulsive-mode spectral acceleration, S_{a1}, is then determined using this frequency and the appropriate damping for the fluid-tank system. Alternatively, the maximum spectral acceleration corresponding to the relevant damping may be used.	The DCPP design/licensing basis does not provide this level of detail concerning the basis of the fundamental natural horizontal impulsive mode of the fluid-tank system for the seismic qualification of the OWST's. DCM T-6, Appendix E, Section 5.1 provides a general discussion of the method for determining the fundamental natural horizontal impulsive mode of the fluid-tank system with consideration of flexibility of the supporting medium, based on a Veletsos approach for the HE.

1 The OWST (condensate storage tanks (CSTs), refueling water storage tanks (RWSTs), and fire water and transfer tank (FWTT)) are seismic Category I above-ground atmospheric tanks. These tanks are steel-lined, reinforced concrete tanks, supported on concrete foundations extending to bedrock, which include rock anchors to prevent sliding, overturning, and uplift.

SRP 3.7.3	Seismic Subsystem Analysis - Outdoor Water Storage Tanks (OWST's)[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.14.D. Damping Ratio for Convective Mode In determining the spectral acceleration in the horizontal convective mode, S_{a2}, the fluid damping ratio shall be 0.5 percent of critical damping unless a higher value can be substantiated by experimental results	DCM T-6, Appendix E, Section 3.2, indicates that a damping value of 1% is used for determining convective (sloshing) spectral acceleration for the HE.
II.14.E. Overturning Moment The maximum overturning moment, M_o, at the base of the tank should be obtained by the modal and spatial combination methods discussed in subsection II of SRP Section 3.7.2:	See discussion below.
II.14.E. (continued) 3.7.2.II.7 Combination of Modal Responses RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	FSARU Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the OWST's.

SRP 3.7.3	Seismic Subsystem Analysis - Outdoor Water Storage Tanks (OWST's)[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.14.G. Fluid Sloshing Effects on Head Either the tank top head must be located at elevation higher than the slosh height above the top of the fluid or else must be designed for pressures resulting from fluid sloshing against this head.	The DCPP design/licensing basis does not address sloshing (i.e., freeboard) heights or the design of the tank roofs and connections for pressures induced by sloshing.
II.14.J. Additional Considerations In addition to the above, a consideration must be given to:	See discussion below.
II.14.J. (continued) - prevent buckling of tank walls and roof	Buckling of the tank walls and roof is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The acceptance criteria provided in SRP Section 3.7.2, subsection II.1, are applicable. The following SRP requirements are extracted from SRP 3.7.2.	The seismic analysis methods for architectural platforms are not described in the FSARU, but a limited amount of information is provided in DCM C-49, "Class I and Class IIA Architectural Platforms".
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method Details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU. Therefore, the SRP comparison reviews for SRP Section 3.7.3 are addressed individually for the major SSC's.
3.7.2.II.1.A. Dynamic Analysis Methods SRP acceptance based on linear elastic analyses with allowable stresses near elastic limits. However, for certain special cases (e.g., evaluation of as-built structures), reliance on limited inelastic/nonlinear behavior is acceptable	DCM C-49, Section 5.5 indicates that Hosgri seismic loads are based on the Equivalent Static Method.

[1] Architectural platforms are structural steel assemblies within containment, auxiliary buildings, and turbine buildings. Design Class I and Design Class IIA (i.e., Design Class II platforms that support Class I equipment) correspond to RG 1.29 Seismic Category I structures.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.21II.1.B. Equivalent Static Load Method An equivalent static load method is acceptable if:	
3.7.2.II.1.B.i. Justification is provided that the system can be realistically represented by a simple model and the method produces conservative results in terms of responses.	Justification for the use of the equivalent static method is not provided in the DCPP design/licensing basis.
3.7.2.II.1.B.ii. The simplified static analysis method accounts for the relative motion between all points of support.	The consideration of relative support motion is not addressed in the DCPP design/licensing basis.
3.7.2.II.1.B.iii. A factor is 1.5 is applied to the peak spectral acceleration, unless a small factor is justified.	DCM C-49, Section 5.5.1 indicates that the applied accelerations are based on the applicable building response spectra but does not require the use of a factor greater than 1.0. DCM C-49, Section 6.2 indicates that peak spectral accelerations are used unless loading is determined by a detailed analysis.
II.3 Procedures Used for Analytical Modeling The acceptance criteria provided in SRP Section 3.7.2, subsection II.3 are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.3 3.7.2.II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
3.7.2.II.3.B. Decoupling Criteria for Subsystems - It can be shown, in general, that frequencies of systems and subsystems have a negligible effect on the error due to decoupling. It can be shown that the mass ratio... SRP Section 3.7.2, subsection II.3.B provides guidance for the decoupling of systems and subsystems.	The DCPP design/licensing basis does not address the decoupling criteria for the platforms relative to the supporting buildings.
3.7.2.II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	Based on a review of supporting calculations, the Hosgri seismic analyses of the platforms are typically based on beam/truss element finite element models.
3.7.2.II.3.C.i. Lumped-Mass Stick Models	Lumped-mass stick models are not used for the platforms.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C.ii Finite Element Models (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The mathematical discretization of the models is not addressed in the DCPP design/licensing basis.
3.7.2.II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The element mesh sizes used in the models is not addressed in the DCPP design/licensing basis.
3.7.2.II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	The methods for the consideration of local regions are not addressed in the DCPP design/licensing basis.
3.7.2.II.3.D. Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models - In addition to the structural mass, the following masses should be included:	See discussions below.
3.7.2.II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	DCM C-49, Section 5.1 indicates that the dead load used for the evaluation of platforms includes attached equipment, piping, raceways, and ventilation system components.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.D (continued) - Mass equivalent to 25% of design live load	DCM C-49, Section 7 indicates that live load is considered in combination with Hosgri loads as follows: - Containment: 0% of live load - Other Buildings: 100% of live load
3.7.2.II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Due to the location of DCPP, snow loading is not considered.
3.7.2.II.3.E. <u>Special Consideration for Dynamic Modeling of Structures</u> - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	This subject is not addressed in the DCPP design/licensing basis for the seismic analysis of platforms.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4. Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment should preferably be selected to be less than 1/2 of more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if equipment is adequately designed for applicable loads.	The DCPP design/licensing basis does not include requirements for the frequency of platforms relative to the supporting structure.
II.7. Combination of Modal Responses The acceptance criteria provided in SRP Section 3.7.2, subsection II.7, are applicable.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.7. Combination of Modal Responses 3.7.2.II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of platforms.
3.7.2.II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
3.7.2.II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	**Seismic Subsystem Analysis - Architectural Platforms**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.8. Interaction of Other Systems with Seismic Category I Systems. To be acceptable, each non-seismic Category I system should be designed to be isolated from any seismic Category I system.... The acceptance criteria provided in SRP Section 3.7.2, subsection II.8, are applicable to all seismic Category I SSCs at the system and subsystem level.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets")*. The details of this program are described in the PG&E report "Description of the Systems Interaction Program for Seismically Induced Events," August 1980 and the ongoing implementation is governed by DCM T-14. * The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
margin of safety is equivalent to that for a Cat I SSC.	
II.9. Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motion of the primary structure or structures at each of the support points may be quite different. A conservative and acceptable approach for analyzing...	This issue is not addressed in the DCPP design/licensing basis for the seismic analysis of platforms.
II.11. Torsional Effects of Eccentric Masses For seismic Category I subsystems, when the torsional effects of an eccentric mass is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for judging the significance will be reviewed on a case-by-case basis.	Certain platforms may include various eccentric masses associated with major equipment. The methods used to consider the effects of eccentric masses on the seismic response of these structures are not described in the DCPP design/licensing basis.
II.12. Seismic Category I Buried Piping, Conduits, and Tunnels. For seismic category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis.	Not applicable to platforms.

SRP 3.7.3	Seismic Subsystem Analysis - Architectural Platforms[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.13. Methods for Seismic Analysis of Seismic Category I Concrete Dams. For the seismic analysis of all seismic Category I concrete dams...	Not applicable to platforms.
II.14. Methods for Seismic Analysis of Above-Ground Tanks. Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	Not applicable to platforms.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The acceptance criteria provided in SRP Section 3.7.2, subsection II.1, are applicable. The following SRP requirements are extracted from SRP 3.7.2.	The seismic analysis of the containment plant vent is not described in the FSARU. A detailed discussion of the seismic analysis of the plant vent is provided in DCM T-1F (Containment Plant Vent).
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.1. Seismic Analysis Methods The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method However, details of the application of these methods to specific SSC's are provided separately, in SSC-specific sections of the FSARU and/or DCMs. Therefore, the SRP comparison review for SRP Section 3.7.3 is addressed separately for the plant vent.
3.7.2.II.1.A. Dynamic Analysis Methods (continued) 3.7.2.II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	The adequacy of the number of mass points is not addressed.

[1] The containment plant vent serves as the elevated atmospheric discharge point for the exhaust from the ventilation systems serving the auxiliary building, the containment penetration area, the fuel handling area, the Gaseous Radwaste System, the Main Condenser Evaluation System, and the Turbine Gland Sealing System. The containment plant vent is a steel box-shaped structure, extending from the roof of the auxiliary building (140 foot elevation) and up the outside of the containment structure, terminating in a truncate cone at the apex of the containment structure cylindrical dome. The containment plant vent is effectively a large heating, ventilation, and air conditioning (HVAC) duct.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE linear analysis of the plant vent uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
3.7.2.II.1.A.vii. Inclusion of significant effects such as piping interactions, externally applied structural restraints, hydrodynamic (both mass and stiffness effects) loads, and nonlinear responses.	Piping interactions, externally applied structural restraints, and hydrodynamic loading are not applicable to the plant vent. However, the nonlinear effects associated with local yielding of the framing are addressed in the modeling and associated nonlinear time history analysis.
3.7.21II.1.B. <u>Equivalent Static Load Method</u> An equivalent static load method is acceptable if:	Per DCM T-1F, Section 4.3.5.1, the evaluation of the plant vent for seismic loads is performed by the equivalent static method, where the accelerations are obtained from the dynamic analysis.
3.7.2.II.1.B.i. Justification is provided that the system can be realistically represented by a simple model and the method produces conservative results in terms of responses.	DCM T-1F does not provide justification for the use of the equivalent static method for the plant vent.
3.7.2.II.1.B.iii. A factor is 1.5 is applied to the peak spectral acceleration, unless a small factor is justified.	DCM T-1F does not discuss the use of a spectral acceleration amplification factor for the equivalent static analysis of the plant vent, so the use of a factor of 1.5 is not specified and justification is not provided for the use of a smaller factor.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3 Procedures Used for Analytical Modeling The acceptance criteria provided in SRP Section 3.7.2, subsection II.3 are applicable. The following SRP requirements are extracted from SRP 3.7.2.	--
From SRP Section 3.7.2, subsection II.3 3.7.2.II.3. Procedures Used for Analytical Modeling To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.
3.7.2.II.3.B. Decoupling Criteria for Subsystems - It can be shown, in general, that frequencies of systems and subsystems have a negligible effect on the error due to decoupling. It can be shown that the mass ratio... SRP Section 3.7.2, subsection II.3.B provides guidance for the decoupling of systems and subsystems.	DCM T-1F does not address the decoupling criteria applied to the plant vent.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	The Hosgri seismic analyses of the plant vent (DCM T-1F, Section 4.3.5) is based on a finite element model comprised of beam elements and lumped masses. This is a finite element model.
3.7.2.II.3.C.i. Lumped-Mass Stick Models	A finite element model is used.
3.7.2.II.3.C.i (continued) - The eccentricities between the centroid, the center of rigidity, and the center of mass should be included in the seismic model.	A finite element model is used.
3.7.2.II.3.C.i (continued) - For selecting an adequate number of discrete mass degrees of freedom in the dynamic modeling, the acceptance criteria given in Subsection II.1.a.iv of this SRP section is acceptable.	A finite element model is used.
3.7.2.II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	Finite element models are used for the plant vent.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C.ii (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The mathematical discretization of the structure is not addressed.
3.7.2.II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The mesh size used in the finite element model is not addressed in the DCPP design/licensing basis.
3.7.2.II.3.C.iii. In developing either a lumped-mass stick model or a finite element model for dynamic response, it is necessary to consider local regions of the structure...	The DCPP design/licensing basis does not address the method of consideration of local regions of the plant vent.
3.7.2.II.3.C.iii (continued) In general, three-dimensional models should be used for seismic analyses. However, simpler models can be used if justification can be provided that the coupling effects of those degrees of freedom that are omitted from the three-dimensional models are not significant.	DCM T-1F, Section 4.3.5 indicates that the finite element model used for the dynamic analysis of the plant vent is two-dimensional. Justification for this simplification is not addressed in the DCPP design/licensing basis.
3.7.2.II.3.D. <u>Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models</u> - In addition to the structural mass, the following masses should be included:	See discussions below.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Plant Vent**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	The DCPP design/licensing basis does not address the inclusion of miscellaneous dead loads in the dynamic analyses of the plant vent.
3.7.2.II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Snow loading is not applicable to DCPP.
3.7.2.II.3.E. <u>Special Consideration for Dynamic Modeling of Structures</u> - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	DCM T-1F, Section 4.3.5.1 indicates that accelerations obtained from the dynamic analysis of the two-dimensional model are applied to another model to obtain member forces. Details of the methods employed are not provided in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4. Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment should preferably be selected to be less than 1/2 of more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if equipment is adequately designed for applicable loads.	The DCPP design/licensing basis does not include requirements for the selection of frequency of subsystems relative to the supporting structure.
II.7. Combination of Modal Responses The acceptance criteria provided in SRP Section 3.7.2, subsection II.7, are applicable.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.7. Combination of Modal Responses 3.7.2.II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.

SRP 3.7.3	**Seismic Subsystem Analysis - Containment Plant Vent**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the plant vent.
3.7.2.II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
3.7.2.II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.8. Interaction of Other Systems with Seismic Category I Systems. To be acceptable, each non-seismic Category I system should be designed to be isolated from any seismic Category I system... The acceptance criteria provided in SRP Section 3.7.2, subsection II.8, are applicable to all seismic Category I SSCs at the system and subsystem level.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets")*. The details of this program are described in the PG&E report, "Description of the Systems Interaction Program for Seismically Induced Events," dated August 1980 and the ongoing implementation is governed by DCM T-14. * The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.

SRP 3.7.3	Seismic Subsystem Analysis - Containment Plant Vent[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
margin of safety is equivalent to that for a Cat I SSC.	
II.12. <u>Seismic Category I Buried Piping, Conduits, and Tunnels</u>. For seismic category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis.	Not applicable to the plant vent.
II.13. <u>Methods for Seismic Analysis of Seismic Category I Concrete Dams</u>. For the seismic analysis of all seismic Category I concrete dams...	Not applicable to the plant vent.
II.14. <u>Methods for Seismic Analysis of Above-Ground Tanks</u>. Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	Not applicable to the plant vent.

SRP 3.7.3	Seismic Subsystem Analysis - Buried Auxiliary Saltwater (ASW) Piping[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.12. Seismic Category I Buried Piping, Conduits, and Tunnels. For seismic Category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis:	The configuration of the buried ASW piping is described in FSAR Section 9.2.7.2.4 (Auxiliary Saltwater System - Piping). The design criteria is described in DCM S-17B (Auxiliary Saltwater System), Appendix A (Criteria for Buried ASW Piping).
II.12.A. Two types of ground shaking-induced loading must be considered for design. .i. Relative deformations imposed by seismic waves traveling through the surrounding soil or by differential deformations between the soil and anchor points. ii . Lateral earth pressures and ground-water effects acting on structures	Per DCM S-17B, Section A4.3.1.1.6, the design of the buried ASW piping considers seismic waves effects and SSI effects. Differential deformations between soil and anchor points, ground water effects, and lateral earth pressures are not addressed in the DCPP design/licensing basis.
II.12.B. The effects of static resistance of the surrounding soil on piping deformations or displacements, differential movements of piping anchors, bent geometry and curvature changes, etc., should be adequately considered. Procedures using the principles of the theory of structures on elastic foundations are acceptable.	Per DCM S-17B, Section A4.3.1.1.6, the design of the buried ASW piping considers SSI effects and cites ASCE Report "Seismic Response of Buried Pipes and Structural Components."

1 The portion of the ASW piping between the intake structure (location of the ASW pumps) and the turbine building (location of the component cooling water heat exchangers) is buried in the ground. The remainder of the ASW piping is above-ground, inside the intake structure and turbine building.

SRP 3.7.3	Seismic Subsystem Analysis - Buried Auxiliary Saltwater (ASW) Piping[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.12.C. When applicable, the effects due to local soil settlements, soil arching, etc., should also be considered in the analysis.	Per DCM S-17B, Section A4.3.1.1.5, the design of the buried ASW piping considers soil settlement. Soil arching is not addressed in the DCPP design/licensing basis.
II.12.D. Actual methods used for determining the design parameters associated with seismically induced transient relative deformations are reviewed and accepted on a case-by-case basis. Additional information, for guidance purposes only, can be found in NUREG/CR-1161, page 26, in American Society of Civil Engineers (ASCE) Standard 4-98, Section 3.5.2 and in ASCE Report - Seismic Response of Buried Pipes and Structural Components.	DCM S-17B cites ASCE Report "Seismic Response of Buried Pipes and Structural Components." The methods used for determining the design parameters associated with seismically induced transient relative deformations are not described in the DCPP design/licensing basis.

SRP 3.7.3	**Seismic Subsystem Analysis - Buried Vital Electrical Conduits**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.12. <u>Seismic Category I Buried Piping, Conduits, and Tunnels</u>. For seismic Category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis:	FSARU Section 9.2.7.2.2 (Auxiliary Saltwater System - Electrical Conduits) describes the buried conduits connecting the turbine building and auxiliary building. Other applications of buried conduits are not described in the FSARU. The FSARU does not provide details of the seismic design requirements for buried conduits. DCM T-8 (Structural Design of Electrical Raceways and Class 1E Supports), Sections 4.3.1 and 4.3.5.3 describe the general requirements for the seismic design of buried conduits, which are based on Bechtel Topical Report BC-TOP-4-A, rev. 3, "Seismic Analysis of Structures and Equipment for Nuclear Power Plants." DCM T-8, Section 4.3.1 indicates that the installation of buried conduits is based on a set of standard cross-sections, which are based on: - No calculations are necessary, because these cross-sections have been used extensively in power plants throughout the world and no problems have been experienced for normal loading conditions or seismic loads, unless conduits go through a region of soft soil or seismic faulting, which is not the case at DCPP. - Buried conduits have flexible connections, in order to accommodate differential seismic displacements between structures and/or pull boxes. These connections have been subjected to testing for conservative displacement estimates. - The cables have been looped in pull boxes to provide sufficient slack.

1 *Portions of vital electrical systems that pass from one building to another are routed through buried (underground) ABS plastic conduits. Key applications of buried conduits are associated with (a) circuits connecting the turbine building and intake structure; and (b) circuits connecting turbine building and auxiliary building.*

SRP 3.7.3	Seismic Subsystem Analysis - Buried Vital Electrical Conduits[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.12.A. Two types of ground shaking-induced loading must be considered for design. .i. Relative deformations imposed by seismic waves traveling through the surrounding soil or by differential deformations between the soil and anchor points. ii . Lateral earth pressures and ground-water effects acting on structures	DCM T-8, Section 4.3.5.3 indicates that the buried conduits are assumed to move with the ground under the propagation of seismic compressional (P) and shear (S) waves. Stresses in the buried conduits are computed as the product of the soil strains and the modulus of elasticity of the structural material using a simplified analysis procedure per BC-TOP-4-A.
II.12.A. (continued) ii . Lateral earth pressures and ground-water effects acting on structures	Lateral earth pressure and ground water effects are not addressed in the DCPP design/licensing basis.
II.12.B. The effects of static resistance of the surrounding soil on piping deformations or displacements, differential movements of piping anchors, bent geometry and curvature changes, etc., should be adequately considered. Procedures using the principles of the theory of structures on elastic foundations are acceptable.	This topic is not addressed in the DCPP design/licensing basis.
II.12.C. When applicable, the effects due to local soil settlements, soil arching, etc., should also be considered in the analysis.	This topic is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	**Seismic Subsystem Analysis - Buried Vital Electrical Conduits**[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.12.D. Actual methods used for determining the design parameters associated with seismically induced transient relative deformations are reviewed and accepted on a case-by-case basis. Additional information, for guidance purposes only, can be found in NUREG/CR-1161, page 26, in American Society of Civil Engineers (ASCE) Standard 4-98, Section 3.5.2 and in ASCE Report - Seismic Response of Buried Pipes and Structural Components.	Details on the determination of the design parameters associated with seismically induced transient relative deformations are not provided in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Seismic Analysis Methods The acceptance criteria provided in SRP Section 3.7.2, subsection II.1, are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.1. Seismic Analysis Methods *The seismic analyses of all seismic category I SSCs should use either suitable dynamic analysis method or an equivalent static analysis method, if justified.*	FSARU Section 3.7.2.1 (Seismic Analysis Methods), provides a general description of the four primary seismic analysis methods used for Design Class I SSC's: - 3.7.2.1.2 Time-History Modal Superposition - 3.7.2.1.3 Response Spectrum Modal Superposition - 3.7.2.1.4 Response Spectrum, Single Degree of Freedom - 3.7.2.1.5 Static Equivalent Method DCM T-6, Appendix B, Section 5.2.5.3 indicates that linear response spectrum analyses were used for the seismic analyses of the FHB crane.

[1] The FHB crane is a single-failure-proof 125 ton overhead bridge crane, supported from crane rails at approximate 170 foot elevation in the FHBSS. The primary function of the FHB crane is the handling of the spent fuel transfer cask in the SFP, cask washdown area, and cask shipping and receiving area of the auxiliary building. The FHB crane has no safety-related function [DCM S-42B Appendix C]. The bridge structure and end trucks are classified as Design Class II structures (Q-list Section II.G.6.1). However, in order to satisfy the requirements of ASME NOG-1-2004 (Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder) for a single-failure-proof crane, certain critical items in the trolley are classified as Design Class I (Q-list Section II.G.6.1.1); while the noncritical items are classified as Design Class II [DCM S-42B, Appendix C Section 4.1]. In order to satisfy licensing commitments associated with the HE evaluation of DCPP, the FHB crane is required to be seismically qualified for the loading associated with the HE. Therefore, the FHB crane is effectively a Seismic Category I structure and SRP Section 3.7.3 will be used for comparison purposes.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.1.A. Dynamic Analysis Methods (cont'd) 3.7.2.II.1.A.iii. consideration of torsional, rocking, and translational responses of the structures and their foundations (including footings, basemats and buried walls)	The FHB crane is located inside the FHBSS, which is supported on top of the auxiliary building. The torsional, rocking, and translational responses of these supporting structures, and their foundations, is addressed in the SRP Section 3.7.2 Comparison Table for the auxiliary building and SRP Section 3.7.3 Comparison Table for the FHBSS. Per DCM T-6, Appendix B, Section 5.2.5.3, the input to the FHB crane analysis is based on the response spectra at the crane rails (170 foot elevation) in the FHBSS.
3.7.2.II.1.A.iv. Use of adequate number of discrete mass degrees of freedom in dynamic modeling	The three-dimensional finite element model of the FHB crane is described in DCM T-6, Appendix B, Section 4.2.6.3 and illustrated in Figure 4.0-11. The adequacy of the number of mass points is not addressed in the DCPP design/licensing basis.
3.7.2.II.1.A.v. When using either the response spectrum method or the modal superposition time history method, responses associated with high frequency modes should be included in the total dynamic solution using the guidance and methods described in RG 1.92, Revision 2, Regulatory Positions C.1.4 and C.1.5.	The HE analysis uses a cut-off frequency of 33 Hz. The DCPP design/licensing basis does not include a specific requirement to account for the responses associated with high frequency modes.
3.7.2.II.1.A.vi. Consideration of maximum relative displacements between adjacent supports of seismic Category I SSCs	The FHB crane is supported from the crane rails (170 foot elevation), which are both attached to the FHBSS.

SRP 3.7.3	**Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.1.A.vii. Inclusion of significant effects such as piping interactions, externally applied structural restraints, hydrodynamic (both mass and stiffness effects) loads, and nonlinear responses.	Piping interactions, externally applied structural restraints, and hydrodynamic loading are not applicable to the FHB crane. The seismic analysis is based on a linear elastic analysis, but, as discussed in DCM T-6, Appendix B, Section 5.2.5.3, it has been demonstrated that the nonlinear effects (e.g., slack in the wire rope and uplift of the wheels due to upwards seismic loading) can conservatively be represented by the linear elastic analysis.
3.7.21II.1.B. <u>equivalent Static Load Method</u> An equivalent static load method is acceptable if:	DCM T-6, Appendix B, Section 5.2.5.3 indicates that the response spectrum method was used.
II.3 <u>Procedures Used for Analytical Modeling</u> The acceptance criteria provided in SRP Section 3.7.2, subsection II.3 are applicable. The following SRP requirements are extracted from SRP 3.7.2.	See discussion below.
<u>From SRP Section 3.7.2, subsection II.3</u> 3.7.2.II.3. <u>Procedures Used for Analytical Modeling</u> To be acceptable, the stiffness, mass, and damping characteristics of the structural systems should be adequately incorporated into the analytical models. Specifically, the following items should be considered in analytical modeling:	See discussion below.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.C. Modeling of Structures - Two types of structural models are widely used by the nuclear industry: lumped-mass stick models and finite element models. Either of these two types of modeling techniques is acceptable if the following guidelines are met:	Per DCM T-6, Appendix B, Section 4.2.6.3, the Hosgri seismic analyses of the FHB crane is based on a finite element model comprised of solid elements.
3.7.2.II.3.C.i. Lumped-Mass Stick Models	A finite element model is used for the seismic analysis of the FHB crane.
3.7.2.II.3.C.ii. Finite Element Models - The type of finite element used for modeling a structural system should depend on the structural details, the purpose of the analysis, and the theoretical formulation upon which the element is based.	The finite element model of the FHB crane is described in DCM T-6, Appendix B, Section 4.2.6.3, and illustrated in Figure 4.0-11. Details of the analysis nor the theoretical formulation of the solid elements used in the model are not described in the DCPP design/licensing basis.
3.7.2.II.3.C.ii (continued) - The mathematical discretization of the structure should consider the effect of the element size, shape, and aspect ratio on the solution accuracy.	The discretization of the model is not addressed in the DCPP design/licensing basis.
3.7.2.II.3.C.ii (continued) - The element mesh size should be selected on the basis that further refinement has only a negligible effect on the solution results	The impact of the element mesh size on the solution results is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.3.D. Representation of Floor Loads, Live Loads, and Major Equipment in Dynamic Models - In addition to the structural mass, the following masses should be included:	See discussions below.
3.7.2.II.3.D (continued) - Mass equivalent to 50 psf to represent misc. dead loads (e.g., minor equipment, piping, and raceways)	DCM S-42B, Appendix C, Section 4.3.2.1 indicates that miscellaneous dead loads are considered.
3.7.2.II.3.D (continued) - Mass equivalent to 75% of design snow load, as applicable	Snow loading is not applicable to DCPP.
3.7.2.II.3.D (continued) - Mass of major equipment should be distributed over representative floor area or included as concentrated lumped masses at equipment locations.	The FHB crane does not support any other major equipment.
3.7.2.II.3.E. Special Consideration for Dynamic Modeling of Structures - It has been common practice that the dynamic models used to predict the seismic response of a structure is not as detailed as the structural model used for the detailed design analysis of all applicable load combinations. Therefore, a methodology is needed to transfer the seismic response loads determined from	A detailed 3-D finite element model is used both for dynamic and structural analyses of the FHB crane.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
the dynamic model to the structural model used for the detailed design analysis of all applicable load combinations. This is reviewed for technical adequacy on a case-by-case basis.	
II.4. Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment should preferably be selected to be less than 1/2 of more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if equipment is adequately designed for applicable loads.	The DCPP design/licensing basis does not include requirements for the frequency of subsystems relative to the supporting structure.
II.7. Combination of Modal Responses The acceptance criteria provided in SRP Section 3.7.2, subsection II.7, are applicable.	See discussion below.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.7. Combination of Modal Responses 3.7.2.II.7.A Response Spectrum Analysis RG 1.92 describes the acceptable methods for combination of modal responses, including consideration of closely-spaced modes and high frequency modes, when response spectrum method of analysis is used to determine the dynamic response of damped linear systems. Use of alternative methods are evaluated on a case-by-case basis for acceptability.	The following provides a comparison of the DCPP design/licensing basis and the acceptance criteria provided in RG 1.92.
3.7.2.II.7.A (continued) RG 1.92, Section 1.1, rev. 2 describes the acceptable modal combination methods	FSARU, Section 3.7.2.1.3 indicates that "the maximum response in each mode is calculated, and modal responses (displacements, accelerations, shears, moments, etc.) are combined by the square root of the sum of the squares (SRSS) method." The DCPP design/licensing basis does not address the criteria applied to closely spaced modes in the analysis of the FHB crane.
3.7.2.II.7.A (continued) RG 1.92, Section 1.4, rev. 2 describes the acceptable missing mass combination methods	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
3.7.2.II.7.B Modal Superposition Time History Analysis Method (continued) In accordance with RG 1.92, only modes with natural frequencies less than or equal to the ZPA frequency of the input spectrum are included in the modal superposition time history analysis. The contribution of the higher frequency modes to the total response is calculated by the missing mass approach.	The method for the consideration of high frequency modes (missing mass) is not addressed in the DCPP design/licensing basis.
3.7.2.II.8. Interaction of Other Systems with Seismic Category I Systems. To be acceptable, each non-seismic Category I system should be designed to be isolated from any seismic Category I system... The acceptance criteria provided in SRP Section 3.7.2, subsection II.8, are applicable to all seismic Category I SSCs at the system and subsystem level.	See discussion below.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
From SRP Section 3.7.2, subsection II.1: 3.7.2.II.8. Interaction of Non-Category I and Category I SSCs - All non-Category I structures should be assessed to determine whether their failure under SSE conditions could impair the integrity of seismic Category I SSCs, or result in incapacitating injury to control room occupants. Each non-Category I structure should meet at least one of the following criteria: A. The collapse of the non-Cat I SSC will not cause it to strike a Cat I SSC. B. The collapse of the non-Cat I SSC will not impair the integrity of a Cat I SSC, nor result in incapacitating injury to control room occupants. C. The non-Cat I SSC will be analyzed and designed to prevent its failure under SSE conditions, such that the margin of safety is equivalent to that for a Cat I SSC.	FSARU Section 3.7.3.13 (System Interaction Program) describes DCPP's program of the evaluation of the impact of the postulated seismically induced failure of nonsafety-related (similar to non-Seismic Category I) SSC's (defined as "sources") on a set of Design Class I (similar to Seismic Category I) SSC's (defined as "targets")*. The details of this program are described in the PG&E report, "Description of the Systems Interaction Program for Seismically Induced Events," dated August 1980 and the ongoing implementation is governed by DCM T-14. * The set of interaction "targets" are limited to "SSC's required to safely shutdown the plant and maintain it in a safe shutdown condition, and certain accident mitigating systems," which is a subset of Design Class I SSC's.
II.9. Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motion of the primary structure or structures at each of the support points may be quite different.	The FHB crane is entirely supported from the FHBSS.

SRP 3.7.3	Seismic Subsystem Analysis - Fuel Handling Building (FHB) Crane[1]
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
A conservative and acceptable approach for analyzing...	
II.12. Seismic Category I Buried Piping, Conduits, and Tunnels. For seismic category I buried piping, conduits, and tunnels, and any other subsystems, the following items should be considered in the analysis.	Not applicable to the FHB crane.
II.13. Methods for Seismic Analysis of Seismic Category I Concrete Dams. For the seismic analysis of all seismic Category I concrete dams...	Not applicable to the FHB crane.
II.14. Methods for Seismic Analysis of Above-Ground Tanks. Most above-ground fluid-containing vertical tanks do not warrant sophisticated...	Not applicable to the FHB crane.

SRP 3.8.1	Concrete Containment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications The design, materials, fabrication, erection, inspection, testing, and inservice surveillance of concrete containments are covered by codes, standards, specifications, and guides that are applicable either in their entirety or in part. The following codes and guides are acceptable:	See below.
II.2. ASME Section III, Div 2, Subsection CC	Containment Structure Exterior ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318-63). AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969 (AISC, 7th edition). Liner and Penetrations Construction of the liner conforms to the applicable parts of Part UW, "Requirements for Unfired Pressure Vessels Fabricated by Welding", Section VIII, ASME Boiler and Pressure Vessel Code, 1968 Edition, including addenda through summer 1968. Those parts of penetration insert plates, penetration sleeves, air locks and access hatches, which form the pressure boundary, conform to Class B requirements of Section III, ASME Boiler and Pressure Vessel Code, 1968 Edition, including addenda through summer 1968.
II.3. Loads and Load Combinations - The specified loads and load combinations are acceptable if found to be in accordance with Article CC-3000 of the ASME Code with the exceptions listed below applied to the requirements specified in Table CC-3230-1. RG 1.136, A, "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments," provides additional guidance for design requirements, including load and load	See below.

SRP 3.8.1	Concrete Containment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
combinations, which should be considered in the design of concrete containments. (The exceptions amend the requirements specified in Table CC-3230-1. The Table CC-3230-1 requirements are captured within this review.):	
II.3.A. The maximum values of Pa, Ta, Ra, Rrr, Rrj, and Rrm should be applied simultaneously, where appropriate, unless a time-history analysis is performed to justify doing otherwise.	The FSARU 3.8.1.3 has the following load combinations: $U = 1.0D \pm 0.05D + 1.0PA + 1.0T + 1.0HE$ U = required load capacity of section D = Dead loads P_A = load due to accident pressure T = load due to maximum temperature associated with $1.0P_A$ HE = loads due to Hosgri Earthquake The DCM's T-1A and 1-D have the following additional load combinations: $U = D \pm 0.05D + HE + To + R + J + M$ To = Thermal operating loads P = Internal Pressure associated with the postulated LOCA R = Pipe Rupture J = Jet Impingement M = Missile Impact
II.3.B. Hydrodynamic loads resulting from LOCA and/or SRV actuation should be combined as indicated in the appendix to this SRP section. Fluid structure interaction associated with these hydrodynamic loads and those from earthquakes should be considered.	Hydrodynamic loads and fluid structure interaction are not considered for the containment concrete shell and the liner.

SRP 3.8.1	Concrete Containment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4. Design and Analysis Procedures - The procedures for design and analysis used for the concrete containment, including the steel liner, are acceptable if found in accordance with those stipulated in Article CC-3300 of the ASME Code, RG 1.136 and this SRP. In particular, for the areas of review outlined in Subsection I.4 above, the following procedures are, in general, acceptable:	See below.
II.4.A. Assumptions on Boundary Conditions.	For the Hosgri seismic evaluation, the containment structure was modeled using a fixed base assumption.
II.4.B. Axisymmetric and Nonaxisymmetric Loads. Even with the large penetrations and buttresses that may be used in the shell, the overall behavior of the shell has been shown to be axisymmetric under pressure. Therefore, it is acceptable to make such an assumption with respect to the containment geometry. However, for loads such as those induced by wind, tornadoes, earthquakes, and pipe rupture, the analysis should consider the nonaxisymmetric effect of these loads.	Axisymmetric model is used to represent the containment shell and basemat. This model was utilized for axisymmetric (i.e., pressure) and nonaxisymmetric (i.e., earthquake) loads. Torsion effects were considered using a separate model.
II.4.C. Transient and Localized Loads. Treatment of transient and localized loads.	Treatment of Transient Loads is not addressed in relation to the seismic design for HE. Localized loads are addressed in DCM T-1A, Section 4.3.3.3. Local effects of these loads are considered and added to the global loads.
II.4.D. Creep, Shrinkage, and Cracking of Concrete. Treatment of the effects of creep, shrinkage, and cracking of concrete	Not addressed. However, concrete design is based on ACI 318-63 Code.

SRP 3.8.1	***Concrete Containment***
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.E. Dynamic Soil Pressure. Consideration of dynamic lateral soil pressures on embedded walls of a concrete containment (if applicable) is acceptable if the lateral earth pressure loads are evaluated for two cases. These are (1) lateral earth pressure equal to the sum of the static earth pressure plus the dynamic earth pressure calculated in accordance with ASCE 4-98 Section 3.5.3.2 and (2) lateral earth pressure equal to the passive earth pressure. If the above methods are shown to be overly conservative for the cases considered, then any alternative methods proposed will be reviewed on a case-by-case basis.	The walls of the containments are not embedded in soil and consideration of lateral soil pressure on them is not applicable the seismic design for the HE.
II.4.H. Variation in Physical Material Properties For the analysis of the effects of possible variations in the physical properties of materials on the analytical results, the upper and lower bounds of these properties should be used, wherever critical. The physical properties that may be critical include the soil modulus, modulus of elasticity, and Poisson's ratio of concrete.	In general, minimum specified material strengths are used for the HE load combinations. However, in certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered. However, to account for possible variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections, the calculated floor spectra were broadened.
II.4.I. Thickened Penetrations. The effect of the large, thickened penetration regions on the overall behavior of the containment may be treated by the same method used for localized loads as discussed in Subsection II.4.C	See Subsection II.4.C.

SRP 3.8.1	Concrete Containment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.J. Steel Liner Plate and Anchors . For the design and analysis of the liner plate and its anchorage system, the procedures furnished are found adequate and acceptable if in accordance with the provisions of Subarticle CC-3600 of the ASME Code.	See liner acceptance criteria discussion below in 5.B.
II.4.K. Ultimate Capacity of Concrete Containment.	Per DCM T-1A, Section 4.3.7, the containment has significant internal pressure capacity or margin of safety beyond the design basis. The capacity was evaluated using average tested material strength.
II.5. Structural Acceptance Criteria	See below.
II.5.A. For the structural portions of the containment, the specified allowable limits for stresses and strains are acceptable if they are in accordance with Subsection CC-3400 of the ASME Code and RG 1.136 (see Subsection II.3 of this SRP section), with the following exceptions:	The DCPP Design Basis relies on ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318-63) and AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969, for structural acceptance criteria. For load combinations including HE, average of the tested strength values were used in lieu of minimum specified design strength.

SRP 3.8.1	Concrete Containment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5.B. For the liner plate and its anchorage system, the specified limits for stresses and strains are acceptable if in accordance with Tables CC-3720-1 and CC-3730-1 of the ASME Code, respectively.	The liner plate acceptance is based on: Part UW, "Requirements for Unfired Pressure Vessels Fabricated by Welding," Section VIII, ASME Boiler and Pressure Vessel Code, 1968 Edition, including addenda through summer 1968. The compression and tension strain limits are identical between CC-3720-1 and DCPP criteria; however, CC-3720-1 requires an additional membrane plus bending check. The anchorage system acceptance is based on: AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969. The Accident level allowable yield strength (fy) is 1.0 fy (liner anchorage) and 0.95 fy (attachments and Basemat anchors) compared the CC-3730 allowable of 0.9 fy.

SRP 3.8.3	Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and in-service surveillance, if any, of containment internal structures are covered by codes, standards, and guides that are applicable either in their entirety or in part	See below.
II.2. ACI 349 (Nuclear Safety-Related Concrete Structures)	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete. However, ACI 318-77 has also been used for specific application (shear friction has been used in the design of the reactor shield wall).
II.2. ASME Section III, Division 2, Subsection CC (Concrete Reactor Vessels and Containments)	ASME Section III, Division 2, Subsection CC is not applicable to DCPP containment internal structures.
II.2. ASME Section III, Division 1, Subsection NE (Class MC Components)	ASME Section III, Division 1, Subsection NE is not applicable to DCPP containment internal structures.
II.2. ANSI/AISC N690-1994 including Supplement 2 (2004) (Steel Safety-Related Structures for Nuclear Facilities)	DCPP licensing basis is the AISC Specification For The Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969 (AISC, 7th Edition).
II.2. RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants, Other Than Reactor Vessels and Containments)	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete. However, ACI 318-77 has also been used for specific application (shear friction has been used in the design of the reactor shield wall).
II.2. RG 1.199 (Anchoring Components and Structural Supports in Concrete)	Design of embedded plates including steel anchors and anchorage into concrete is in accordance with DCM C-63, which is based on ACI 318-63 for concrete, AISC, 7th Edition for steel and TRW Nelson Division catalogs for studs.

SRP 3.8.3	***Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure***
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3. Loads and Load Combinations The specified loads and load combinations for containment internal structures are acceptable if they are consistent with the guidance given below:	See below.
II.3.A. Concrete Structures All loads and load combinations to be in accordance with ACI 349 and RG 1.142, with supplemental criteria. For structures or structural components subjected to hydrodynamic loads resulting from LOCA and/or SRV actuation, such loads should be considered as indicated in the appendix to SRP Section 3.8.1. Fluid structure interaction associated with these hydrodynamic loads and those from earthquakes should be taken into account.	ACI 349 uses Strength Design load combinations and load factors. The DCPP Load Combination containing HE is: U = D + L + CP + HE + R + J + M U = required load capacity of section D = Dead loads L = Live Load CP = accident pressure load due to loss-of-coolant accident (LOCA) or high-energy line break (HELB) HE = loads due to Hosgri Earthquake R, J = pipe restraint and pipe whip reactions, and jet impingement loads, due to LOCA or HELB M = Missile Impact Per DCM T-1B, Section 4.3.3.2, accident temperature loads, T_A (accident temperature), are not included in the load combinations as they are secondary and do not affect the capability of the structures to perform their required functions. The containment recirculation sump, strainer and debris interceptors are evaluated for concurrent hydrodynamic effects of SSE acting during LOCA flooding.

SRP 3.8.3	***Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure***
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4. <u>Design and Analysis Procedures</u> The design and analysis procedures used for the containment internal structures are acceptable if found to be in accordance with the following:	See below.
II.4.A. PWR Dry Containment Internal Structures	See below.
4.A.i. Primary Shield Wall and Reactor Cavity	See below.
II.4.A.i. The design and analysis procedures for the shield wall are acceptable if found to be in accordance with ACI 349 with additional guidance provided by RG 1.142. The design and analysis of anchors on concrete structures are acceptable if found to be in accordance with ACI 349, Appendix B, with additional guidance provided by RG 1.199	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete. However, ACI 318-77 has also been used for specific application (shear friction has been used in the design of the reactor shield wall). Design of embedded plates including steel anchors and anchorage into concrete is in accordance with DCM C-63, which is based on ACI 318-63 for concrete, AISC, 7th Edition for steel and TRW Nelson Division catalogs for studs.
II.4.A.i. Analyses for LOCA loads applicable to the primary shield wall are acceptable if these loads are treated as dynamic time-dependent loads, with supplemental criteria	The effect of LOCA loads, jet impingement and missiles are considered with Hosgri loads per load combinations listed in DCM T-1B, Section 4.3.3.2 and FSAR 3.8.1.3.2.2.
II.4.A.ii. Secondary Shield Walls	See below.

SRP 3.8.3	Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.A.ii. The procedures for the secondary shield walls are acceptable if found to be in accordance with conventional beam/slab design and analysis procedures described in ACI 349, with additional guidance per RG 1.142. The design and analysis of anchors on concrete structures are acceptable if found to be in accordance with ACI 349, Appendix B, with additional guidance per RG 1.199	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete. However, ACI 318-77 has also been used for specific application (shear friction has been used in the design of the reactor shield wall). Design of embedded plates including steel anchors and anchorage into concrete is in accordance with DCM C-63, which is based on ACI 318-63 for concrete, AISC, 7th Edition for steel and TRW Nelson Division catalogs for studs.
II.4.A.ii. Similar to the primary shield wall, the secondary shield walls are also subject to dynamic LOCA loads. Methods described in Subsection II.4.A.i are applicable.	The effect of LOCA loads, jet impingement, and missiles are considered with Hosgri loads per load combinations listed in DCM T-1B, Section 4.3.3.2 and FSARU 3.8.1.3.2.2.
II.4.A.iii. Other Interior Structures	See below.
II.4.A.iii. Analytical techniques for these Category I structures are acceptable if found to be in accordance with ACI 349, with additional guidance provided by RG 1.142 and 1.199 for concrete and anchors, respectively, and with ANSI/AISC N690-1994 including Supplement 2 (2004) for steel	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete. However, ACI 318-77 has also been used for specific application (shear friction has been used in the design of the reactor shield wall). Design of embedded plates including steel anchors and anchorage into concrete is in accordance with DCM C-63, which is based on ACI 318-63 for concrete, AISC, 7th Edition for steel and TRW Nelson Division catalogs for studs. For steel, the DCPP licensing basis is Specification For The Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969 (AISC, 7th Edition).

SRP 3.8.3	**Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.E. For all containment internal structures, the design and analysis methods described in Subsections II.4 of SRP Sections 3.8.1 (concrete) and 3.8.2 (steel) also need to be considered.	See below.
SRP 3.8.1, Section II.4 (Concrete)	See below.
II.4.E. 3.8.1.II.4.A. Assumptions on Boundary Conditions	See SRP Section 3.7.2.
II.4.E. 3.8.1.II.4.B. Treatment of Axisymmetric and nonaxisymmetric loads	See SRP Section 3.7.2.
II.4.E. 3.8.1.II.4.C. Treatment of transient and localized loads	See SRP Section 3.7.2.
II.4.E.3.8.1.II.4.D. Treatment of the effects of creep, shrinkage, and cracking of concrete	See SRP Section 3.7.2.
II.4.E. 3.8.1.II.4.E. Dynamic Soil Pressure	*No embedded internal structures.*
II.4.E. 3.8.1.II.4.G. The treatment of the effects of seismically induced tangential (membrane) shears.	See SRP Section 3.7.2.

SRP 3.8.3	Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.E.3.8.1.II.4.H. The evaluation of the effects of variation in specified physical properties of materials on analytical results	In general, minimum specified material strengths are used for the HE load combinations. However, in certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered. However, to account for possible variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections, the calculated floor spectra were broadened.
II.4.E.3.8.1.II.4.I. The treatment of large, thickened penetration regions.	Containment internal structures do not have large, thickened penetration regions.
II.4.E.3.8.1.II.4.J. The treatment of the steel liner plate and its anchors	See SRP Section 3.7.2.
SRP 3.8.2, Section II.4 (Steel)	See below.
II.4.E.3.8.2.II.4.A. Treatment of nonaxisymmetric and localized loads	See SRP Section 3.7.2.
II.4.E.3.8.2.II.4.B. Treatment of buckling effects	The effect of buckling is generally considered in accordance with the code of record for steel and concrete as listed in section II.2. "Applicable Codes, Standards, and Specifications".
II.5. Structural Acceptance Criteria The structural acceptance criteria for containment internal structures described in Subsection I.1 of this SRP section are acceptable if found to be in accordance with the guidance given below. See Section II.4.E of this SRP section for criteria relating to modular construction	See below.

SRP 3.8.3	**Concrete and Steel Internal Structures for Concrete Containment – Interior Concrete Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5.A. Concrete Structures ACI 349 and RG 1.142 define the structural acceptance criteria for concrete structures. The structural acceptance criteria for anchors to concrete structures are acceptable if found to be in accordance with Appendix B to ACI 349, with additional guidance provided by RG 1.199	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete. However, ACI 318-77 has also been used for specific application (shear friction has been used in the design of the reactor shield wall). The average tested strength of the materials was used for the load combinations with the HE while the minimum specified was used for the other load combinations.
II.5.B. Steel Structures ANSI/AISC N690-1994 including Supplement 2 (2004) defines the structural acceptance criteria for steel structures	For steel, the DCPP licensing basis is AISC Specification For The Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969. The N690-1994, Plastic Design allowable strength for the "Abnormal Extreme" load combination is 0.9Y (N690, Section Q2.1), where Y = the required section strength based on plastic design methods. The DCPP Design Basis is 1.0Y (for load combinations with HE) The average tested strength of the materials was used for the load combinations with the HE while the minimum specified was used for the other load combinations.

SRP 3.8.3	Concrete and Steel Internal Structures for Concrete Containment – Annulus Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and in-service surveillance, if any, of containment internal structures are covered by codes, standards, and guides that are applicable either in their entirety or in part	
II.2. - ACI 349 (Nuclear Safety-Related Concrete Structures)	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete.
II.2. - ANSI/AISC N690-1994 including Supplement 2 (2004) (Steel Safety-Related Structures for Nuclear Facilities)	DCPP licensing basis is AISC Specification For The Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969 (AISC, 7th Edition).
II.2. - RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants, Other Than Reactor Vessels and Containments)	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete.
II.2. - RG 1.199 (Anchoring Components and Structural Supports in Concrete)	DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete.
II.3. Loads and Load Combinations - The specified loads and load combinations for containment internal structures are acceptable if they are consistent with the guidance given below:	See below.

SRP 3.8.3	**Concrete and Steel Internal Structures for Concrete Containment – Annulus Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.A. <u>Concrete Structures</u> - All loads and load combinations to be in accordance with ACI 349 and RG 1.142, with supplemental criteria. For structures or structural components subjected to hydrodynamic loads resulting from LOCA and/or SRV actuation, such loads should be considered as indicated in the appendix to SRP Section 3.8.1. Fluid structure interaction associated with these hydrodynamic loads and those from earthquakes should be taken into account.	The DCPP Load Combination containing HE are: Working Stress Design (WSD): 1.7C = D + HE 1.7C = D + HE + R_a Ultimate Strength Design (USD): U = D + HE U = D + HE + R_a C = Required capacity of the section based on the WSD method of ACI 318-63 U = Section capacity D = Dead loads HE = Hosgri Earthquake loads R_a = Pipe loads associated with abnormal conditions

SRP 3.8.3	**Concrete and Steel Internal Structures for Concrete Containment – Annulus Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B. Steel Structures - All loads and load combinations are to be in accordance with ANSI/AISC N690-1994 including Supplement 2 (2004) with the supplemental criteria for concrete structures also being applicable for steel structures.	The DCPP Load Combination containing HE are: WSD: $1.7S = D + HE$ $1.7S = D + HE + R_a$ Plastic Design: $Y = D + HE$ $Y = D + HE + R_a$ S = Required capacity of the section based on WSD methods of AISC, 7th Edition, Part 1 Y = Required capacity of the section based on plastic design methods of AISC, 7th Edition, Part 2 D = Dead loads HE = Hosgri Earthquake loads R_a = Pipe loads associated with abnormal conditions The Plastic Design Loads and Load Combinations are consistent with N690, Section Q2.1 (Plastic Design).
II.4. Design and Analysis Procedures - The design and analysis procedures used for the containment internal structures are acceptable if found to be in accordance with the following:	See below.
II.4.A. PWR Dry Containment Internal Structures	See below.
II.4.A.i. Primary Shield Wall and Reactor Cavity	See below.

SRP 3.8.3	Concrete and Steel Internal Structures for Concrete Containment – Annulus Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.A.i. The procedures for the shield wall are acceptable if found to be in accordance with ACI 349 with additional guidance provided by RG 1.142. The design and analysis of anchors on concrete structures are acceptable if found to be in accordance with ACI 349, Appendix B, with additional guidance provided by RG 1.199	The design and analysis procedures for the primary shield wall and reactor cavity are not applicable to the seismic design of the annulus structure for the HE.
II.4.A.i. Analyses for LOCA loads applicable to the primary shield wall are acceptable if these loads are treated as dynamic time-dependent loads, with supplemental criteria	The design and analysis procedures for the primary shield wall and reactor cavity are not applicable to the seismic design of the annulus structure for the HE.
II.4.A.ii. *Secondary Shield Walls*	*See below.*
II.4.A.ii. The procedures for the secondary shield walls are acceptable if found to be in accordance with conventional beam/slab design and analysis procedures described in ACI 349, with additional guidance per RG 1.142. The design and analysis of anchors on concrete structures are acceptable if found to be in accordance with ACI 349, Appendix B, with additional guidance per RG 1.199	The design and analysis procedures for secondary shield walls are not applicable to the seismic design of the annulus structure for the HE.
II.4.A.ii. Similar to the primary shield wall, the secondary shield walls are also subject to dynamic LOCA loads. Methods described in Subsection II.4.A.i are applicable.	The design and analysis procedures for secondary shield walls are not applicable to the seismic design of the annulus structure for the HE.
II.4.A.iii. Other Interior Structures	See below.

SRP 3.8.3	Concrete and Steel Internal Structures for Concrete Containment – Annulus Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.A.iii. Analytical techniques for these Category I structures are acceptable if found to be in accordance with ACI 349, with additional guidance provided by RG 1.142 and 1.199 for concrete and anchors, respectively, and with ANSI/AISC N690-1994 including Supplement 2 (2004) for steel	For concrete, the DCPP licensing basis is ACI 318-63, Building Code Requirements for Reinforced Concrete. For steel, the DCPP licensing basis is AISC Specification For The Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969 (AISC, 7th Edition).
II.4.E. For all containment internal structures, the design and analysis methods described in Subsections II.4 of SRP Sections 3.8.1 and 3.8.2 also need to be considered	See below.
II.4.E. SRP 3.8.2, Section II.4 (Steel)	See below.
II.4.E. SRP 3.8.2, Section II.4.A. Treatment of nonaxisymmetric and localized loads	The annulus is not an axisymmetric structure; therefore combination of axisymmetric and nonaxisymmetric loads is not applicable to the annulus structure.
II.4.E. 3.8.2, Section II.4.B. Treatment of buckling effects	The annulus is a steel frame structure. It does not contain atypical box-sections or shells requiring detailed treatment of buckling effects; however, design is based on AISC code 1969 Edition (AISC, 7th Edition).
II.5. Structural Acceptance Criteria - The structural acceptance criteria for containment internal structures described in Subsection I.1 of this SRP section are acceptable if found to be in accordance with the guidance given below. See Section II.4.E of this SRP section for criteria relating to modular construction	See below.

SRP 3.8.3	Concrete and Steel Internal Structures for Concrete Containment – Annulus Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5.B. Steel Structures - ANSI/AISC N690-1994 including Supplement 2 (2004) defines the structural acceptance criteria for steel structures	For steel, the DCPP licensing basis is AISC Specification For The Design, Fabrication, and Erection of Structural Steel for Buildings, February 12, 1969 (AISC 7^{th} Edition). The yield strengths of steel for the HE are taken as the average values of properly substantiated test results (rather than nominal minimum design strengths). The N690-1994, Plastic Design allowable strength for the "Abnormal Extreme" load combination is 0.9Y (N690, Section Q2.1) , the DCPP Design Basis is 1.0Y (for load combinations with HE)

SRP 3.8.4	Other Seismic Category 1 Structures – Outdoor Water Storage Tanks (OWST's)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes standards, and guides that are either applicable in their entirety or in portions thereof. A list of such documents follows:	See below.
II.2. ACI 349 ("Code Requirements for Nuclear Safety-Related Concrete Structures" with additional criteria provided by RG 1.142) II.2. ANSI/AISC N690-1994, including Supplement 2 (2004) ["Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities"] II.2. RG 1.142 ("Safety-Related Concrete Structures for Nuclear Power Plants {Other Than Reactor Vessels and Containments})	The Code of Record for concrete structures at DCPP is ACI 318-63. The Hosgri re-evaluation is in accordance with ACI 318-71, including the 1973 Supplement. The Code of Record for steel structures at DCPP is AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 6^{th} and 7^{th} Editions. The Code of Record for concrete structures at DCPP is ACI 318-63. The Hosgri re-evaluation is in accordance with ACI 318-71, including the 1973 Supplement.
II.2. RG 1.199 ("Anchoring Components and Structural Supports in Concrete")	ACI 318-63 and 318-71 are the Codes of Record for concrete structures. Rock anchor capacities are based on field testing per DCM T-28, Section 4.3.4.
II.3. Loads and Load Combinations	See below.
II.3.A. Concrete Structures All loads and load combinations are to be in accordance with ACI 349 and RG 1.142..... *[Upon review of RG 1.142, Rev. 2 (Nov. 2001), ACI 349-97 is appropriate code*	Per FSARU Section 3.8.3.5.2 for evaluation of concrete tank structures (i.e., refueling Water storage tanks, condensate storage tanks and transfer tank) to accommodate Hosgri loads, the Code of Record is ACI 318-71 for ultimate strength design of concrete sections. Per FSARU Section 3.8.3.3.2, the load combination applicable to the HE design of the OWST is:

SRP 3.8.4	Other Seismic Category 1 Structures – Outdoor Water Storage Tanks (OWST's)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
edition that is discussed in that RG.] II.3.B. Steel Structures All loads and load combinations are to be in accordance with AISC N690-1994 including Supplement 2 (2004). This specification uses the allowable stress design (ASD) method…	$U = D + HS + 1.0\ HE + 1.0\ R_A$ U = strength required to resist abnormal loads D = dead load of tank HS = hydrostatic load HE = loads resulting from the Hosgri Earthquake (HE) R_A = pipe reactions during abnormal conditions, including dead, thermal, and DDE or HE loads
II.4. <u>Design and Analysis Procedures</u> The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See below.
II.4.A. For concrete structures, the procedures are in accordance with ACI 349, as supplemented by RG 1.1.42….	The Code of Record for concrete structures at DCPP is ACI 318-63. The Hosgri re-evaluation is in accordance with ACI 318-71, including the 1973 Supplement.
II.4.B. The design and analysis methods described in Subsections II.4 of SRP Sections 3.8.1 and 3.8.2, which apply to the other Category I concrete and steel structures, respectively, also need to be considered. Items to be considered include assumptions on boundary conditions, transient and localized loads, and shrinkage and cracking of concrete. See below.	See below.
Various Consideration Areas per SRP 3.8.1 (Concrete Containment), Subsection II.4 judged pertinent to seismic design of OWSTs	See below.

SRP 3.8.4	Other Seismic Category 1 Structures – Outdoor Water Storage Tanks (OWST's)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. 3.8.1.II.4.D. Creep, Shrinkage, and Cracking of Concrete	Surface cracking and spalling of the gunite concrete shrouds on the OWST's have been identified and addressed via reduction in safety margins.
II.4.B. 3.8.1.II.4.E. Dynamic Soil Pressure Consideration of dynamic lateral soil pressures on embedded walls of a concrete containment (if applicable) is acceptable if the lateral earth pressure loads are evaluated ...	OWST walls are not embedded in soil.
II.4.B. 3.8.1.II.4.G. Tangential Shear	Methodologies per ACI 318-71 for ultimate strength design of concrete sections are used.
II.4.B. 3.8.1.II.4.H. Variation in Physical Material Properties For the analysis of the effects of possible variations in the physical properties of materials on the analytical results, the upper and lower bounds of these properties should be used, wherever critical. The physical properties that may be critical include the soil modulus, modulus of elasticity, and Poisson's ratio of concrete.	In general, minimum specified material strengths are used for the HE load combinations. However, in certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered.
II.4.B. 3.8.1.II.4.I. Thickened Penetrations	Tank vault openings in the steel liner plates and concrete shroud and pipe nozzles are considered in the design. Both axisymmetric mathematical model and a 3-D, nonaxisymmetric mathematical model, with the fluid level up to design levels are used. The 3-D nonaxisymmetric model is used to assess the stress distribution in the steel liner and concrete shell in and around the vault opening area.

SRP 3.8.4	Other Seismic Category 1 Structures – Outdoor Water Storage Tanks (OWST's)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. 3.8.1.II.4.J. Steel Liner Plate and Anchors	For the evaluation of the steel liner plates, Section VIII, Division 2, of the ASME B&PV, 1974 applies. For the evaluation of the welded studs, acceptance criteria in DCM C-63 apply.
II.4.B. 3.8.1.II.4.K. Ultimate Capacity of Concrete Containment	OWST's are not required to maintain pressure boundary integrity.
II.4.B. SRP 3.8.2, Section II.4 (Steel)	
II.4.B. 3.8.2.II.4.B. Treatment of buckling effects	In general, buckling/ovaling is not an issue because the tanks steel shells are shrouded in and stiffened with reinforced concrete. Buckling is addressed for the fire water tank, but is assumed not to affect the structural integrity of the outer tank and/or the functionality of the interconnecting systems.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004).	For the evaluation of structural steel elements for the HE load combination, Part 2 of AISC 7th Edition, the Plastic Design method applies.
II.4.H. Consideration of dynamic lateral soil pressures on embedded walls is acceptable if the lateral earth pressures are evaluated for two cases. These are (1) lateral earth pressure equal to the sum of the static earth pressure plus the dynamic earth pressure calculated in accordance with ASCE 4-98, Section 3.5.3.2, and (2) lateral earth pressure equal to the passive earth pressure. If these methods are shown to be overly conservative for the cases considered, then the staff reviews alternative methods on a case-by-case basis. For earth retaining walls, the guidance in ASCE 4-98 Sections 3.5.3.1 through 3.5.3.3 is acceptable.	OWST walls are not embedded in soil.

SRP 3.8.4	Other Seismic Category 1 Structures – Outdoor Water Storage Tanks (OWST's)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the structural acceptance criteria appear in ACI 349 and RG 1.142 for concrete structures, and AISC N690-1994, including Supplement 2 (2004), for steel structures.	Per FSARU Section 3.8.3.5.2, for concrete elements the strength design method of ACI 318-71 applies for HE loads. For the evaluation of structural steel elements for the HE load combination, Part 2 of AISC 7th Edition, the Plastic Design method applies. For the evaluation of the steel liner plates, Section VIII, Division 2, of the ASME B&PV, 1974 applies (allowable stresses are increased by a factor of 2.4 for the evaluation of local stresses around the nozzles.). For the evaluation of the welded studs, acceptance criteria in DCM C-63 apply. DCM C-63 criteria are based on ACI 318-63 for concrete, AISC, 7th Edition for steel and TRW Nelson Division catalogs for studs.

SRP 3.8.4	Other Seismic Category 1 Structures – Auxiliary Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. <u>Applicable Codes, Standards, and Specifications</u> The design, materials, fabrication, erection, *inspection, testing, and surveillance, if any, of* Seismic Category I structures are covered by codes standards, and guides that are either applicable in their entirety or in portions thereof. A list of such documents follows:	
II.2. ACI 349 ("Code Requirements for Nuclear Safety-Related Concrete Structures" with additional criteria provided by RG 1.142)	ACI 349 will be discussed later in this table, under SRP Acceptance Criteria 3 (Loads and Load Combinations), 4 (Design and Analysis Procedures), and 5 (Structural Acceptance Criteria).
II.2. ANSI/AISC N690-1994, *including* Supplement 2 (2004) ["Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities"]	*Structural steel systems will be covered by other SRP reviews such as platforms.*
II.2. RG 1.142 ("Safety-Related Concrete Structures for Nuclear Power Plants {Other Than Reactor Vessels and Containments})	See SRP Acceptance Criteria 3 (Loads and Load Combinations), 4 Design and Analysis Procedures), and 5 (Structural Acceptance Criteria).
II.2. RG 1.199 ("Anchoring Components and Structural Supports in Concrete")	ACI 318-63 is the code of record for concrete structures.
II.3. Loads and Load Combinations	See below.
II.3.A. Concrete Structures All loads and load combinations are to be in accordance with ACI 349 and RG 1.142...." *[Upon review of RG 1.142, Rev. 2 (Nov. 2001), ACI 349-97 is appropriate code edition that is discussed in that RG.]*	Per FSARU Section 3.8.2.3.2.2 for evaluation of concrete structural elements to accommodate Hosgri loads, the code of record is ACI 318-63 for ultimate strength of concrete elements. Per FSARU Section 3.8.2.3.2.2, the following PG&E load combination is applicable for Hosgri Event, including definition of individual load term symbols. $U = D + L + T_A + R_A + 1.0\ P_A + 1.0\ (Y_j + Y_m + Y_r) + HE$

SRP 3.8.4	**Other Seismic Category 1 Structures – Auxiliary Building**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
The baseline load combinations for reinforced-concrete elements per ACI 349-97 that include SSE load term (i.e., E_{ss}) are as follows: 4. $U = D + F + L + H + T_o + R_o + E_{ss}$ 8. $U = D + F + L + H + T_a + R_a + 1.0\ P_a + 1.0\ (Y_r + Y_j + Y_m) + 1.0\ E_{ss}$ *ACI 349 Load Combination 8 will envelope ACI 349 Load Combination 4 since T_a and R_a effects include T_o and R_o effects, respectively from Load Combination 4. Therefore, governing SRP SSE load combination is ACI 349 Load Combination 8.*	U = ultimate strength required to resist design loads D = dead load of structure and equipment loads L = live load T_o = thermal loads during normal operating conditions R_o = pipe reactions during normal operating conditions T_A = thermal loads on structure generated by a postulated pipe break, including T_O R_A = pipe reactions on structure from unbroken pipe generated by postulated pipe break conditions, including R_O PA = pressure load within or across a compartment and/or building generated by a postulated pipe break, and including an appropriate dynamic factor (DLF) to account for the dynamic nature of the load Y_j = jet load on structure generated by a postulated pipe break, including an appropriate DLF Y_m = missile impact load on a structure generated by, or during, a postulated pipe break, such as a whipping pipe, including an appropriate DLF Y_r = reaction on structure from broken pipe generated by a postulated pipe break, including an appropriate DLF HE = loads resulting from an HE
II.4. Design and Analysis Procedures The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See below.
II.4.A. For concrete structures, the procedures are in accordance with ACI 349, as supplemented by RG 1.1.42. The design and analysis of anchors (steel embedments) used for component and structural supports on concrete structures are acceptable if found in accordance with Appendix B to ACI 349, as supplemented by RG 1.199.	Per FSARU Sections 3.8.2.3.2.2, 3.8.2.5.2, and 3.8.2.5.3, ACI 318-63 is the design code of record for concrete elements associated with HE. In-plane loads for concrete elements are not explicitly covered by ACI 318-63. A separate document was created to address in-plane loads for the auxiliary building that is based on test data and consistent with provisions ACI 318-63.

SRP 3.8.4	Other Seismic Category 1 Structures – Auxiliary Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. The design and analysis methods described in Subsections II.4 of SRP Sections 3.8.1 and 3.8.2,which apply to the other Category I concrete and steel structures, respectively, also need to be considered. Items to be considered include assumptions on boundary conditions, transient and localized loads, and shrinkage and cracking of concrete.	See below.
Various Consideration Areas per SRP 3.8.1 (Concrete Containment), Subsection II.4	See below.
II.4.B. 3.8.1.II.4.B. Axisymmetric and Nonaxisymmetric Loads	Because the auxiliary building is not a cylindrical/spherical structure, consideration of these types of load concerns are not necessary for the seismic design for the HE.
II.4.B. 3.8.1.II.4.C. Transient and Localized Loads	The effects of high energy line break postulated during abnormal conditions which produce global (compartment pressure, P_A, and temperature, T_A) as well as local effects (pipe reactions R_A and Y_R, pipe whip load Y_M and jet impingement load, Y_J) are addressed.
II.4.B. 3.8.1.II.4.D. Creep, Shrinkage, and Cracking of Concrete	Concrete design is based on ACI 318-63 requirements.
II.4.B. 3.8.1.II.4.E. Dynamic Soil Pressure	This item is addressed under SRP 3.8.4 Acceptance Criteria Item II.4.H.
II.4.B. 3.8.1.II.4.H. Variation in Physical Material Properties For the analysis of the effects of possible variations in the physical properties of materials on the analytical results, the upper and lower bounds of	In general, minimum specified material strengths are used for the HE load combinations. In certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered. To account for possible variations in the parameters used in the dynamic analyses, such

SRP 3.8.4	Other Seismic Category 1 Structures – Auxiliary Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
these properties should be used, wherever critical. The physical properties that may be critical include the soil modulus, modulus of elasticity, and Poisson's ratio of concrete.	as mass values, material properties, and material sections, the calculated floor spectra were broadened.
II.4.B. 3.8.1.II.4.I. <u>Thickened Penetrations</u>	The auxiliary building does not have thickened penetration regions.
II.4.B. 3.8.1.II.4.J. <u>Steel Liner Plate and Anchors</u>	The Spent Fuel Liner Plate is addressed under SRP 3.8.4 Acceptance Criteria, Appendix D (separate SRP review).
II.4.B. 3.8.1.II.4.K. <u>Ultimate Capacity of Concrete Containment</u>	The auxiliary building is not a concrete containment structure and determination of its internal pressure capacity is not relevant to its seismic design.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004).	Structural steel SSCs are out-of-scope for this SRP table as various structural steel SSCs (e.g., platforms) are covered by other separate SRP-reviews.
II.4.G. The design of the spent fuel pool and racks is considered acceptable when it meets the criteria of Appendix D to this SRP section.	The SFP walls are already included in this SRP comparison review under reinforced-concrete portions of auxiliary building and Appendix D does not contain any unique seismic criteria for these walls. The SFP racks are addressed through another SRP-review for these specific racks. The seismic requirements for the SFP liner, as required by Appendix D, are addressed in a separate SRP comparison table.
II.4.H. Consideration of dynamic lateral soil pressures on embedded walls is acceptable if the lateral earth pressures are evaluated for two cases. These are (1) lateral earth pressure equal to the sum of the static earth pressure plus the dynamic earth pressure calculated in accordance with ASCE 4-98, Section 3.5.3.2, and (2) lateral earth pressure equal to the passive earth pressure. If these methods are shown to be overly conservative for the cases	DCPP design/licensing bases does not specify how embedded auxiliary building walls are evaluated for dynamic lateral soil pressures induced by seismic events.

SRP 3.8.4	Other Seismic Category 1 Structures – Auxiliary Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
considered, then the staff reviews alternative methods on a case-by-case basis. For earth retaining walls, the guidance in ASCE 4-98 Sections 3.5.3.1 through 3.5.3.3 is acceptable.	
II.5. Structural Acceptance Criteria - "For each of the loading combinations delineated in Subsection II.3 of this SRP, the structural acceptance criteria appear in ACI 349 and RG 1.142 for concrete structures..."	Per FSARU Section 3.8.2.3.2.2 and DCM T-2, Sections 4.3.3.2 and 4.3.5.1, the code of record is ACI 318-63.
II.8. Masonry Walls	The masonry walls inside the auxiliary building are addressed in a separate SRP comparison table that is specific to all power-block masonry walls.

<table>
<tr><th>SRP 3.8.4</th><th>Other Seismic Category 1 Structures – Containment Plant Vent</th></tr>
<tr><th>SRP Acceptance Criteria</th><th>DCPP Design/Licensing Basis</th></tr>
<tr><td><u>II.2. Applicable Codes, Standards, and Specifications</u>

The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes standards, and guides that are either applicable in their entirety or in portions thereof. A list of such documents follows:

• ANSI/AISC N690-1994, including Supplement 2 (2004) ["Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities"]
• For concrete structures, the procedures are in accordance with ACI 349, as supplemented by RG 1.142. The design and analysis of anchors (steel embedments) used for component and structural supports on concrete structures are acceptable if found in accordance with Appendix B to ACI 349, as supplemented by RG 1.199.</td><td>Per review of FSARU Sections 3.7.1, 3.7.2, 3.7.3, and 3.8, the applicable design codes for structural analysis of containment plant vent are not explicitly addressed.

Per Section 3.5 of DCM T-1F, applicable codes are as follows:

"Structural Steel - American Institute of Steel Construction Specification For The Design, Fabrication, And Erection Of Structural Steel For Buildings, 1969 (AISC)"

"Concrete anchorages - American Concrete Institute Building Code Requirements for Reinforced Concrete (ACI 318-63)"</td></tr>
<tr><td><u>II.4. Design and Analysis Procedures</u>
The acceptance criteria provided in SRP Section 3.8.4, subsection II.4, are applicable.

The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:

<u>II.4.A</u> For concrete structures, the procedures are in accordance with ACI 349, as supplemented by RG 1.1.42..</td><td>Per review of FSARU Sections 3.7.1, 3.7.2, 3.7.3, and 3.8, the applicable design codes for structural analysis of containment plant vent is not explicitly addressed.

Per Section 3.5 of DCM T-1F, applicable codes are as follows:

"Structural Steel - American Institute of Steel Construction Specification For The Design, Fabrication, And Erection Of Structural Steel For Buildings, 1969 (AISC)"

"Concrete anchorages - American Concrete Institute Building Code Requirements for Reinforced Concrete (ACI 318-63)"</td></tr>
</table>

SRP 3.8.4	Other Seismic Category 1 Structures – Containment Plant Vent
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004).	
II.5. Structural Acceptance Criteria The acceptance criteria provided in SRP Section 3.8.4, subsection II.5, are applicable. *For each of the loading combinations delineated in Subsection II.3 of this SRP, the structural acceptance criteria appear in ACI 349 and RG 1.1.42 for concrete structures, and AISC N690-1994, including Supplement 2 (2004), for steel structures.*	Per review of FSARU Sections 3.7.1, 3.7.2, 3.7.3, and 3.8, the applicable structural acceptance criteria associated with structural analysis of containment plant vent is not explicitly addressed. Per above DCPP Design/Licensing Basis discussions for SRP Acceptance Criteria 3 (Loads and Load Combinations), and 4 (Design and Analysis Procedures), PG&E's code of record is 1969 AISC Specification for structural steel. Per "Nomenclature" sections of 1969 AISC Specification and AISC N690-1994, the definition of F_y is "Specified minimum yield stress of the type of steel being used…as used in this Specification, 'yield stress' denotes either the specified minimum yield point (for those steels that have a yield point) or specified minimum yield strength (for those steels that do not have a yield point)." Per Sections 4.3.4.1 and 4.3.4.2 of DCM T-1F, it is indicated that, "Actual average material properties as determined by properly substantiated test results may be used for the HE load combination." Table Q1.5.8.1 of AISC N690-1994 that addresses allowable ductility factors for structural steel elements. Section 4.3.4.2 of DCM T-1F cites ductility values that are permitted for the HE (i.e., ductility equals 3 and 6 locally). DCM T-1F does not address ductility limits. For box sections, the permissible PG&E ductility values appear to be more stringent than Table Q1.5.8.1 of AISC N690-1994.

SRP 3.8.4	Other Seismic Category 1 Structures – Fuel Handling Building Steel Superstructure (FHBSS)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in portions thereof.	
II.2. ACI 349 (Concrete)	The FHBSS is a steel frame building; however, per DCM T-3, the column anchorage into the auxiliary building concrete is within the boundary of the building. DCM T-3 references ACI 318-63 for concrete design.
II.2. ANSI/AISC N690-1994 (including Supplement 2 (2004) (Structural Steel)	Code of record is AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition.
II.2. RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	The FHBSS is a steel frame building; however, per DCM T-3, the column anchorage into the auxiliary building concrete is within the boundary of the building.
II.2. RG 1.199 (Anchoring Components and Structural Supports in Concrete)	Column anchorage is designed per ACI 318-63.
II.4. Design and Analysis Procedures - The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See below.
II.4.A. The design and analysis of anchors used for component and structural supports on concrete structures are acceptable if found in accordance with Appendix B of ACI 349, as supplemented by RG 1.199.	Per the DCM T-3, Sections 3.5 and 4.0, the column anchorage into the auxiliary building concrete is within the boundary of the building and is designed per ACI 318-63.

SRP 3.8.4	**Other Seismic Category 1 Structures – Fuel Handling Building Steel Superstructure (FHBSS)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. The design and analysis methods described in Subsections of II.4 of SRP Sections 3.8.1 and 3.8.2, which apply to other Category I concrete and steel structures, respectively, also need to be considered:	See individual sections listed below.
II.4.B. SRP 3.8.1, Section II.4 (Concrete)	Treatment of concrete near embedded columns is addressed per ACI 318-63 requirements.
II.4.B. SRP 3.8.2, Section II.4 (Steel)	See below.
II.4.B. SRP 3.8.2, Section II.4.A. Treatment of nonaxisymmetric and localized loads	The FHBSS is not an axisymmetric structure; therefore, combination of axisymmetric and nonaxisymmetric loads is not necessary.
II.4.B. SRP 3.8.2, Section II.4.B. Treatment of buckling effects	The FHBSS is a steel frame structure. It does not contain atypical box-sections or shells requiring detailed treatment of buckling effects. However, design is based on AISC Code 1969 Edition.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004)	AISC 7th Edition (1969) is used for design and analysis of the FHBSS. The major differences between N690 and AISC 7th Edition steel manual are with respect to required loads and load combinations and allowable stresses. These topics are discussed in more detail in "Section 5.0 – Structural Acceptance Criteria" below.
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the structural acceptance criteria appear in the following:	See below.

SRP 3.8.4	Other Seismic Category 1 Structures – Fuel Handling Building Steel Superstructure (FHBSS)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Concrete Structures - ACI 349 and RG 1.142 and RG 1.199 U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess ACI 349 requires the use of minimum specified material strengths.	The acceptance criteria used for the FHB column anchorage are consistent with the SRP acceptance criteria with the following exceptions: – The anchorage is evaluated using ACI 318-63 methodology. – Material strengths used for load combinations, which include HE, utilized average tested rather than minimum strengths.
II.5. Steel Structures - AISC N690-1994, including Supplement 2 (2004) Elastic Design: [N690 Supplement 2 Table Q1.5.7.1]: 1.6S=D+L+Ro+To+Es 1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa Plastic Design: [N690 Section Q2.1]: Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es) AISC N690-1994 incl. Supplement 2 (2004) specifies the use of minimum strength properties in the acceptance criteria. For the load combinations with SSE as listed in N690-1994, with Supplement 2, the Stress Limit Coefficients for shear stresses in members and bolts is 1.4. N690-1994 provides the allowable loads for bolts.	The FHB steel acceptance criteria is based on AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition. The gaps between the DCPP Design Basis and AISC N690-1994 are as follows: The N690-1994, Plastic Design allowable strength for the "Abnormal Extreme" load combination is 0.9 Y; the DCPP Design Basis is 1.0 Y (for load combinations with HE). Y = Required section strength based on plastic design methods and stresses. For the load combinations with SSE as listed in N690-1994, with Supplement 2, the Stress Limit Coefficients for shear stresses in members and bolts is 1.4. DCPP criteria specify a limit of 1.6. N690-1994 specifies the use of minimum strength properties. DCPP acceptance criteria allow material strengths used for load combinations, which include HE, to utilize average tested rather than minimum strengths. N690-1994 bolt allowables are different than those specified in the DCM T-3 and AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition.

SRP 3.8.4	Other Seismic Category 1 Structures – Fuel Handling Building Steel Superstructure (FHBSS)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.8. Masonry Walls - Appendix A to this SRP section contains the acceptance criteria for masonry walls	Addressed in a separate SRP comparison table (SRP 3.8.4 review for Masonry walls).

SRP 3.8.4	Other Seismic Category 1 Structures – Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in portions thereof.	See codes discussed below.
II.2. ACI 349 (Concrete)	The Hosgri evaluation of the turbine building is in accordance with ACI 318-71, including the 1973 Supplement. The original code of record for concrete structures at DCPP was ACI 318-63.
II.2. ANSI/AISC N690-1994 including Supplement 2 (2004) (Structural Steel)	The Hosgri evaluation of the turbine building is in accordance with the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, Dated February 12, 1969 (7th Edition). However, AISC specification dated November 1, 1978 (8th Edition) is used for the evaluation of selected connections.
II.2. RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	ACI 318-63 is the code of record for concrete structures.
II.2. RG 1.199 (Anchoring Components and Structural Supports in Concrete)	ACI 318-63 is the code of record for concrete structures.
II.3. Loads and Load Combinations - The specified loads and load combinations are acceptable if found to be in accordance with the guidance given below:	The turbine building is a combination of a steel structure (columns, beams, braces, roof trusses) and a concrete structure (shear walls, floor slabs, buttresses, foundations); therefore, both material types are addressed.

SRP 3.8.4	Other Seismic Category 1 Structures – Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.A. Concrete Structures - All loads and load combinations to be in accordance with ACI 349 and RG 1.142, with supplemental criteria. ACI 349 Section 9.2.1 provides two load combinations which include the SSE (E_{ss}). U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess	DCM T-4, Section 4.3.4.2 specifies the following load combination for turbine building for the HE: - Dead + Abnormal Live + Abnormal Pipe Reaction + HE DCM T-4 Section 4.3.4.2 specifies the following load combinations for Turbine Pedestal for the HE: - Dead + HE - Dead + HE + Condenser Vacuum + Normal Generator Torque + Normal Turbine Torque - Dead + $[(HE)^2 + (\text{Turbine Generator Short Circuit Torque})^2]^{0.5}$ + Condenser Vacuum Specific loads not addressed: - Fluid Loads (not applicable) - Soil pressure (not applicable) - Pipe Rupture Loads - Jet Impingement Loads - Thermal Loads Note: Even though the crane loads (including rated capacity) are not explicitly specified in the load combination equation, DCM T-4, Section 4.3.2.2 indicates that the crane loads, including hook loads, are included in the live load.

SRP 3.8.4	Other Seismic Category 1 Structures – Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B. <u>Steel Structures</u> - All loads and load combinations to be in accordance with AISC N690-1994 including Supplement 2 (2004), with the supplemental criteria specified for concrete structures. AISC N690- 1994 provides the following load combinations which include the SSE (E_{ss}). Elastic Design: [N690 Supplement 2 Table Q1.5.7.1] 1.6S=D+L+Ro+To+Es 1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa Plastic Design: [N690 Section Q2.1] Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es)	DCM T-4, Section 4.3.4.2 specifies the following load combination for the HE: - Dead + Live + Abnormal Pipe Reaction + HE *Specific loads not addressed:* - Pipe Rupture Loads - Jet Impingement Loads - Thermal Loads Note: Even though the crane loads (included rated capacity) are not explicitly specified in the load combination equation; DCM T-4, Section 4.3.2.2 and AISC N690-1994 Q1.3.2 indicate that the crane loads, including hook loads, are included in the live load.
II.4.4. <u>Design and Analysis Procedures</u> - The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See procedures discussed below.
II.4.A. *For concrete structures, the procedures are in* accordance with ACI 349, as supplemented by RG 1.142. The design and analysis of anchors used for component and structural supports on concrete structures are acceptable if found in accordance with Appendix B of ACI 349, as supplemented by RG 1.199	The Hosgri *evaluation and design of the turbine building is in accordance with* ACI 318-71 including 1973 Supplements. ACI 318-63 was the original code of record for the turbine building as documented in DCM T-4.
II.4.B. The design and analysis methods described in Subsections of II.4 of SRP Sections 3.8.1 and 3.8.2, which apply to other Category I concrete and steel structures, respectively, also need to be considered:	See design and analysis methods discussed below.

SRP 3.8.4	Other Seismic Category 1 Structures – Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. SRP 3.8.1, Section II.4 (Concrete)	See below.
SRP 3.8.1.II.4.H. The evaluation of the effects of variation in specified physical properties of materials on analytical results	In general, minimum specified material strengths are used for the HE load combinations. In certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered. To account for possible variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections, the calculated floor spectra were broadened.
II.4.B. SRP 3.8.2, Section II.4 (Steel)	Not applicable or addressed in other sections of this SRP comparison table.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004)	The Hosgri evaluation and design of the turbine building is in accordance with the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, Dated February 12, 1969 (7^{th} Edition). However, AISC specification dated November 1, 1978 (8^{th} Edition), is used for the evaluation and design of selected connections.
II.4.H. Consideration of dynamic lateral soil pressures on embedded walls is acceptable if the lateral earth pressure loads are evaluated for two cases (see SRP for description of two cases)	Lateral earth pressure, including the effects of the weight of any permanent facility supported on the ground, is considered. Dynamic earth pressures acting on the diesel fuel oil trench walls are considered. Dynamic lateral soil pressure on embedded portion of the building is not addressed.
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the structural acceptance criteria appear in the following:	See acceptance criteria discussed below.

SRP 3.8.4	Other Seismic Category 1 Structures – Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Concrete Structures - ACI 349 and RG 1.142 and RG 1.199	The concrete structure is evaluated for the HE using ACI 318-71, including 1973 supplement methodology. ACI 318-63 was the original code of record for the turbine building. Material strengths used for load combinations which include HE utilize average tested values rather than minimum strengths. Inelastic behavior is permitted in lateral force resisting elements subjected to ductility limits.
II.5. Steel Structures - AISC N690-1994, including Supplement 2 (2004) N690-1994 specifies the use of minimum strength properties N690-1994 specifies the shear stress limit coefficients for load combinations with SSE in members and bolts are 1.4. N690-1994 does not allow inelastic deformation.	The turbine building steel acceptance criteria is based on AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, dated February 12, 1969. Selected steel connections acceptance criteria is based on AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, dated November 1, 1978 (8th Edition). The gaps between the DCPP Design Basis and AISC N690-1994 are as follows: The N690-1994, Plastic Design allowable strength for the "Abnormal Extreme" load combination is 0.9Y; the DCPP Design Basis is 1.0Y (for load combinations with HE). DCPP criteria specify the shear stress limit coefficients for load combinations with SSE in members and bolts are 1.6. DCPP acceptance criteria allow material strengths used for load combinations, which include HE to utilize average tested values rather than minimum strengths. N690-1994 bolt allowables are different than those specified in the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 or 1978 Editions.

SRP 3.8.4	Other Seismic Category 1 Structures – Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
	DCPP acceptance criteria allow lateral force resisting elements to deform inelastically subject to ductility limits.
II.8. Masonry Walls - Appendix A to this SRP section contains the acceptance criteria for masonry walls	The turbine building contains a number of masonry walls, but their seismic design is addressed in a separate SRP comparison table specific to masonry walls, rather than being included with the review for the turbine building.

SRP 3.8.4	Other Seismic Category 1 Structures – Intake Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in portions thereof.	
II.2. ACI 349 (Concrete)	The FSARU and DCM T-5 reference ACI 318-63 for concrete design.
II.2. ANSI/AISC N690-1994 (including Supplement 2 (2004) (Structural Steel)	The intake structure is a reinforced concrete structure.
II.2. RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	ACI 318-63 is the Code of Record for concrete structures.
II.2. RG 1.199 (Anchoring Components and Structural Supports in Concrete)	ACI 318-63 is the Code of Record for concrete structures.
II.3. Loads and Load Combinations - The specified loads and load combinations are acceptable if found to be in accordance with the guidance given below:	See below.

SRP 3.8.4	**Other Seismic Category 1 Structures – Intake Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.A. <u>Concrete Structures and Anchorage</u> - All loads and load combinations to be in accordance with ACI 349, RG 1.142, and RG 1.199, with supplemental criteria. U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess	The FSARU provides minimal loading information. DCM T-5 provides greater detail regarding Intake Structure loads: $C = D + L + MH + R_o + HE + EP + DEP$ C = combined load demand D = Dead loads L = Live loads MH = Mechanical and Hydraulic Loads due to the operation of circulating and ASW pumps. R_O = Pipe Reactions EP = Static Lateral Earth Pressure DEP = Dynamic Lateral Earth Pressure HE = Loads due to Hosgri Earthquake Temperature loads (both To and Ta) are not listed in the DCM T-5 load combinations as required by ACI 349. Loads related to postulated pipe rupture (Ra, Pa, Yr, Yj, Ym) are not listed in the DCM T-5 load combinations as per ACI 349, but normal pipe reactions (Ro) are included.
II.4. <u>Design and Analysis Procedures</u> - The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See below.
II.4.A. The design and analysis of concrete structures and anchors used for component and structural supports on concrete structures are acceptable if found in accordance with Appendix B of ACI 349, as supplemented by RG 1.199.	The FSARU and DCM T-5 reference ACI 318-63 for concrete design.

SRP 3.8.4	Other Seismic Category 1 Structures – Intake Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. The design and analysis methods described in Subsections of II.4 of SRP Sections 3.8.1 and 3.8.2, which apply to other Category I concrete and steel structures, respectively, also need to be considered:	See below.
II.4.B. SRP 3.8.1, Section II.4 (Concrete)	See below.
II.4.B. SRP 3.8.1.II.4.A. Assumptions on Boundary Conditions	The current models for Hosgri evaluation are based on a fixed base boundary condition.
II.4.B. SRP 3.8.1.II.4.C. Transient and localized loads	Load combinations for HE do not address transient and localized loads for the intake structure.
II.4.B. SRP 3.8.1.II.4.D. Creep, shrinkage, and cracking of concrete	Concrete design is based on ACI 318-63 Code.
II.4.B. SRP 3.8.1.II.4.E. Dynamic soil pressure Static plus dynamic soil pressure in accordance with ASCE 4-98 and passive earth pressure should be considered.	DCM T-5 indicates that static and lateral earth pressures are considered, but ASCE 4-98 Methods are not referenced.

SRP 3.8.4	Other Seismic Category 1 Structures – Intake Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. SRP 3.8.1.II.4.H. Variation in physical material properties	In general, minimum specified material strengths are used for the HE load combinations. In certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered. To account for possible variations in the parameters used in the dynamic analyses, such as mass values, material properties, and material sections, the calculated floor spectra were broadened.
II.4.B. SRP 3.8.2, Section II.4 (Steel)	The intake structure is a reinforced concrete structure.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004)	The intake structure is a reinforced concrete structure.
II.4.H. Consideration of dynamic lateral soil pressures on embedded walls is acceptable if the lateral earth pressure loads are evaluated for two cases (see SRP for description of two cases)	DCM T-5, Section 4.3.2 indicates that static and lateral earth pressures are considered, but ASCE 4-98 Methods are not referenced.
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the structural acceptance criteria appear in the following:	See below.

SRP 3.8.4	Other Seismic Category 1 Structures – Intake Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Concrete Structures - ACI 349 and RG 1.142 and RG 1.199 U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess	The acceptance criteria used for the intake structure are consistent with SRP acceptance criteria with the following exceptions: $C = D + L + MH + R_o + HE + EP + DEP$ Maximum strength of structural elements is determined in accordance with the applicable building codes (ACI). This strength must be equal or greater than the load demand C. Shear strength of concrete shear walls is based on methods described in Section 3(c) of Recommended Lateral Force Requirements, 1974 Seismology Committee, Structural Engineers Association of California. Concrete structural elements are evaluated in accordance with ACI 318-63 methodology. DCPP acceptance criteria allows the following: For load combinations involving HE effects, the maximum strengths can be calculated using averages of tested material properties in-lieu of code specified minimum values. In the evaluation of required section strength, the Hosgri load demand may be reduced by considering the structure's ductility. For concrete, a ductility ratio of 1.3 is permitted.

SRP 3.8.4	Other Seismic Category 1 Structures – Masonry Walls
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in portions thereof.	See codes discussed below.
II.2. Uniform Building Code 1979	DCM T-31, Section 3.5.4 references the Uniform Building Code (UBC) 1970. The safety-related masonry walls were designed to meet the criteria of the NRC Bulletin IE 80-11.
ANSI/AISC N690-1994 (including Supplement 2 (2004) (Structural Steel)	The Hosgri evaluation of the masonry walls is in accordance with the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, dated February 12, 1969.
II.2. RG 1.199 (Anchoring Components and Structural Supports in Concrete)	The design of the masonry walls is in accordance UBC 1970 and ACI 531.
II.3. Loads and Load Combinations - The specified loads and load combinations are acceptable if found to be in accordance with the guidance given below:	Safety-related masonry walls are addressed below:

SRP 3.8.4	**Other Seismic Category 1 Structures – Masonry Walls**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.A. Masonry Structures - All loads and load combinations to be in accordance with SRP 3.8.4 Appendix A Section 2. The following load combinations are applicable to the evaluation of a structure subjected to an SSE: U=D+L+To+Ro+E' U=D+L+Ta+Ra+Pa+(Yr+Yj+Ym)+E'	FSARU Section 3.8.7.3.1.7 and DCM T-31 Section 4.4.3 specify the following load combination for safety-related masonry wall for the HE: – Dead + Live + Normal Thermal + Normal Pipe Reaction + HE – Dead + Live + Abnormal Thermal + Abnormal Pipe Reaction + HE SRP 3.8.4, Appendix A provides two load combinations which include the SSE (E') combine additional loads compared to the HE load combination for the safety-related masonry wall. Specific loads not addressed: – Jet Impingement Loads Note: DCM T-31, Section 4.1.1.2 states that the masonry walls are not relied upon to withstand jet loads or reactions resulting from HELB's.
II.3.B. Steel Structures - All loads and load combinations to be in accordance with AISC N690-1994 including Supplement 2 (2004, with the supplemental criteria specified for concrete structures. The following load combinations are applicable to the evaluation of a structure subjected to an SSE: Elastic Design: [N690 Supplement 2 Table Q1.5.7.1] 1.6S=D+L+Ro+To+Es 1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa Plastic Design: [N690 Section Q2.1] Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es)	FSARU Section 3.8.7.3.1.7 and DCM T-31, Section 4.4.3 specify the following load combination for safety-related masonry wall for the HE: - Dead + Live + Normal Thermal + Normal Pipe Reaction + HE - Dead + Live + Abnormal Thermal + Abnormal Pipe Reaction + HE AISC N690- 1994 Table Q1.5.7.1 provides two load combinations which include the SSE (E_s) combine several additional loads compared to the HE load combination for the safety-related masonry walls. Specific loads not addressed: - Pipe Rupture Loads - Jet Impingement Loads Notes: (1) DCM T-31, Section 4.1.1.2 states that masonry walls are not relied upon to withstand jet loads or reactions resulting from HELB's.

SRP 3.8.4	Other Seismic Category 1 Structures – Masonry Walls
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
	(2) Even though the crane loads (included rated capacity) is not explicitly specified in the load combination equation; DCM T-4, Section 4.3.2.2 and AISC N690-1994 Q1.3.2 indicate that the crane loads, including hook loads, are included in the live load.
II.4. <u>Design and Analysis Procedures</u> - The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See procedures discussed below.
II.4.A. For masonry structures, the procedures are in accordance with UBC 1979	The Hosgri evaluation of the masonry walls is in accordance with UBC 1970 and ACI 531-79.
II.4.B. The design and analysis methods described in Subsection 4 of SRP 3.8.4 Appendix A, which apply to safety-related masonry walls, also need to be considered:	See design and analysis methods discussed below.
Appendix A, 4.D. Variations and uncertainties in mass, materials, and other pertinent parameters	In general, minimum specified material strengths are used for the HE load combinations. In certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered.
Appendix A, 4.H. Minimum reinforcement requirements shall be as provided in ACI 531	Per applicable codes (UBC 1970 and ACI 531-79).
Appendix A, 4.K. SRP Section 3.5.3 should apply for masonry walls requiring protection for spalling and scabbing resulting from accident pipe reaction, jet impingement and missile impact.	DCM T-31, Section 4.1.1.2 states that masonry walls are not relied upon to withstand jet loads or reactions resulting from HELB. Therefore, SRP Section 3.5.3 is not applicable.

SRP 3.8.4	Other Seismic Category 1 Structures – Masonry Walls
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004)	The Hosgri evaluation of the masonry walls is in accordance with the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, dated February 12, 1969 (7th Edition).
II.4.H. Consideration of dynamic lateral soil pressures on embedded walls is acceptable if the lateral earth pressure loads are evaluated for two cases (see SRP for description of two cases)	Does not apply to masonry walls. No embedded walls.
II.4.I. The design of masonry walls is considered acceptable when it meets the requirements of Appendix A of this SRP.	The safety-related masonry walls are evaluated according to NRC issued IE Bulletin 80-11, which required that operating plant licensees establish a program for the evaluation of masonry walls supporting or in the proximity of safety-related items.
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection 2 of this SRP Appendix A, the structural acceptance criteria appear in the following:	See acceptance criteria discussed below.
II.5. Masonry Structures - UBC 1979	The masonry structure is evaluated using UBC 1970. Material strengths used for load combinations which include HE utilize average tested value rather than minimum strengths. Shear allowable values for reinforced solid and hollow unit masonry are different between UBC 1979 and UBC 1970.

SRP 3.8.4	Other Seismic Category 1 Structures – Masonry Walls
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Masonry Structures - ACI 531-79 (inspection, and allowable stress with some exceptions)	Inspection procedure is based on Section 4.5 of ACI 531-79. Some allowable stresses for extreme environmental condition (load combination with HE) are different between SRP 3.8.4, Appendix A, Subsection 3 and DCM T-31, Section 4.4.4. For example, DCM T-31, Section 4.4.4.2.1 allows a moment capacity strength reduction factor of 1.0 (based on 1.0 fy, where fy = yield strength), while SRP limits the reinforcement stress to 0.9 fy. DCM T-31, Section 4.4.4.7 specifies allowable capacities of expansion anchors at masonry wall connections to the building structure as 1/3 of the ultimate capacities, while SRP limits the allowable stress to 1.5 times that from ACI 531-79.
II.5. Steel Structures - AISC N690-1994, including Supplement 2 (2004) Elastic Design: [N690 Supplement 2 Table Q1.5.7.1]: 1.6S=D+L+Ro+To+Es 1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa Plastic Design: [N690 Section Q2.1]: Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es) AISC N690-1994 incl. Supplement 2 (2004) specifies the use of minimum strength properties in the acceptance criteria. For the load combinations with SSE as listed in N690-1994, with Supplement 2, the Stress Limit Coefficients for shear stresses in members and bolts is 1.4. N690-1994 provides the allowable loads for bolts.	The steel acceptance criteria are based on AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, Dated February 12, 1969. The gaps between the DCPP Design Basis and AISC N690-1994 are as follows: DCPP criteria specify a limit of 1.6. DCPP acceptance criteria allow material strengths used for load combinations which include HE to utilize average tested values rather than minimum strengths. N690-1994 bolt allowables are different than those specified in the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition.

SRP 3.8.4	Other Seismic Category 1 Structures – Spent Fuel Racks
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Appendix D, Introduction: Reg. Guide 1.29 "Seismic Design Classification" classifies spent fuel racks as Seismic Category I structures.	Fuel storage racks are classified as PG&E Design Class I.
Appendix D, Section 1: Description of the Spent Fuel Pool and Racks	Not applicable to the seismic design for the HE.
Appendix D, *Section 2:* Applicable Codes, Standards, and Specifications	*See below.*
Appendix D, Section 2 - Construction materials *should conform* to ASME Section III Div. 1, Subsection NF and should be selected to be compatible with the fuel pool environment and to minimize corrosion and galvanic effects.	ASME III NF is referenced as a design code and construction materials are ASTM A-240- Type 3054/304L, ASTM 479-S21800, and ASTM SA564-630, (and weld filler metal ASME SFA-5-9 Type 304/308L and 308LSI), which are approved ASME III-1 materials.
Appendix D, Section 3: Seismic and Impact Loads.	See below.
Appendix D, Section 3 - For plants where dynamic input data such as floor response spectra or ground response spectra are not available, necessary dynamic analyses may be performed using the criteria described in SRP Section 3.7. The ground response spectra and damping values should correspond to RG 1.60 and 1.61, respectively. For plants where dynamic data are available (e.g., ground response spectra for a fuel pool supported by the ground, floor response spectra for fuel pools supported on soil where soil-structure interaction was considered in the pool design, or a floor response spectra for a fuel pool supported by the reactor building), the design and analysis of the new rack system may be performed by using either the existing input parameters including the old damping values or new parameters in accordance with RG	See SRP Sections 3.7.1 "Seismic Design Parameters."

SRP 3.8.4	Other Seismic Category 1 Structures – Spent Fuel Racks
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
1.60 and 1.61. The use of existing input with new damping values in RG 1.61 is not acceptable.	
Appendix D, Section 3 - Seismic excitation along three orthogonal directions should be imposed simultaneously for the design of the new rack system.	This topic is covered by SRP Section 3.7.1 "Seismic Design Parameters."
Appendix D, Section 3 - The peak response from *each direction should be combined by SRSS in* accordance with RG 1.92.	This topic is covered by SRP Section 3.7.1 "Seismic Design Parameters."
Appendix D, Section 3 - If response spectra are available for a vertical and horizontal direction only, the same horizontal spectrum may be used for both horizontal directions.	This topic is covered by SRP Section 3.7.1 "Seismic Design Parameters."
Appendix D, Section 3 - It should be demonstrated that the impact loads on the fuel assembly do not lead to damage of the fuel.	This requirement is not related specifically to the HE. Load drop force due to an accidental drop of a lifted fuel assembly (the heaviest load) from the maximum height of 36 inches above the top of the racks is considered in the design.
Appendix D, Section 3 - Loads from other impact events may be acceptable based on missile mass and velocity and ductility ratio of target material.	Other impact events are not included in any load combination associated with the HE. Load drop force due to an accidental drop of a lifted fuel assembly (the heaviest load) from the maximum height of 36 inches above the top of the racks is considered in the design.
Appendix D, Section 4: Loads and Load Combinations	See below.
Appendix D, Section 4 - Maximum uplift forces available from the crane should be indicated and considered in the rack and pool floor/liner design, if applicable.	Uplift forces from the crane are not included in any load combination associated with the HE. However, fuel binding load generated by the unlikely event that a fuel assembly would bind in the rack while being lifted by the spent fuel bridge crane is considered in the design.

SRP 3.8.4	Other Seismic Category 1 Structures – Spent Fuel Racks
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Appendix D, Section 4 - Load drops (cask, fuel assembly, etc) should be considered.	Load drop effects are not included in any load combination associated with the HE. However, load drop force due to an accidental drop of a lifted fuel assembly (the heaviest load) from the maximum height of 36 inches above the top of the racks is considered in the design.
Appendix D, Section 4 - The specific loads and load combinations are acceptable if they conform with the applicable portions of this SRP, Subsection II.3, and Table 1 provide in this Appendix. Loads and Load Combinations – Steel Structures: All loads and load combinations are to be in accordance with AISC N690-1994 including Supplement 2 (2004). This specification uses the allowable stress design (ASD) method. The supplemental criteria on the use of loads and load combinations presented above for concrete structures also apply to steel structures.	DCM S-42B, Appendix E, Section 4.3.3 refers to ASME Code, Section III, Subsection NF, 1983 Edition for load combinations. Per Appendix D of the SRP, which is specific to fuel racks, ASME criteria are used in place of AISC N690-1994.
Appendix D, Section 5: Design and Analysis Procedures	
Appendix D, Section 5 - American National Standards Institute, N210-76, "Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants, Design," provides general information regarding design of spent fuel pool racks.	Design of the racks and stress limits are in accordance with ASME Code, Section III, Subsection NF, 1983 Edition.
Appendix D, Section 5 - Seismic analysis of un-anchored (sliding) racks is typically performed using nonlinear dynamic time history analysis methods. NUREG/CR-5912 provides further guidance on the design and analysis of free-standing fuel racks.	NUREG/CR-5912 is not referenced in the DCM S-42B, Appendix E, but it only provides general guidance and suggestions on modeling strategy, not strict requirements. The racks are analyzed using nonlinear time history analyses.

SRP 3.8.4	Other Seismic Category 1 Structures – Spent Fuel Racks
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Appendix D, Section 6: Structural Acceptance Criteria	See below.
Appendix D, Section 6 - When the design considers buckling loads, the criteria provided in ASME Code, Section III, Division 1, Appendix XVII should limit the structural acceptance criteria.	Neither buckling loads nor Appendix XVII is mentioned in the FSARU or DCM S-42B, Appendix E. However, the racks are designed for impact forces resulting from an accidental drop of a lifted fuel assembly and from inter-rack or rack-structure impact.
Appendix D, Section 6 - The fuel pool structure should be designed for the increased loads that stem from the new and/or expanded high-density racks. The fuel pool liner leak-tight integrity should be maintained, or the functional capability of the fuel pool should be demonstrated.	Fuel pool structure and liner evaluations are not applicable to the topic/SSC "Spent Fuel Racks." DCPP already utilizes high density racks.
Appendix D, Notes: 3. The provisions of ASME Code, Section III, Division 1, Subsection NF 3231.1 shall be amended by the requirements of paragraphs c. 2, 3, and 4 of RG 1.124. (RG 1.124 modifies and clarifies the regulatory position regarding allowable stresses for Class 1 Linear-Type Supports)	The design of the racks is based on nonlinear analyses and the racks are freestanding.
Appendix D, Notes: 4. Fd is the force caused by the accidental drop of the heaviest load from the maximum possible height, and Pf is the upward force on the racks caused by a postulated struck fuel assembly.	Load drops are not applicable to the seismic design for the HE. However, load drop force due to an accidental drop of a lifted fuel assembly (the heaviest load) from the maximum height of 36 inches above the top of the racks is considered in the design.

SRP 3.8.4	Other Seismic Category 1 Structures – Pipeway Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in portions thereof.	See below.
II.2.- ACI 349 (Concrete)	ACI 318-63 is referenced for elements such as concrete local to embedded plates and anchors. In general, pipeway is a steel frame structure.
II.2.- ANSI/AISC N690-1994 (including Supplement 2 (2004) (Structural Steel)	Code of Record for design of steel structures is the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition.
II.2.- RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	ACI 318-63 is the Code of Record for concrete structures. In general, pipeway is a steel frame structure. However, concrete requirements are used for items such as embedded plates and anchors.
II.2.- RG 1.199 (Anchoring Components and Structural Supports in Concrete)	ACI 318-63 is the Code of Record for concrete structures.
II.3. Loads and Load Combinations - The specified loads and load combinations are acceptable if found to be in accordance with the guidance given below:	See below.

SRP 3.8.4	Other Seismic Category 1 Structures – Pipeway Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.A. Concrete Structures - All loads and load combinations are to be in accordance with ACI 349 and RG 1.142, with supplemental criteria. U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess	ACI 318-63 is referenced for elements such as concrete local to embedded plates and anchors. In general, pipeway is a steel frame structure. FSARU 3.8.6 does not specify concrete load combinations. Where Working Stress Design (WSD) methods are used: 1.7C = D + HE Where ultimate strength design (USD) methods are used: U = D + HE C = Required capacity of the section based on the WSD methods of ACI 318-63. U = Required capacity of the section based on USD methods of ACI 318-63. D = Dead Loads HE = Loads resulting from Hosgri Earthquake The DCPP load combinations for the HE do not include the following loads in SRP acceptance criteria: – Live – Thermal – Pipe Break/Pipe Whip/Jet Impingement

SRP 3.8.4	**Other Seismic Category 1 Structures – Pipeway Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B. Steel Structures - All loads and load combinations to be in accordance with AISC N690-1994 including Supplement 2 (2004), with the supplemental criteria specified for concrete structures. The following load combinations are applicable to the evaluation of a structure subjected to an SSE: Elastic Design: [N690 Supplement 2 Table Q1.5.7.1] 1.6S=D+L+Ro+To+Es 1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa Plastic Design: [N690 Section Q2.1] Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es)	Code of Record for steel structures is AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition. Where elastic working stress design methods are used: 1.7S = D + HE S = required section strength based on elastic design methods and allowable stresses defined in Part 1 of the AISC "Specifications for the Fabrication and Erection of Structural Steel for Buildings," 1969 Edition. Where plastic design methods are used: (DCM T-1E lists no HE load combinations) The DCPP load combinations for the HE do not include the following loads in the SRP acceptance criteria: – Live – Thermal – Pipe Break/Pipe Whip/Jet Impingement
II.4. Design and Analysis Procedures - The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See below.

SRP 3.8.4	Other Seismic Category 1 Structures – Pipeway Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.A. For concrete structures, the procedures are in accordance with ACI 349, as supplemented by RG 1.142. The design and analysis of anchors used for component and structural supports on concrete structures are acceptable if found in accordance with Appendix B of ACI 349, as supplemented by RG 1.199	ACI 318-63 is referenced for use in checking concrete local to embedded plates and anchors.
II.4.B. The design and analysis methods described in Subsections of II.4 of SRP Sections 3.8.1 and 3.8.2, which apply to other Category I concrete and steel structures, respectively, also need to be considered:	See below.
II.4.B. SRP 3.8.1, Section II.4 (Concrete)	Treatment of concrete near embedded anchors is addressed in various other SRP comparison tables and is per ACI 318-63. Pipeway is a steel frame structure.
II.4.B. SRP 3.8.2, Section II.4 (Steel)	See below.
II.4.B. – 3.8.2, Section II.4.A. Treatment of nonaxisymmetric and localized loads	The pipeway is not an axisymmetric structure; therefore combination of axisymmetric and nonaxisymmetric loads is not necessary.
II.4.B. 3.8.2, Section II.4.B. Treatment of buckling effects	The pipeway is a steel frame structure. It does not contain atypical box-sections or shells requiring detailed treatment of buckling effects; however, design is based on AISC Code 1969 Edition.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004)	Code of record for steel structures is AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition.

SRP 3.8.4	Other Seismic Category 1 Structures – Pipeway Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.H. Consideration of dynamic lateral soil pressures on embedded walls is acceptable if the lateral earth pressure loads are evaluated for two cases (see SRP for description of two cases)	There are no embedded portions of the pipeway structure in soil.
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the structural acceptance criteria appear in the following:	
II.5. - Concrete Structures - ACI 349 and RG 1.142 U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess	The pipeway is a steel frame structure, but concrete acceptance criteria may be applicable to the design of embedded plates and anchors. Where WSD methods are used: 1.7C = D + HE C = required capacity of the section based on the working stress design (WSD) methods of the ACI 318-63 Where ultimate strength design (USD) methods are used: U = D + HE U = required capacity of the section based on USD methods of the ACI 318-63. WSD methods are not covered in the ACI 349. Material strengths used for load combinations which include HE utilize average tested rather than minimum strengths.

SRP 3.8.4	Other Seismic Category 1 Structures – Pipeway Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. - Steel Structures - AISC N690-1994, including Supplement 2 (2004) Elastic Design: [N690 Supplement 2 Table Q1.5.7.1]: 1.6S=D+L+Ro+To+Es 1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa Plastic Design: [N690 Section Q2.1]: Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es) AISC N690-1994 incl. Supplement 2 (2004) specifies the use of minimum strength properties in the acceptance criteria. For the load combinations with SSE as listed in N690-1994, with Supplement 2, the Stress Limit Coefficients for shear stresses in members and bolts is 1.4. N690-1994 provides the allowable loads for bolts.	Where elastic working stress design methods are used: 1.7S = D + HE S = Required section strength based on elastic design methods and allowable stresses defined in Part 1 of the AISC "Specifications for the Fabrication and Erection of Structural Steel for Buildings," 1969 Edition. Where plastic design methods are used: (DCM T-1E lists no HE load combinations) The 1.7 factor on elastic section strength exceeds the 1.6 factor required per the SRP. Material strengths used for load combinations which include HE utilize average tested rather than minimum strengths. Load combinations including pipe break load, local section strength capacities may be exceeded provided there is no loss of function of any safety-related system.

SRP 3.8.4	Other Seismic Category 1 Structures – Containment Polar Crane
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in portions thereof.	
II.2.- ACI 349 (Concrete)	ACI 318-63 is the Code of Record for design of concrete elements associated with the crane rail anchorage.
II.2.- ANSI/AISC N690-1994 including Supplement 2 (2004) (Structural Steel)	The polar crane was designed in accordance with the Association of Iron and Steel Engineers (AISE), Standard Number 6, "Specification for Electric Overhead Traveling Cranes for Steel Mill Service" (Tentative, May 1, 1969), and "Specifications for the Design, Fabrication and Erection of Structural steel for Buildings" by the American Institute of Steel Construction (AISC), 7th Edition, as required by PG&E Specification 8839, Section 5.3.
II.2.- RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	ACI 318-63 is the Code of Record for design of concrete elements associated with the crane rail anchorage.
II.2.- RG 1.199 (Anchoring Components and Structural Supports in Concrete)	ACI 318-63 is the Code of Record for design of concrete elements associated with the crane rail anchorage.
II.3. Loads and Load Combinations - The specified loads and load combinations are acceptable if found to be in accordance with the guidance given below:	See below.

<table>
<tr><td>SRP 3.8.4</td><td>Other Seismic Category 1 Structures – Containment Polar Crane</td></tr>
<tr><td>SRP Acceptance Criteria</td><td>DCPP Design/Licensing Basis</td></tr>
<tr><td>II.3.A. <u>Concrete Structures and Anchorage</u> - All loads and load combinations to be in accordance with ACI 349, RG 1.142, and RG 1.199, with supplemental criteria.

U=D+F+L+H+To+Ro+Ess
U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess</td><td>(Concrete load combinations may be applicable to the polar crane rail anchorage design)
Per FSARU:
U=1.7S= D+TD+L+HE

U = Capacity of the section
D = Dead loads
L = Crane rated live load
TD = Trolley dead weight
HE = Loads resulting from the Hosgri Earthquake

Per DCM S-42B, Appendix A:
Elastic Design:
1.7S=D+TD+L+HE+DSCp
1.7S=D+TD+HE+DSCo

Plastic Design:
1.0Y=D+TD+L+HE+DSCp
1.0Y=D+TD+HE+DSCo

S = Required section strength based on elastic design methods
Y = Required section strength based on plastic design methods
DSC_p = Gravity and seismic contribution of the dome service crane in parked position.
DSC_o = Gravity and seismic contribution of the dome service crane in operating position.

Load combinations for the polar crane are consistent with SRP acceptance criteria (if F, H, To, Ro, and pipe break related loads are considered not applicable to the crane). However, per the SRP (and as noted in the DCM S-42B, Appendix A), jet impingement forces and containment compartment pressurization are applicable loads for the polar crane but are not combined with HE loads.</td></tr>
</table>

SRP 3.8.4	Other Seismic Category 1 Structures – Containment Polar Crane
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B. Steel Structures - All loads and load combinations to be in accordance with AISC N690-1994 including Supplement 2 (2004), with the supplemental criteria specified for concrete structures. Elastic Design: [N690 Supplement 2 Table Q1.5.7.1] 1.6S=D+L+Ro+To+Es 1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa Plastic Design: [N690 Section Q2.1] Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es)	Per FSARU: U=1.7S=D+TD+L+HE U = Capacity of the section D = Dead loads L = Crane rated live load TD = Trolley dead weight HE = Loads resulting from the Hosgri Earthquake Per DCM S-42B, Appendix A: Elastic Design: 1.7S=D+TD+L+HE+DSCp 1.7S=D+TD+HE+DSCo Plastic Design: 1.0Y=D+TD+L+HE+DSCp 1.0Y=D+TD+HE+DSCo S = Required section strength based on elastic design methods Y = Required section strength based on plastic design methods DSC_p = Gravity and seismic contribution of the dome service crane in parked position. DSC_o = Gravity and seismic contribution of the dome service crane in operating position. Load combinations for the polar crane are consistent with SRP acceptance criteria (if F, H, To, Ro, and pipe break related loads are considered not applicable to the crane). However, per the SRP (and as noted in the DCM S-42B, Appendix A), jet impingement forces and containment compartment pressurization are applicable loads for the polar crane but are not combined with HE loads.

SRP 3.8.4	Other Seismic Category 1 Structures – Containment Polar Crane
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4. Design and Analysis Procedures - The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See below.
II.4.A. For concrete structures, the procedures are in accordance with ACI 349, as supplemented by RG 1.142. The design and analysis of anchors used for component and structural supports on concrete structures are acceptable if found in accordance with Appendix B of ACI 349, as supplemented by RG 1.199	Strength of bolt anchorage is based on ultimate stresses defined in Part IV-B of the ACI 318-63 Code.
II.4.B. The design and analysis methods described in Subsections of II.4 of SRP Sections 3.8.1 and 3.8.2, which apply to other Category I concrete and steel structures, respectively, also need to be considered:	See below.
II.4.B. SRP 3.8.1, Section II.4 (Concrete)	These criteria are generally addressed as part of other SRP sections. Note that the polar crane is steel structure except for its rail anchorage interface with concrete.
II.4.B.- SRP 3.8.2, Section II.4 (Steel)	These criteria are generally addressed as part of other SRP sections.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004)	The polar crane was designed in accordance with the Association of Iron and Steel Engineers (AISE), Standard Number 6, "Specification for Electric Overhead Traveling Cranes for Steel Mill Service" (Tentative, May 1, 1969), and "Specifications for the Design, Fabrication and Erection of Structural steel for Buildings" by the American Institute of Steel Construction (AISC), 7th Edition, as required by PG&E Specification 8839, Section 5.3.

SRP 3.8.4	Other Seismic Category 1 Structures – Containment Polar Crane
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the structural acceptance criteria appear in the following:	See below.
II.5.- Concrete Structures - ACI 349 and RG 1.142 and RG 1.199 U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+(Yr+Yj+Ym)+Ess	Strength of bolt anchorage is based on ultimate stresses defined in Part IV-B of the ACI 318-63 Code. (Concrete load combinations may be applicable to the polar crane rail anchorage design) Per FSARU: U=1.7S=D+TD+L+HE Per DCM S-42B, Appendix A: Plastic Design: 1.0Y=D+TD+L+HE+DSCp 1.0Y=D+TD+HE+DSCo For load combinations including Hosgri seismic loads, section strengths and load demands defined in Section 4.3.3 may be reduced by considering the structure's ductility in accordance with DCM T-6.
II.5.- Concrete Structures - ACI 349 and RG 1.142 and RG 1.199	DCPP acceptance criteria for polar carne allow use of actual tested properties of materials. The section strength may be determined on the basis of these material properties, if a specific heat used for the element evaluated is identified on construction drawings and in the calculations.

<table>
<tr><th>SRP 3.8.4</th><th>Other Seismic Category 1 Structures – Containment Polar Crane</th></tr>
<tr><th>SRP Acceptance Criteria</th><th>DCPP Design/Licensing Basis</th></tr>
<tr><td>II.5.- <u>Steel Structures</u> - AISC N690-1994, including Supplement 2 (2004)

Elastic Design: [N690 Supplement 2 Table Q1.5.7.1]
1.6S=D+L+Ro+To+Es
1.7S=D+L+Ra+Ta+Yr+Yj+Ym+Es+Pa
Plastic Design: [N690 Section Q2.1]
Y=1.1(D+L+Ta+Ra+Pa+Yj+Yr+Rm+Es)</td><td>Per FSARU:
U=1.7S=D+TD+L+HE

Per DCM S-42B, Appendix A:
Elastic Design:
1.7S=D+TD+L+HE+DSCp
1.7S=D+TD+HE+DSCo

Plastic Design:
1.0Y=D+TD+L+HE+DSCp
1.0Y=D+TD+HE+DSCo

For load combinations including Hosgri seismic loads, section strengths and load demands defined in Section 4.3.3 may be reduced by considering the structure's ductility in accordance with DCM T-6.

AISC N690-1994 including Supplement 2 (2004) specifies the use of minimum strength properties. However, DCPP acceptance criteria for polar carne allow use of actual tested properties of materials. The section strength may be determined on the basis of these material properties, if a specific heat used for the element evaluated is identified on construction drawings and in the calculations.

The N690-1994, Plastic Design allowable strength for the "Abnormal Extreme" load combination is (1/1.1=) 0.9Y ; the DCPP Design Basis is 1.0Y (for load combinations with HE)

For the load combinations with SSE as listed in N690-1994, with Supplement 2, the Stress Limit Coefficients for shear stresses in members and bolts is 1.4. DCPP criteria specify a limit of 1.6.

N690-1994 bolt allowables are different than those specified in the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1969 Edition.</td></tr>
</table>

SRP 3.8.4	**Other Seismic Category 1 Structures – Fuel Handling Building (FHB) Crane**
SRP Acceptance Citeria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in portions thereof.	See codes discussed below.
II.2. ACI 349 (Concrete)	FHB crane is a steel structure supported by the FHBSS columns and use of ACI code is not necessary for design of any of its structural elements.
II.2. ANSI/AISC N690-1994 (including Supplement 2 (2004) (Structural Steel)	The Hosgri evaluation of the FHB crane is in accordance with the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, Dated February 12, 1969 (7th Edition), and AISE Standard Number 6 "Specification For Electric Overhead Traveling Cranes For Steel Mill Service."
II.2. RG 1.199 (Anchoring Components and Structural Supports in Concrete)	FHB crane is a steel structure supported by the FHBSS columns and use of ACI code is not necessary for design of any of its structural elements.
II.3. Loads and Load Combinations - The specified loads and load combinations are acceptable if found to be in accordance with the guidance given below:	The FHB crane is a steel structure (grid, beams, braces, truck and wheel assembly, trolley, hoist and crane rail etc). Therefore, only steel material types are addressed below.

SRP 3.8.4	**Other Seismic Category 1 Structures – Fuel Handling Building (FHB) Crane**
SRP Acceptance Citeria	**DCPP Design/Licensing Basis**
II.3.B. Steel Structures - All loads and load combinations to be in accordance with AISC N690-1994 including Supplement 2 (2004)	DCM S-42B, Appendix C, Section 4.3.2.3 specifies crane operation loads: - Vertical impact for cab operated traveling crane = 30% of maximum wheel load - Lateral force = 5% each of the bridge dead load, the trolley dead load, and the maximum lifted load - Longitudinal force = 10% of the trolley dead load and the maximum lifted load DCM S-42B, Appendix C, Section 4.3.3.3 specifies the following load combination for the HE: - Dead + Lift Load + HE (with both the loaded and unloaded crane conditions) - Dead + HE (this combination applicable only to the Seismically Induced Systems Interaction evaluation of miscellaneous items attached to FBH crane) The gaps between the DCPP Design Basis and AISC N690-1994 are as follows: The following compares the differences between crane impact loads between these two codes (DCCP vs. SRP): - Vertical impact: 30% vs. 25% - Lateral force: 10% (= 2 x 5%) vs. 20% - Longitudinal force: 10% vs. 10% AISC N690-1994, Table Q1.5.7.1 provides two load combinations, which include the SSE (E_{ss}) load combined with several additional loads compared to the HE load combination for the FHB crane. Specific loads not addressed: - Pipe Rupture Loads - Jet Impingement Loads - Thermal Loads However, DCM S-42B, Appendix C, Section 4.4 states that there are no missiles or pipe rupture requirements applicable to the FHB crane.

SRP 3.8.4	Other Seismic Category 1 Structures – Fuel Handling Building (FHB) Crane
SRP Acceptance Citeria	**DCPP Design/Licensing Basis**
II.4. Design and Analysis Procedures - The design and analysis procedures used for Seismic Category I structures, including assumptions about boundary conditions and expected behavior under loads, are acceptable if found to be in accordance with the following:	See procedures discussed below.
II.4.B. The design and analysis methods described in Subsections of II.4 of SRP Sections 3.8.1 and 3.8.2, which apply to other Category I concrete and steel structures, respectively, also need to be considered:	See design and analysis methods discussed below.
II.4.B.- SRP 3.8.1, Section II.4 (Concrete)	The FHB crane is a steel structure and meeting any concrete related criteria are not necessary.
II.4.B. - SRP 3.8.2, Section II.4 (Steel)	See below.
II.4.B. - SRP 3.8.2.II.4.A Treatment of non-axisymmetric and localized loads	The FHB crane is not an axisymmetric structure. Nonaxisymmetric and localized loads in this context need not be addressed for the seismic design of the FHB crane for the HE.
II.4.C. For steel structures, the procedures are in accordance with ANSI/AISC N690-1994, including Supplement 2 (2004)	The Hosgri evaluation of the FHB Crane is in accordance with the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, Dated February 12, 1969 (7th Edition), and AISE Standard Number 6 "Specification For Electric Overhead Traveling Cranes For Steel Mill Service."

SRP 3.8.4	Other Seismic Category 1 Structures – Fuel Handling Building (FHB) Crane
SRP Acceptance Citeria	**DCPP Design/Licensing Basis**
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the structural acceptance criteria appear in the following:	See acceptance criteria discussed below.
II.5. - Concrete Structures - ACI 349 and RG 1.142 and RG 1.199	The FHB crane is a steel structure supported by the FHBSS columns and use of ACI code is not necessary for design of any of its structural elements.
II.5.- Steel Structures - AISC N690-1994, including Supplement 2 (2004)	The FHB crane steel acceptance criteria is based on AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, Dated February 12, 1969 (7th Edition), and AISE Standard Number 6 "Specification For Electric Overhead Traveling Cranes For Steel Mill Service" for steel members. AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2000 edition for bolts. The gaps between the DCPP Design Basis and AISC N690-1994 are as follows: The N690-1994, Plastic Design allowable strength for the "Abnormal Extreme" load combination is 0.9Y (where Y = required section strength based on plastic design methods and stresses). DCPP Design Basis is 1.0Y (for load combinations with HE). For the load combinations with SSE as listed in N690-1994, with Supplement 2, the Stress Limit Coefficients for shear stresses in members and bolts is 1.4. DCPP criteria specify a limit of 1.6. N690-1994 specifies the use of minimum strength properties. For structural steel elements associated with the original fabrication of the crane, DCPP acceptance criteria for load combinations, which include HE, utilize average tested values rather than minimum strengths.

SRP 3.8.5	Foundations - Containment Exterior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I foundations are covered by codes, standards, and guides, either applicable in their entirety or in part. Subsection II.2 of SRP Section 3.8.4 includes a list of such documents:	See below.
II.2. - ACI 349 (Concrete)	The Code of Record for concrete design is ACI 318-63.
II.2.- RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	ACI 318-63 is used for design and analysis of the containment structure foundation.
In addition, the documents listed in Subsection II.2 of SRP Section 3.8.1 are acceptable for the containment foundation:	See below.
II.3. Loads and Load Combinations - The specified loads and load combinations used in the design of Seismic Category I foundations are acceptable if found to be in accordance with:	See below.
II.3. Containment Foundation - Combinations referenced in Subsection II.3 of SRP Section 3.8.1 for containment foundation:	See below.

SRP 3.8.5	Foundations - Containment Exterior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3. The specified loads and load combinations are acceptable if found to be in accordance with Article CC-3000 of the ASME Code with the exceptions to the requirements specified in Table CC-3230-1 listed in Subsection II.3 of SRP Section 3.8.1 Two SSE Load Combinations are required: 1. D+L+F+G+To+Ess+Ro+Pv 2. D+L+F+G+Pa+Ta+Ess+Ra+Rr Ess = Safe Shutdown Earthquake Weights considered shall be the same as for Eo (Operating Basis Earthquake): "Only the actual dead load and existing live load weights need be considered in evaluating seismic response forces" Dead Loads = including hydrostatic and permanent equipment loads Live Loads = including any movable equipment loads and other loads which vary with intensity and occurrence, such as soil pressures. Note 1 to Table CC-3230-1 indicates that Live Load also includes all temporary construction loading during and after construction of containment. With the exceptions listed below.	FSARU: "Exterior Shell and Base Slab:" U = D±0.05D+Pa+T+HE U = Required load capacity of section D = Dead loads P_A = Load due to accident pressure T = Load due to maximum temperature associated with $1.0P_A$ HE = Loads due to Hosgri Earthquake DCM T-1A: U = D±0.05D+P+T+HE U = D±0.05D+HE+To+R+J+M To = Thermal operating loads P = Internal Pressure associated with the postulated LOCA. R = Pipe Rupture J = Jet Impingement M = Missile Impact Dead Loads consist of the weight of concrete, reinforcing steel, steel liner, structural steel, and permanent equipment loads. Live Loads consist of temporary equipment loads and a uniform load to account for the miscellaneous temporary loadings that may be placed on the structure. The DCPP definition of Dead Load is consistent with the SRP. The DCPP definition of Live Load does not include the soil pressure loading required by the SRP. FSARU Section 3.7.2.1.7.1 indicates that computer models for DE/DDE seismic analysis include the weight of mechanical equipment. DCM T-6 Section 4.3.1 indicates that the HE and DE/DDE models are similar with the exception of the fixed-base assumption.

SRP 3.8.5	Foundations - Containment Exterior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4. Design and Analysis Procedures - The design and analysis procedures used for Seismic Category I foundations are acceptable if found to be in accordance with the following:	See below.
II.4.A. The design should consider the soil-structure interaction, hydrodynamic effect, and dynamic soil pressure.	See SRP section 3.7.2 for Containment Exterior and Interior Structure. Dynamic soil pressure is not addressed in the DCM T-1A or the FSARU. The HE model is based on fixed base assumption.
II.4.D. For the containment foundation, if in accordance with the design and analysis procedures referenced in SRP Section 3.8.1, Subsection II.4:	See below.
II.4.D. 3.8.1.II.4.D. Treatment of the effects of creep, shrinkage, and cracking of concrete	Design is per ACI 318-63. Analysis descriptions do not mention evaluation for the effects of concrete cracking on dynamic behavior.
II.4.D. 3.8.1.II.4.H. The evaluation of the effects of variation in specified physical properties of materials on analytical results	In general, minimum specified material strengths are used for the HE load combinations. However, in certain cases, the average tested material strengths have been used. No variations (upper or lower bounds) in physical material properties have been considered.
II.4. Additionally, the design and analysis procedures for the following details are reviewed on a case-by-case basis:	See below.

SRP 3.8.5	Foundations - Containment Exterior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. The method to calculate the factor of safety against sliding. If sliding is the sum of shear friction along the base mat and passive pressures induced by embedment effects, how these effects are considered in an analysis based on a consistent lateral displacement criterion? (To be reviewed on a case-by-case basis)	See SRP section 3.7.2 for Containment Exterior and Interior Structure
II.4.C. Evaluation of the capability of a foundation to transfer shear when waterproofing is used for a range of site conditions (soil sites with shear wave velocity of 1000 feet per second to hard rock)? (To be reviewed on a case-by-case basis)	Application of waterproofing, or lack thereof, is not explicitly addressed in FSARU or pertinent DCMs T-1A and T-6, Appendix A.
II.4.E. Detail explanation of how settlement (including potential effects of static or dynamic differential settlement) was considered. (To be reviewed on a case-by-case basis)	See SRP section 3.7.2 for Containment Exterior and Interior Structure. The basemat was poured against underlying rock. The bedrock is rigid and settlement is not applicable.
II.4.E. Evaluation of the allowable settlement (total and differential) that can be accommodated in the foundation/structures? (To be reviewed on a case-by-case basis)	See SRP section 3.7.2 for Containment Exterior and Interior Structure. Effects of containment tilting on safety-related systems connected to containment have been addressed in SSER08, Section 3.8.5.4.1.
II.4.F. The maximum toe pressure for base mat design under worst-case static and dynamic loads and its justification. (To be reviewed on a case-by-case basis)	Toe pressure is not explicitly addressed in the FSARU or DCM T-1A for HE loading. Under DDE seismic loading the containment was subject to extremely large overturning moments. Under this condition, foundation resisting pressure was concentrated over a small area near the edge of the basemat. Analysis for HE was changed from this methodology to the finite element method where uplift of the basemat was considered. There is no further mention of toe pressure.

SRP 3.8.5	Foundations - Containment Exterior Structure
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.G. The stiff and soft spots evaluation in the foundation soil to maximize the bending moments used in the design of the foundation mat. (To be reviewed on a case-by-case basis)	Stiff and soft spots are not addressed in the FSARU or DCM T-1A. The containment foundation is supported by a rigid rock foundation.
II.4.H. Description of the design details of critical locations, such as the junction of sidewall and base mat and the junctions of base mat to sumps. (To be reviewed on a case-by-case basis)	The description of design details of critical locations is addressed in DCMs T-1A and T-6, Appendix A.
II.4.I. Detail explanation of the load path from all superstructures to the foundation mat to the subgrade. Discussion of any unique design features that occur in the load path (e.g., any safety-related function that the tendon gallery may have as part of the foundation in a prestressed containment or the connection of any internal structures to a steel containment and its supporting foundation). (To be reviewed on a case-by-case basis)	Superstructure load paths to the foundation are addressed in DCMs T-1A and T-6, Appendix A.
II.5. <u>Structural Acceptance Criteria</u> - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the allowable limits that constitute the acceptance criteria are referenced in Subsection II.5 of SRP Section 3.8.1 for the containment foundation:	See below.
II.5.A. For the structural portions of the containment, the specified allowable limits for stresses and strains are acceptable if they are in accordance with:	See below.

SRP 3.8.5	**Foundations - Containment Exterior Structure**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5.- ASME Subsection CC-3400 and exceptions relating to tangential shear stress carried by concrete listed in Subsection II.5 of SRP Section 3.8.1	ACI 318-63 was used for concrete capacity calculations. Additionally, ductility and average tested material strengths were used for the HE seismic analyses.
II.5.- <u>Concrete Structures</u> - ACI 349 and RG 1.142	ACI 318-63 is the Code of Record for concrete design.
II.5.- For the five other load combinations in Subsection II.3 of this SRP section, the factors of safety against overturning, sliding and flotation are acceptable if found in accordance with Subsection II.5 of this SRP section. (Safety factor of 1.1 for sliding and overturning required for SSE event)	The Safety Factor against overturning calculated during HE re-evaluation was 1.11. Sliding is not mentioned in the FSARU or DCM T-1A. However, the depth of embedment of the foundation into bedrock, specifically at the area of the reactor cavity, prevents seismically-induced sliding.

SRP 3.8.5	Foundations - Auxiliary Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. <u>Applicable Codes, Standards, and Specifications</u> The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I foundations are covered by codes, standards, and guides that are either applicable in their entirety or in part. Subsection II.2 of SRP Section 3.8.4 includes a list of such documents. In addition, the documents listed in Subsection II.2 of SRP Section 3.8.1 are acceptable for the containment foundation. *A list of such documents in above-mentioned SRP sections are as follows:*	See below.
II.2. ACI 349 ("Code Requirements for Nuclear Safety-Related Concrete Structures" with additional criteria provided by RG 1.142)	Note: ACI 349 will be discussed later in this table, under SRP Acceptance Criteria 3 (Loads and Load Combinations), 4 (Design and Analysis Procedures), and 5 (Structural Acceptance Criteria).
II.2. RG 1.142 ("Safety-Related Concrete Structures for Nuclear Power Plants {Other Than Reactor Vessels and Containments})	Note: RG 1.142 is discussed later in this table, under SRP Acceptance Criteria 3 (Loads and Load Combinations), 4 (Design and Analysis Procedures), and 5 (Structural Acceptance Criteria).
II.3. <u>Loads and Load Combinations</u> "The specified loads and load combinations used in the design of Seismic Category I foundations are acceptable if found to be in accordance with those combinations referenced in........Subsection II.3 of SRP Section 3.8.4 for all other Seismic Category I foundations. In addition to the load combinations referenced above, the combinations used to check against	Per FSARU Section 3.8.4, foundation for auxiliary building is included in FSARU Section 3.8.2. Per Licensing Basis Relationship discussion of SRP acceptance criteria per Subsection II.3 of SRP Section 3.8.4, the governing load combination per SRP criteria (i.e., ACI 349 and as supplemented by RG 1.142) for SSE associated with concrete portions of auxiliary building is not equivalent to PG&E's load combination for HE. The same applies for the auxiliary building foundation.

SRP 3.8.5	Foundations - Auxiliary Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
sliding and overturning attributable to earthquakes, winds, tornadoes and against flotation because of floods are acceptable if found to be in accordance with the following: A. D + H + E B. D + H + W C. D + H + E' ***(i.e., SSE case)*** D. D + H + W_t E. D + F' Where D, E, W, E' and W_t are as referenced in Subsection II.3 of SRP Section 3.8.4, where H is the lateral earth pressure, and F' is the buoyant force of the design-basis flood….." *Note: There is a problem with above SRP paragraph as E and E' are not specifically used in the referenced section (symbols are different for use in required ACI 349-97). Based on my experience, E' represents the SSE load term.*	
II.4. Design and Analysis Procedures The design and analysis procedures used for Seismic Category I foundations are acceptable if found to be in accordance with the following:	See below.
II.4.A. The design should consider the soil-structure interaction, hydrodynamic effect and dynamic soil pressure.	See SRP Section 3.7.2 for Auxiliary Building. Per review of FSARU Sections 3.7.2.1.7.1 and 3.8.2.1, there is no specific discussion of SSI, hydrodynamic effect and dynamic soil pressures effects regarding design of auxiliary building foundation. However, SSI is addressed in Section 4.2.1.1 of Appendix B to D CM T-6, including effect of sloping surface on the east side of the auxiliary building. Effects associated with water in SFP and associated modeling approaches are addressed in Section 4.2.2 of Appendix B to DCM T-6.

SRP 3.8.5	**Foundations - Auxiliary Building**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.B. For Seismic Category I concrete foundations other than the containment foundations, the procedures are in accordance with the ACI 349, with additional guidance provided by RG 1.142.	Per FSARU Section 3.8.2.3.2.2 for evaluation of concrete structural elements, including foundation, to accommodate Hosgri loads and Sections 4.3.3.2 and 4.3.5.3 of DCM T-2, the Code of Record is ACI 318-63 for ultimate strength of concrete elements.
II.4.D. For the containment foundation, if in accordance with the design and analysis procedures referenced in SRP Section 3.8.1, Subsection II.4.	The auxiliary building foundation is independent of the containment foundation.
In addition to the above, the design and analysis procedures for the following details are reviewed on a case-by-case basis.	See below.
II.4.A. Method for determination of the bending moments and shear forces in the foundation mat for seismic loads?	See SRP Section 3.7.2. There is no explicit mention of methods to determine overturning moments or shear forces in foundation induced by HE.
II.4.B. Performance of the sliding analysis method and how the analysis adequately accounts for potential foundation mat liftoff effects, if appropriate? The method to calculate the factor of safety against sliding. If sliding resistance is the sum of shear friction along the base mat and passive pressures induced by embedment effects, how these effects are considered in an analysis based on a consistent lateral displacement criterion?	See SRP Section 3.7.2. These SRP topics associated with sliding analysis are not explicitly addressed. However, the configuration of the auxiliary building foundation (below-ground basement levels embedded into the bedrock) makes sliding impossible.
II.4.C. Evaluation of the capability of a foundation to transfer shear when waterproofing is used for a range of site conditions (soil sites with shear wave velocity of 1000 feet per second to hard rock?	Application of waterproofing, or lack thereof, is not addressed.

SRP 3.8.5	**Foundations - Auxiliary Building**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.D. The definition of dead load for uplift evaluations (flotation and seismic overturning), including the treatment of the stored volume of water in any pools?	Per review of FSARU Sections 3.7.2.1.7.1 and 3.8.2.1, there is no specific discussion of dead load for uplift evaluations, including treatment of stored volume of water in pools. There are no flotation concerns with auxiliary building foundation as it is above ground water table. However, effects associated with water in SFP and associated modeling approaches are addressed in Section 4.2.2 of Appendix B to DCM T-6.
II.4.F. The maximum toe pressure for base mat design under worst-case static and dynamic loads and its justification.	The maximum toe pressure for auxiliary building foundation is not quantified.
II.4.G. The stiff and soft spots evaluation in the foundation soil to maximize the bending moments used in the design of the foundation mat.	The auxiliary building foundation is on bedrock and/or concrete fill on bedrock.
II.5. Structural Acceptance Criteria "For the loading combinations referenced in the first paragraph of Subsection II.3 of this SRP section, the allowable limits that constitute the acceptance criteria are referenced in Subsection II.5 of SRP Section 3.8.1 for the containment foundation and in Subsection II.5 SRP Section 3.8.4 for all other foundations. In addition, for the five other load combinations in Subsection II.3 of this SRP section, the factors of safety against overturning, sliding, and floatation are acceptable if found to be in accordance with the following:" *For Load Combination C that involves the SSE term, the required safety factor for overturning and sliding is specified as 1.1.*	Per FSARU Section 3.8.2.3.2.2 for evaluation of concrete sections for the HE, including the foundation, the Code of Record is ACI 318-63 for concrete design. Per FSARU Section 3.8.2.3.2.2 for evaluation of concrete sections for HE including the foundations, the ultimate strength method for determining capacities shall be based on ACI 318-63. FSARU Sections 3.8.2.6.1 and 3.8.2.6.2, indicate that average tested material strengths are used to determine concrete section capacities for the HE. In FSARU Section 3.8.2, there is no mention of existing safety factors for overturning and sliding of auxiliary building foundation associated with the HE.

SRP 3.8.5	Foundations - Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I foundations are covered by codes, standards, and guides, either applicable in their entirety or in part. Subsection II.2 of SRP Section 3.8.4 includes a list of such documents:	See below.
II.2.- ACI 349 (Concrete)	ACI 318-71 including the 1973 Supplement is used for the HE analyses cases, with ACI 318-63 being the original Code of Record for the turbine building.
II.2.- RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	ACI 318-71 including the 1973 Supplement is used for the HE analyses cases, with ACI 318-63 being the original Code of Record for the turbine building.
II.2.- II.2. - ANSI/AISC N690-1994 including Supplement 2 (2004) (Structural Steel)	Foundation demand loads are based on the load combinations for steel structures, which is based on AISC 1969 Edition.
II.2.- RG 1.199 (Anchoring Components and Structural Supports in Concrete)	Allowable tensile loads for rock bolts as limited by the strength of the bolt steel are determined in accordance with the acceptance criteria for reinforcing steel in concrete structures per ACI 318-71 (DCM T-4, Section 4.3.5.2).
II.3. Loads and Load Combinations - The specified loads and load combinations used in the design of Seismic Category I foundations are acceptable if found to be in accordance with:	See below.
II.3.B. Seismic Category I Foundations - Combinations listed in Subsection II.3 of SRP Section 3.8.4:	See below.

SRP 3.8.5	Foundations - Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B.Concrete Structures - All loads and load combinations to be in accordance with ACI 349 and RG 1.142, with supplemental criteria. Per ACI 349: U=D+F+L+H+To+Ro+Ess U=D+F+L+H+Ta+Ra+Pa+Yr+Yj+Ym+Ess	Foundation demand loads are based on the load combinations for steel structures as given in DCM T-4, Sections 4.3.4.2(c) for the HE. $1.0Y = D + L_A + R_A + HE$ $1.7S = D + L_A + R_A + HE$ Y = The maximum strength of the section based on the methods and allowable stresses defined in Part 2 of the AISC Specifications, 1969. S = Capacity of the section based on Part 1 of the AISC Specifications, 1969 Edition (for load combinations including HE) D = Dead loads L_A = Live loads present during abnormal conditions HE = Hosgri earthquake loads R_A = Pipe reactions during abnormal conditions
II.3. Additional load combinations used to check against sliding and overturning attributable to earthquakes, winds, tornadoes and against flotation because of floods in Section II.3 of this SRP Section. D+H+E' (where H = lateral soil pressure)	Evaluations for sliding and overturning are not mentioned in the FSARU or DCM T-4. Lateral soil pressure does not appear in turbine building load combinations for the HE. See SRP Section 3.7.2 for details on sliding and overturning. FSARU Section 3.7.2.13 states, "The maximum overturning moments for Design Class I Structures are determined as part of the time-history modal superposition analyses. Vertical earthquake is considered to act concurrently with the maximum horizontal overturning moments." Sliding of foundations is not explicitly addressed, although the portions of the turbine building that are embedded into the bedrock (e.g., basements at the 12kV cable spreading rooms, circulating water conduits, and caissons for the buttresses) prevent sliding.
II.4. Design and Analysis Procedures - The design and analysis procedures used for Seismic Category I foundations are acceptable if found to be in accordance with the following:	See below.

SRP 3.8.5	Foundations - Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.A. The design should consider the soil-structure interaction, hydrodynamic effect, and dynamic soil pressure.	The FSARU and DCMs T-4 and T-6, Appendix C do not address SSI or dynamic soil pressures. The model for HE evaluation is a fixed base model. The main (original) portion of the foundation base mat rests on base rock or on lean concrete fill down to base rock. At the west end of the west buttress areas the basemat is underlain with compacted fill, and support is provided by reinforced concrete grade beams and by drilled concrete piles extending down to the base rock. DCM T-4 Section 4.4.2 indicates that flooding loads are not applicable inside or outside the turbine building. Therefore, hydrodynamic effects need not be considered as they are not mentioned in DCM T-4 or FSARU.
II.4.B. For Seismic Category I concrete foundations other than containment foundations, the procedures are in accordance with the ACI 349, with additional guidance provided by RG 1.142.	ACI 318-71 including the 1973 Supplement is used for HE analyses, with ACI 318-63 being the original Code of Record for the turbine building.
Additionally, the design and analysis procedures for the following details are reviewed on a case-by-case basis:	See below.
II.4.D. The definition of dead load for uplift evaluations (floatation and seismic overturning), including the treatment of the stored volume of water in any pools? (To be reviewed on a case-by-case basis)	Dead load is defined as the weight of the structure, permanent attachments, and permanent equipment. No specific definition with respect to uplift load cases is provided. The turbine building does not contain pools of stored water.
II.4.E. Detail explanation of how settlement (including potential effects of static or dynamic differential settlement) was considered. (To be reviewed on a case-by-case basis)	Settlement is not discussed in the FSARU or DCM T-4. The main (original) portion of the foundation basemat rests on base rock or on lean concrete fill down to base rock. At the west end of the west buttress areas the basemat is underlain with compacted fill, and support is provided by reinforced concrete grade beams and by drilled concrete piles extending down to the base rock.

SRP 3.8.5	Foundations - Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.F. The maximum toe pressure for base mat design under worst-case static and dynamic loads and its justification. (To be reviewed on a case-by-case basis)	No discussion of the maximum toe pressure or procedures used to determine the maximum toe pressure is provided in the FSARU or DCM T-4. Allowable foundation pressures are noted in DCM T-4.
II.4.G. The stiff and soft spots evaluation in the foundation soil to maximize the bending moments used in the design of the foundation mat. (To be reviewed on a case-by-case basis)	The main (original) portion of the foundation basemat rests on base rock or on lean concrete fill down to base rock. At the west end of the west buttress areas the basemat is underlain with compacted fill, and support is provided by reinforced concrete grade beams and by drilled concrete piles extending down to the base rock.
II.4.H. Description of the design details of critical locations, such as the junction of sidewall and base mat and the junctions of base mat to sumps. (To be reviewed on a case-by-case basis)	Descriptions of design details of critical locations are addressed in DCMs T-4 and T-6, Appendix C.
II.5. Structural Acceptance Criteria - For each of the loading combinations delineated in Subsection II.3 of this SRP section, the allowable limits that constitute the acceptance criteria are referenced as follows:	See below.
II.5. - Subsection II.5 of SRP Section 3.8.4 for all other foundations:	See below.
II.5. - ACI 349 and RG 1.142 for concrete structures	ACI 318-71 including the 1973 Supplement is used for HE analyses, with ACI 318-63 being the original Code of Record for the turbine building. Additionally, ductility and average tested material strengths were used for HE seismic analyses in-lieu of minimum code values.

SRP 3.8.5	Foundations - Turbine Building
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5. - *For the five other load combinations in* Subsection II.3 of this SRP section, the factors of safety against overturning, sliding and flotation are acceptable if found in accordance with Subsection II.5 of this SRP section. (Safety factor of 1.1 for sliding and overturning required for SSE event)	*Overturning and sliding factors of safety are not explicitly mentioned in the FSARU or DCMs* T-4 and T-6, Appendix C. However, FSARU Section 3.7.2.13 states, "The maximum overturning moments for Design Class I Structures are determined as part of the time-history modal superposition analyses. Vertical earthquake is considered to act concurrently with the maximum horizontal overturning moments." Sliding of foundations is not explicitly addressed, though the portions of the turbine building that are embedded into the bedrock (e.g., basements at the 12kV cable spreading rooms, circulating water conduits, and caissons for the buttresses) prevent sliding.

SRP 3.8.5	Foundations - Intake Structure
SRP Acceptance Requirements	**DCPP Design/Licensing Basis**
II.2. Applicable Codes, Standards, and Specifications - The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I structures are covered by codes, standards, and guides, either applicable in their entirety or in part. Subsection II.2 of SRP Section 3.8.4 includes a list of such documents:	See below.
II.2.- ACI 349 (Concrete)	ACI 318-63 is the Code of Record for concrete design.
II.2.- RG 1.142 (Safety Related Concrete Structures for Nuclear Power Plants)	ACI 318-63 is the Code of Record for concrete design.
II.3. Loads and Load Combinations - The specified loads and load combinations used in the design of Seismic Category I foundations are acceptable if found to be in accordance with:	See below.
II.3.B. Seismic Category I Foundations - Combinations listed in Subsection II.3 of SRP Section 3.8.4:	See below.

SRP 3.8.5	Foundations - Intake Structure
SRP Acceptance Requirements	**DCPP Design/Licensing Basis**
II.3.B. Concrete Structures - All loads and load combinations to be in accordance with ACI 349 and RG 1.142, with supplemental criteria. 1. U=D+F+L+H+To+Ro+Ess 2. U=D+F+L+H+Ta+Ra+Pa+Yr+Yj+Ym+Ess	The FSARU provides minimal loading information. The DCM T-5 provides much more detail regarding intake structure loads. C=D+L+MH+Ro+HE+EP+DEP C = Combined load demand D = Dead loads L = Live loads MH = Mechanical and Hydraulic Loads due to the operation of circulating and ASW pumps. R_O = Pipe Reactions EP = Static Lateral Earth Pressure DEP = Dynamic Lateral Earth Pressure HE = Loads due to Hosgri Earthquake Temperature loads (both To and Ta) are not listed in the DCM T-5 load combinations as required by ACI 349. Loads related to postulated pipe rupture (Ra, Pa, Yr, Yj, Ym) are not listed in the DCM T-5 load combinations, but normal pipe reactions (Ro) are included.
II.4. Design and Analysis Procedures - The design and analysis procedures used for Seismic Category I foundations are acceptable if found to be in accordance with the following:	See below.
II.4.B. For Seismic Category I concrete foundations other than containment foundations, the procedures are in accordance with the ACI 349, with additional guidance provided by RG 1.142.	ACI 318-63 is the Code of Record for concrete design.
Additionally, the design and analysis procedures for the following details are reviewed on a case-by-case basis:	See below.

SRP 3.8.5	Foundations - Intake Structure
SRP Acceptance Requirements	**DCPP Design/Licensing Basis**
II.4.B. Performance of the sliding analysis method and how the analysis adequately accounts for potential foundation mat liftoff effects, if appropriate? (To be reviewed on a case-by-case basis)	The sliding analysis methods are not explicitly presented in the FSARU or DCM T-5. However, sliding and overturning are indeed design considerations as stated in DCM T-5, Sections 4.3.5.3 and 4.3.7.1.
II.4.B. The method to calculate the factor of safety against sliding. If sliding is the sum of shear friction along the base mat and passive pressures induced by embedment effects, how these effects are considered in an analysis based on a consistent lateral displacement criterion? (To be reviewed on a case-by-case basis)	DCM T-5, Section 4.3.7.1 states the factor of safety against sliding is based on the shear strength of the bedrock, 8.3 kips per square foot, and the action of shear keys formed by the basemat configuration.
II.4.C. Evaluation of the capability of a foundation to transfer shear when waterproofing is used for a range of site conditions (soil sites with shear wave velocity of 1000 feet per second to hard rock)? (To be reviewed on a case-by-case basis)	Shear transfer with respect to waterproofing methods is not discussed in the FSARU or DCM T-5. DCM T-5, Section 4.3.7.1 states the shear strength of the bedrock is 8.3 kips per square foot when interacting with shear keys formed by the basemat.
II.4.D. The definition of dead load for uplift evaluations (floatation and seismic overturning), including the treatment of the stored volume of water in any pools? (To be reviewed on a case-by-case basis)	DCM T-6, Appendix D covers the treatment of equipment with regards to dead load and seismic mass. DCM T-6, Appendix D, Section 5 states that the effect of virtual mass of the contained water is considered in the north-south direction by including the total mass of water tributary to the transverse piers. The effect of water in the response of the structure to an earthquake in the east-west direction or the vertical direction is negligible and is ignored (water can flow in and out of the structure and exerts relatively little force on the structure).
II.4.E. Detail explanation of how settlement (including potential effects of static or dynamic differential settlement) was considered. (To be reviewed on a case-by-case basis)	Topic is not addressed in the FSARU or DCM T-5; however, the foundation is located in an excavation into bedrock.

SRP 3.8.5	Foundations - Intake Structure
SRP Acceptance Requirements	**DCPP Design/Licensing Basis**
II.4.E. Evaluation of the allowable settlement (total and differential) that can be accommodated in the foundation/structures? (To be reviewed on a case-by-case basis)	Topic is not addressed in the FSARU or DCM T-5; however, the foundation is located in an excavation into bedrock.
II.4.F. The maximum toe pressure for base mat design under worst-case static and dynamic loads and its justification. (To be reviewed on a case-by-case basis)	The maximum toe pressure demand for basemat design is not explicitly presented in the FSARU of DCM T-5. However, DCM T-5, Section 4.3.5.3 states that the allowable foundation bearing pressure is 50,000 psf.
II.4.G. The stiff and soft spots evaluation in the foundation soil to maximize the bending moments used in the design of the foundation mat. (To be reviewed on a case-by-case basis)	DCM T-6, Appendix D, Section 4.2.1 states that fixed boundary conditions are used for Hosgri analysis. The foundation is located in an excavation into bedrock.
II.4.I. Detail explanation of the load path from all superstructures to the foundation mat to the subgrade. Discussion of any unique design features that occur in the load path (e.g., any safety-related function that the tendon gallery may have as part of the foundation in a prestressed containment or the connection of any internal structures to a steel containment and its supporting foundation). (To be reviewed on a case-by-case basis)	Load path is generally described in DCMs T-5 and T-6, Appendix D.
Subsection II.5 of SRP Section 3.8.4 for all other foundations:	See below.

SRP 3.8.5	Foundations - Intake Structure
SRP Acceptance Requirements	**DCPP Design/Licensing Basis**
II.5. Concrete Structures - ACI 349 and RG 1.142	The acceptance criteria used for the intake structure (foundation) are consistent with SRP acceptance criteria with the following exceptions: Concrete structural elements are evaluated in accordance with ACI 318-63 methodology. DCPP acceptance criteria allows the following: For load combinations involving HE effects, the maximum strengths can be calculated using averages of tested material properties in-lieu of code-specified minimum values. In the evaluation of required section strength, the Hosgri load demand may be reduced by considering the structure's ductility. For concrete, a ductility ratio of 1.3 is permitted.

SRP 3.8.5	Foundations - Outdoor Water Storage Tank (OWST)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. <u>Applicable Codes, Standards, and Specifications</u> The design, materials, fabrication, erection, inspection, testing, and surveillance, if any, of Seismic Category I foundations are covered by codes, standards, and guides that are either applicable in their entirety or in part. Subsection II.2 of SRP Section 3.8.4 includes a list of such documents. In addition, the documents listed in Subsection II.2 of SRP Section 3.8.1 are acceptable for the containment foundation. *A list of such documents in above-mentioned SRP sections are as follows:*	See below.
II.2. ACI 349 ("Code Requirements for Nuclear Safety-Related Concrete Structures" with additional criteria provided by RG 1.142)	Note: ACI 349 will be discussed later in this table, under SRP Acceptance Criteria 3 (Loads and Load Combinations), 4 (Design and Analysis Procedures), and 5 (Structural Acceptance Criteria).
II.2. RG 1.142 ("Safety-Related Concrete Structures for Nuclear Power Plants {Other Than Reactor Vessels and Containments})	Note: RG 1.142 is discussed later in this table, under SRP Acceptance Criteria 3 (Loads and Load Combinations), 4 (Design and Analysis Procedures), and 5 (Structural Acceptance Criteria).
II.3. <u>Loads and Load Combinations</u> "The specified loads and load combinations used in the design of Seismic Category I foundations are acceptable if found to be in accordance with those combinations referenced in........Subsection II.3 of SRP Section 3.8.4 for all other Seismic Category I foundations. In addition to the load combinations referenced above, the combinations used to check against sliding and overturning attributable to earthquakes, winds, tornadoes and against flotation because of floods are	Per licensing and design basis relationship discussion of SRP acceptance criteria per Subsection II.3 of SRP Section 3.8.4 for OWST's, the governing load combination per SRP criteria (ACI 349) for SSE is not equivalent to PG&E's load combination for HE. The same extension process would apply for foundation qualification work for OWST's. However, the additional SRP acceptance criteria for Load Combination C for SSE are equivalent to PG&E's load combination for HE and used for qualification of tank foundations.

SRP 3.8.5	Foundations - Outdoor Water Storage Tank (OWST)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
acceptable if found to be in accordance with the following: A. D + H + E B. D + H + W C. D + H + E' *(i.e., SSE case)* D. D + H + W_t E. D + F' Where D, E, W, E' and W_t are as referenced in Subsection II.3 of SRP Section 3.8.4, where H is the lateral earth pressure, and F' is the buoyant force of the design-basis flood....."	
II.4. Design and Analysis Procedures The design and analysis procedures used for Seismic Category I foundations are acceptable if found to be in accordance with the following:	See below.
II.4.B. For Seismic Category I concrete foundations other than the containment foundations, the procedures are in accordance with the ACI 349, with additional guidance provided by RG 1.142.	Per FSARU Sections 3.8.4.1.2 and 3.8.3.5.2, and DCM T-28, Section 4.3.4.2, the Code of Record is ACI 318-63 and ACI 318-71 for ultimate strength design of concrete sections for HE.
II.4. In addition to the above, the design and analysis procedures for the following details are reviewed on a case-by-case basis.	See below.
II.4.A. Method for determination of the bending moments and shear forces in the foundation mat for seismic loads?	This SRP topic is not explicitly addressed in FSARU Sections 3.7.2, 3.8.3, and 3.8.4. Per Section 4.3.5.1 of DCMT-28, it is specified that OWST foundations were checked for overturning and sliding associated with HE. The foundations include rock anchors to prevent sliding, overturning and uplift.

SRP 3.8.5	Foundations - Outdoor Water Storage Tank (OWST)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.C. Evaluation of the capability of a foundation to transfer shear when waterproofing is used for a range of site conditions (soil sites with shear wave velocity of 1000 feet per second to hard rock?	Application of waterproofing, or lack thereof, is not explicitly addressed in FSARU or DCM T-28.
II.4.D. The definition of dead load for uplift evaluations (flotation and seismic overturning), including the treatment of the stored volume of water in any pools?	Per review of FSARU Sections 3.7.2 and 3.8.4 and DCM T-28, there is no explicit definition of dead load for uplift evaluations. There are no flotation concerns with OWST foundations as it is above ground water table. However, per FSARU Section 3.8.3.1, the OWST's, including their foundations, are anchored to supporting bed rock to prevent sliding, overturning, and uplift.
II.4.F. The maximum toe pressure for base mat design under worst-case static and dynamic loads and its justification.	The maximum toe pressure for OWST foundations are not quantified in FSARU or DCM T-28.
II.5. <u>Structural Acceptance Criteria</u> "For the loading combinations referenced in the first paragraph of Subsection II.3 of this SRP section, the allowable limits that constitute the acceptance criteria are referenced in Subsection II.5 of SRP Section 3.8.1 for the containment foundation and in Subsection II.5 SRP Section 3.8.4 for all other foundations. In addition, for the five other load combinations in Subsection II.3 of this SRP section, the factors of safety against overturning, sliding, and floatation are acceptable if found to be in accordance with the following:" *For Load Combination C that involves the SSE term, the required safety factor for overturning and sliding is specified as 1.1.*	The additional SRP acceptance criteria for Load Combination C and its associated required minimum safety factor thresholds for overturning and sliding to qualify foundations for OWST's for SSE event is not explicitly mentioned in FSARU Sections 3.7.2, 3.8.3, and 3.8.4. However, per Section C.3.2.7.3 of SSER 18 regarding seismic qualification of foundations for RWSTs, the factor of safety against overturning and sliding is 1.60 based on DCP qualification work. This safety factor for RWST foundations exceeds the minimum SRP acceptance criteria of 1.1 for overturning and sliding. Per Section 4.3.5.1 of DCM T-28, it is specified that foundations were checked for overturning and sliding associated with HE.

SRP 3.9.1	**Special Topics for Mechanical Components – Mechanical Equipment (Westinghouse) - Fuel Assembly**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3 - To meet the requirements of GDCs 1, 14, and 15, if experimental stress analysis methods are used in lieu of analytical methods for any seismic Category I Code or non-Code items, the section of the SAR addressing the experimental stress analysis methods is acceptable if the information meets the provisions of Appendix II to ASME Code, Section III, Division 1 and, as in the case of analytical methods, if the information is sufficiently detailed to show the design meeting the provisions of the Code-required "Design Specifications."	No additional experimental stress analysis methods are used in-lieu of analytical methods for seismic SSE load condition.

<table>
<tr><td>SRP 3.9.1</td><td>Special Topics for Mechanical Components - Mechanical Equipment (Westinghouse) - Pressurizer</td></tr>
<tr><th>SRP Acceptance Criteria</th><th>DCPP Design/Licensing Basis</th></tr>
<tr><td rowspan="5">II.2. To meet the requirements of 10 CFR Part 50, a list of computer programs to be used in dynamic and static analyses to determine the structural and functional integrity of seismic Category I Code and non-Code items and the analyses to determine stresses should be provided. For each program the following information should be provided to demonstrate applicability and validity:

II.2.A Author, source, dated version, and facility.

II.2.B A description and the extent and limitation of its application.</td><td>Many computer programs are listed in the Westinghouse AOR. The programs are listed below.

Recently, steam generators were replaced; however, that did not have a bearing on pressurizer seismic analysis. The programs listed below are based on the seismic analysis from the 1970s and 1980s era.</td></tr>
<tr><td>SEAL-SHELL-2
C.M. Friedrich, "Seal-Shell-2, A Computer Program for the Stress Analysis of a Thick Shell of Revolution with Axisymmetric Pressures, Temperatures, and Distributed Loads," WAPD-TM-398, Addendum II, Bettis Atomic Power Laboratory, Pittsburgh, Pennsylvania, 1963.

Description: Finite element program of 2-D axisymmetric shell analysis.</td></tr>
<tr><td>TIGER:
D.L. Briggs, "Tiger, Temperatures from Internal Generation Rates," KAPL-M-EC-29, Knowles Atomic Power Laboratory, Schenectady, New York, 1963.

Description: Thermal analysis program (with heat generation).</td></tr>
<tr><td>TIGER-P
W.A. Rinne, "Tiger-P, Temperatures from Internal Generation Rates with Provision for Plotting Thermal Output," WTD-ED (SA-70-006, Tampa, Florida, 1970).</td></tr>
<tr><td>SHAKE
Smith, Peter G., "Computer Program SHAKE,"
WTD-SM-74-027, Westinghouse Electric Corp., Tampa Division, Tampa, Florida, April 1974.

Description: Modal analysis program.</td></tr>
</table>

SRP 3.9.1	Special Topics for Mechanical Components - Mechanical Equipment (Westinghouse) - Pressurizer
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
	"Source Listing with Test Case," Computer Programs SHAKE-SHAPE-RESAN, Microfiche TFTES97 (07/16/74), Engineering Library, Westinghouse Electric Corp., Tampa Division, Tampa, Florida
	SHAPE Smith, Peter G., "Computer Program SHAPE," WTD-SM-74-033, Westinghouse Electric Corp., Tampa Division, Tampa, Florida, May 1974. Description: Mode shape plot program.
	RESAN Smith, Peter G., "Computer Program RESAN," WTD-SM-74-034, Westinghouse Electric Corp., Tampa Division, Tampa, Florida, May 1974. Description: Applies response spectrum method to determine maximum response.
	SSAP "Source Listing with Test Case," Computer Program SSAP, Microfiche TFSSA98 (07/17/74), Engineering Library, Westinghouse Electric Corp., Tampa Division, Tampa, Florida Smith, Peter G., "User's Guide to Computer Program SSAP," WTD-ED(SA)-72-023, Westinghouse Electric Corp., Tampa Division, Tampa, Florida, April 1972. Description: Linear elastic static analysis using beam elements and other elastic elements (derived from SAP). Harrell, David L., "Verification of the SSAP Computer Program," WTD-SM-74-051, Westinghouse Electric Corp., Tampa Division, Tampa, Florida, June 1974.

SRP 3.9.1	Special Topics for Mechanical Components - Mechanical Equipment (Westinghouse) - Pressurizer
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
	SAP Wilson, Edward L., "SAP A General Structural Analysis Program," Report Number SESM-70-20, Structural Engineering Laboratory, University of California, Berkeley, California, September 1970.
	PVAP "Source Listing with Test Case," Computer Program PVAP, Microfiche TFPVA89 (07/22/74), Engineering Library, Westinghouse Electric Corp., Tampa Division, Tampa, Florida Smith, Peter G., "Computer Program PVAP: Vibration Analysis of Plates," WTD-ED(SA)-70-021, Westinghouse Electric Corp., Tampa Division, Tampa, Florida, June 1970. Description: Determines frequencies and mode shapes for elastic plate structures
	SAPIV "Bathe, K.J., Wilson, E.L., and Peterson, F.E., "SAPIV A Structural Analysis Program for Static and Dynamic Response of Linear Systems," Report Number EERC-73-11, Earthquake Engineering Research Center, University of California, Berkeley, California, June 1973. Description: Provides static and dynamic analysis for linear systems. "Source Listing with Test Case," Computer Program SAP4, Microfiche TFSAP07 (07/16/74), Engineering Library, Westinghouse Electric Corp., Tampa Division, Tampa, Florida Sidhu, H.S., "Training and Reference Manual for Solid SAP," Analytical and Technical Services, Inc., P. O. Box 672, Barrington, Illinois, 60010, 1973.

SRP 3.9.1	**Special Topics for Mechanical Components - Mechanical Equipment (Westinghouse) - Pressurizer**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
	PSAP Smith, Peter P., "Computer Program PSAP," WTD-SM-74-036, Westinghouse Electric Corp., Tampa Division, Tampa, Florida, May 1974. Description: Provides post processing for SAP IV results.
	WHEAT "Transient and Steady State Heat Conduction by the Finite Element Method (WHEAT)," WTD-ED(SA)-70-044, 1970. Description: Finite Element Method heat conduction program

SRP 3.9.1	Special Topics for Mechanical Components - Mechanical Equipment (Westinghouse) - Pressurizer
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C - The computer program solutions to a series of test problems demonstrated to be substantially similar to solutions obtained from any one of sources (i) to (iv) and source (v): (i) Hand calculations (ii) Analytical results published in relevant engineering literature (iii) Acceptable experimental results (iv) Results from a similar program within acceptable margins (v) The benchmark problems prescribed in NUREG/CR-1677, "Piping Benchmark Problems," Vols. I and II.	Not listed for every program in the AOR. For some programs, the "source" listing (preceding section) indicates a test case or verification is included in the documentation.
II.4. - To meet the requirements of GDCs 1, 14, and 15, when Service Level D limits are specified by the applicant for Code Class 1 and core support components and for supports, reactor internals, and other non-Code items, the methods of analysis to calculate the stresses and deformations should conform to the methods outlined in Appendix F to ASME Code, Section III, Division 1, subject to the conditions addressed in subsection III.4 of this SRP section (elastic or elastic-plastic methods).	Appendix F not used in all cases. Service Level D applies; however, some AOR documents may predate the "Level D" definition.

SRP 3.9.1	Special Topics for Mechanical Components – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - The transients used in the design and fatigue analysis of Code Class 1 components, supports, and reactor internals within the reactor coolant pressure boundary are acceptable if (1)the transient conditions selected for equipment fatigue evaluations are based upon a conservative estimate of the magnitude and frequency of the temperature and pressure conditions, and (2) the transients and consequent loads and load combinations with appropriate specified design and service limits should provide a complete basis for the design of the reactor coolant pressure boundary for all conditions and events expected over the service lifetime of the plant.	Fatigue evaluations are not applicable for faulted condition transients such as the HE.
II.2. A list of computer programs used in the dynamic and static analyses to determine the structural and functional integrity of seismic Category I Code and non-Code items and the analyses to determine stresses should be provided. For each program the following information should be provided to demonstrate applicability and validity. II.2.A. The author, source, dated version, and facility. II.2.B. A description and the extent and limitation of its application. II.2.C. The computer program solutions to a series of test problems demonstrated to be substantially similar to solutions obtained from any one of sources (i) through (iv) and source (v). (i) Hand calculations	The RCP seismic analysis was performed using a finite element dynamic model of the RCP. The ANSYS® computer program was used to compute the system response. The ANSYS computer program is a finite element program that may be used for solving several types of engineering analyses. The analysis capabilities of ANSYS include the ability to solve static structural analysis, dynamic structural analysis, and mode-frequency analysis. The response spectrum option of ANSYS mode-frequency analysis was used. The ANSYS program used for the RCP seismic AOR was authored by Swanson Analysis Systems, Inc. (October 1972). All the other information required to be provided for this SRP criterion is not documented in the AOR. Additionally, due to the timeframe in which the analysis was performed (1975), the information required by this SRP criterion could not be located, and it is not known what level of test problems were performed.

SRP 3.9.1	**Special Topics for Mechanical Components – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
(ii) Analytical results published in relevant engineering literature (iii) Acceptable experimental tests (iv) Results from a similar program within the acceptable margins (v) The benchmark problems prescribed in NUREG/CR-1677 "Piping Benchmark Problems." Vols. I and II	
II.3. Experimental stress analysis methods used in lieu of analytical methods for seismic Category I Code or non-Code items shall meet the provisions of Appendix II to ASME Code, Section III, Division 1. In the case of analytical methods, the information should be sufficiently detailed to show the design meeting the provisions of the Code-required Design Specification.	Analytical stress analysis methods were used to evaluate the DCPP RCP's rather than experimental stress analysis methods.
II.4. When service Level D limits are specified for Code Class 1 and core support components and for supports, reactor internals, and other non-Code items, the methods of analysis to calculate the stresses and deformations should conform to the methods outlined in Appendix F to ASME Code, Section III, Division 1.	The Code used in the evaluation of the DCPP RCP pressure boundary components is the ASME Boiler and Pressure Vessel Code, Section III, 1968 Edition with Addenda through Winter 1970. Appendix F to the ASME Code, Section III, Division 1 is not part of the 1968 Edition with Addenda through Winter 1970 Code and was introduced into the Code in a later edition.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - Relevant requirements of GDCs 1, 2, 4, 14, and 15 are met if vibration, thermal expansion, and dynamic effects testing are conducted during startup functional testing for specified high- and moderate-energy piping and their supports and restraints. The purpose of these tests are to confirm that the piping, components, restraints, and supports have been designed to withstand the dynamic loadings and operational transient conditions encountered during service as required by the code and to confirm that no unacceptable restraint of normal thermal motion occurs.	The seismic analysis for SSE - Hosgri is focused on the methods for dynamic analysis. This section is applicable with regards to thermal expansion and vibration during startup. There is no issue with respect to the HE.
II.2.A(i)4 - Consideration of maximum relative displacements among supports of Category I systems and components.	Relative seismic displacements or seismic anchor motions between supports on the RCL piping system are not considered in the RCL piping seismic analyses. It has been assumed that the separate support locations are sufficiently rigid with respect to each other and no significant relative displacements would be present. For other than RCL piping, the seismic anchor motion between supports is considered when the relative displacement results in greater than 1/16 inch.
II.2.A(ii) - Equivalent Static Load Method. An equivalent static load method is acceptable if: 1. There is justification that the system can be realistically represented by a simple model and the method produces conservative results in responses. Typical	The RCL piping analysis used the dynamic method.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
examples or published results for similar systems may be submitted in support of the use of the simplified method. 2. The design and simplified analysis account for the relative motion between all points of support. 3. To obtain an equivalent static load of equipment or components which can be represented by a simple model, a factor of 1.5 is applied to the peak acceleration of the applicable floor response spectrum. A factor of less than 1.5 may be used with adequate justification.	
II.2.C - Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment selected preferably should be less than 1/2 or more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if the equipment is adequately designed for the applicable loads.	The primary equipment support structures are included in the seismic analyses only as stiffness matrices. Inertial masses of the support structures are not included in the RCL piping analyses, so frequency response effects from the primary equipment supports on the RCL piping are not considered.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.D - Three Components of Earthquake Motion. Depending upon what basic methods are used in the seismic analysis (i.e., response spectra or time history method) the following two approaches are acceptable for the combination of three-dimensional earthquake effects. i. Response Spectra Method. When the response spectra method is adopted for seismic analysis, the maximum structural responses due to each of the three components of earthquake motion should be combined by taking the square root of the sum of the squares of the maximum codirectional responses caused by each of the three components of earthquake motion at a particular point of the structure or of the mathematical model. ii. Time-History Analysis Method. When the time history analysis method is employed for seismic analysis, two types of analysis are generally performed depending on the complexity of the problem. (1) To obtain maximum responses to each of the three components of the earthquake motion. (2) To obtain time history responses from each of the three components of the earthquake motion and combine them at each time step algebraically.	The seismic analyses of piping (i.e., DE, DDE, and HE) were performed using the modal response spectrum analysis method. The SRP acceptance criteria are to combine all three component responses by the SRSS method at a modal level. However, the RCL piping analyses used multiple cases of one horizontal and one vertical direction component combined by the absolute sum method. The time-history analysis method is not applicable to the RCL piping since the modal response spectrum analysis method was used.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.E - Combination of Modal Responses. SRP Section 3.7.2 and RG 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis," present criteria and guidance for modal response combination methods acceptable to the staff.	The combination of modal responses is performed using the SRSS method. The SRSS method is not used to combine three directions response. In addition the effects of closely spaced modes are not considered with the SRSS method. It was used before the issuance of RG 1.92 defining the modal combination method for closely spaced modes.
II.2.G - Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motions of the primary structure or structures at each of the support points may be quite different.	The response spectra from multiple elevations are considered in the RCL piping analyses, but it is done by creating one composite spectra from the multiple elevations and applying it to the entire model. The pieces of the response spectra were selected based on the modal response of the RCL piping and the response spectrum itself was developed from a composite of accelerations from different spectra elevations.
II.2.H - Use of Constant Vertical Static Factors. The use of constant vertical load factors as vertical response loads for the seismic design of all Category I systems, components, equipment, and their supports in lieu of a vertical seismic system dynamic analysis is acceptable only if the structure is demonstrably rigid in the vertical direction. The criterion for rigidity is that the lowest frequency in the vertical direction be more than 33 Hz.	Dynamic analysis (i.e., response spectrum analysis) was performed to evaluate the vertical seismic response. Constant vertical load factors were not used.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs: – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.I - Torsional Effects of Eccentric Masses. For Seismic Category I systems, if the torsional effect of an eccentric mass like a valve operator in a piping system is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for significance will have to be determined case by case.	No eccentric masses, such as valve operators, are on the RCL piping system. Lumped-mass models are provided from the steam generator, reactor pressure vessel, and RCP groups to be included in the RCL piping system seismic analysis. It is assumed that the provided lumped-mass models sufficiently represent the components with respect to the impact to the RCL piping system analyses.
II.2.J - Category I Buried Piping System. For category I buried piping system, the following item should be considered in the analysis: * Inertial effects due to an earthquake * Effects of static resistance of the surrounding soil on piping * Effects of local soil settlements, soil settlements, soil arching etc.	There is no buried RCL piping.
II.2.K - Interaction of Other Piping with Category I Piping. To be acceptable, each non-Category I piping system should be designed to be isolated from any Category I piping system by either a constraint or barrier or should be located remotely from the seismic Category I piping system.	RCL piping is Category I piping and is evaluated for seismic. Non-Category I piping is addressed in "Piping, non-Reactor Coolant Loop (non-RCL)" SRP 3.9.2, Subsection II.2.(K).

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3 - SRP requirements related to vibration testing, evaluations, and hydrodynamic effects of the reactor internals.	The SRP acceptance criteria are related to the vibration testing, evaluations, and hydrodynamic effects of the reactor internals. Not applicable to the RCL piping.
II.4 - SRP requirements related to vibration testing, evaluations, and hydrodynamic effects of the reactor internals.	The SRP acceptance criteria are related to the vibration testing, evaluations, and hydrodynamic effects of the reactor internals. Not applicable to the RCL piping.
II.5 - For requirements of GDCs 2, 4, 14, and 15 dynamic system analyses should confirm the structural design adequacy of the reactor internals and the reactor coolant piping (unbroken loops) to withstand the dynamic loadings of the most severe LOCA in combination with the SSE. Mathematical models used for dynamic system analysis for LOCAs in combination with SSE effects should include the following:	DCPP criteria combines the LOCA loading with Hosgri loading. The adequacy of the reactor coolant piping to withstand LOCA loading in combination with Hosgri is documented in DCPP's Corrective Action Program, reference SAP Notifications (SAPN) 50403189 and 50403377.
II.5.D - The effects of flow upon the mass and flexibility properties of the system should be addressed.	Fluid flow does not significantly affect the seismic analyses. For the RCL piping LOCA analyses, the effects of flow are considered through the use of time-history RCL piping hydraulic forcing functions.
II.6 - SRP acceptance criteria related to correlation of tests and analyses of the reactor internals.	The SRP acceptance criteria are related to the reactor internals. Not applicable to the RCL piping.
II.7 - SRP acceptance criteria related to equipment testing.	The SRP acceptance criteria are related to equipment testing. Not applicable to the seismic analysis of the RCL piping.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs. – Piping, non-Reactor Coolant Loop (non-RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - Relevant requirements of GDCs 1, 2, 4, 14, and 15 are met if vibration, thermal expansion, and dynamic effects testing are conducted during startup functional testing for specified high- and moderate-energy piping and their supports and restraints. The purpose of these tests are to confirm that the piping, components, restraints, and supports have been designed to withstand the dynamic loadings and operational transient conditions encountered during service as required by the code and to confirm that no unacceptable restraint of normal thermal motion occurs.	Not applicable because the seismic analysis for the HE is focused on the methods for dynamic analysis. This section applies to thermal expansion and vibration during startup.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs. – Piping, non-Reactor Coolant Loop (non-RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.A(ii) - Equivalent Static Load Method. An equivalent static load method is acceptable if: 1. There is justification that the system can be realistically represented by a simple model and the method produces conservative results in responses. Typical examples or published results for similar systems may be submitted in support of the use of the simplified method. 2. The design and simplified analysis account for the relative motion between all points of support. 3. To obtain an equivalent static load of equipment or components which can be represented by a simple model, a factor of 1.5 is applied to the peak acceleration of the applicable floor response spectrum. A factor of less than 1.5 may be used with adequate justification.	The simplified analysis of small bore piping (nominal pipe size of 2 inch or less) applies peak acceleration of the applicable building response spectra envelope (Reference DCM M-40, Section 2.1).

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.D - Three Components of Earthquake Motion. Depending upon what basic methods are used in the seismic analysis (i.e., response spectra or time history method) the following two approaches are acceptable for the combination of three-dimensional earthquake effects. i. Response Spectra Method. When the response spectra method is adopted for seismic analysis, the maximum structural responses due to each of the three components of earthquake motion should be combined by taking the square root of the sum of the squares of the maximum codirectional responses caused by each of the three components of earthquake motion at a particular point of the structure or of the mathematical model. ii. Time History Analysis Method. When the time history analysis method is employed for seismic analysis, two types of analysis are generally performed depending on the complexity of the problem. (1) To obtain maximum responses to each of the three components of the earthquake motion. (2) To obtain time history responses from each of the three components of the earthquake motion and combine them at each time step algebraically.	The seismic analyses of piping were performed using the modal response spectrum analysis method. The piping analysis has used one horizontal direction and vertical direction component and combined by absolute sum method. Similarly, the other perpendicular horizontal direction and vertical direction component and combined them using the absolute sum method. For the reactor head vent piping and reactor vessel level instrumentation system (RVLIS) piping, which are an integral part of the integrated head assembly, the response for each mode is calculated for a particular direction earthquake (e.g., X). Then those modes were combined by SRSS method. Then the same calculation is performed for remaining two other directions. The result of X direction is combined with Y direction using absolute sum. Similarly, the result of Z is combined with Y direction using absolute sum. The final result is obtained by selecting the maximum of X+Y and Y+Z.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.E - Combination of Modal Responses. SRP Section 3.7.2 and RG 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis," present criteria and guidance for modal response combination methods acceptable to the staff.	The combination of modal responses is performed using the SRSS method. The effects of closely spaced modes are not considered with the SRSS method.
II.2.G - Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motions of the primary structure or structures at each of the support points may be quite different.	At DCPP, the SSRS method has been used to combine the inertia analysis with the relative movements of the structure.
II. 2.J - Category I Buried Piping System. For category I buried piping system, the following item should be considered in the analysis: * Inertial effects due to an earthquake * Effects of static resistance of the surrounding soil on piping * Effects of local soil settlements, soil settlements, soil arching etc.	See the response from SRP 3.7.3, Subsection II, Item 12, "Buried piping, conduits, and Tunnels."

SRP 3.9.2	Dynamic Testing and Analysis of SSCs. – Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3 - To meet the requirement of GDCs 1 and 4, the following guidelines, in addition to RG 1.20 " Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing", apply to the analytical solutions to predict vibrations of reactor internals for prototype plants.	Not applicable to the non-RCL piping.
II.4 - For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20, including vibration prediction, vibration monitoring, adverse flow effects (flow-induced acoustic and structural resonances, data reduction, bias errors and uncertainty analysis, and walkdown and surface inspections.	Not applicable to the non-RCL piping.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs. – Piping, non-Reactor Coolant Loop (non-RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.5 - For requirements of GDCs 2, 4, 14, and 15 dynamic system analyses should confirm the structural design adequacy of the reactor internals and the reactor coolant piping (unbroken loops) to withstand the dynamic loadings of the most severe LOCA in combination with the SSE. Where a substantial separation between the forcing frequencies of the LOCA (or SSE) loading and the natural frequencies of the internal structures can be demonstrated, the analysis may treat the loadings statically.	The response for RCL system is provided in the SRP comparison table for "Piping, Reactor Coolant Loop (RCL)" SRP 3.9.2, Subsection II.5.
II.6 - SRP acceptance criteria related to correlation of tests and analyses of the reactor internals.	Not applicable to the non-RCL piping.
II.7 - SRP acceptance criteria related to equipment testing.	Not applicable to the non-RCL piping.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Pipe Supports, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.A – Seismic Analysis Methods	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.B – Determination of Number of Earthquake Cycles.	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.D – Three Components of Earthquake Motion	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.E – Combination of Modal Responses	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.F – Analytical Procedures for Piping Systems	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.G – Multiply-Supported Equipment and Components With Distinct Inputs	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.H – Use of Constant Vertical Static Factors	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.I – Torsional Effects of Eccentric Masses	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.J – Category I Buried Piping Systems	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.L – Criteria Used for Damping	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs – Pipe Supports, non-Reactor Coolant Loop (non-RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3 – To meet the requirements of GDCs 1 and 4, the following guidelines, in addition to RG 1.20 "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing", apply to the analytical solutions to predict vibrations of reactor internals for prototype plants.	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.4 – For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20, including vibration prediction, vibration monitoring, adverse flow effects (flow-induced acoustic and structural resonances, data reduction, bias errors and uncertainty analysis, and walkdown and surface inspections.	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.5 – For requirements of GDCs 2, 4, 14, and 15 dynamic system analyses should confirm the structural design adequacy of the reactor internals and the reactor coolant	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs – Pipe Supports, non-Reactor Coolant Loop (non-RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
piping (unbroken loops) to withstand the dynamic loadings of the most severe LOCA in combination with the SSE. Where a substantial separation between the forcing frequencies of the LOCA (or SSE) loading and the natural frequencies of the internal structures can be demonstrated, the analysis may treat the loadings statically.	
II.6 – For requirements of GDC 1, as to the correlation of tests and analyses of reactor internals, the applicant should address the following items to ensure the adequacy and sufficiency of the test and analysis results.	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.7 – For new applications, test specifications should be in accordance with ASME OM-S/G-1990, "Standards and Guides For Operation of Nuclear Power Plants," Part 3, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant Piping Systems," and Part 7, "Requirements for Thermal Expansion Testing of Nuclear Power Plant Piping Systems."	The subjects are related to piping and not pipe supports. See SRP 3.9.2 "Piping, non-Reactor Coolant Loop (non-RCL)."

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Relevant requirements of GDCs 1, 2, 4, 14, and 15 are met if vibration, thermal expansion, and dynamic effects testing are conducted during startup functional testing for specified high- and moderate-energy piping and their supports and restraints. The purposes of these tests are to confirm that the piping, components, restraints, and supports have been designed to withstand the dynamic loadings and operational transient conditions encountered during service as required by the code and to confirm that no unacceptable restraint of normal thermal motion occurs. An acceptable test program to confirm the adequacy of the designs should include the following:	Not applicable to the fuel assembly SSE qualification.
II.1.A. A list of systems to be monitored.	Not applicable to the fuel assembly SSE qualification.
II.1.B. A list of the flow modes of operation and transients like pump trips, valve closures, etc. to which the components will be subjected during the test. (For additional guidance see RG 1.68). For example, the transients of the reactor coolant system heatup tests should include but not necessarily be limited to: (i) Reactor coolant pump start. (ii) Reactor coolant pump trip. (iii) Operation of pressure-relieving valves. (iv) Closure of a turbine stop valve.	
II.1.D. A list of snubbers on systems which experience sufficient thermal movement to measure snubber travel from cold to hot position.	
II.1.E. A description of the thermal motion monitoring program (i.e., verification of snubber movement,	

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
adequate clearances and gaps, including acceptance criteria and how motion will be measured).	
II.1.F. If vibration is noted beyond the acceptance levels set by the criteria of Item II.1.C above, corrective restraints should be designed, incorporated in the piping system analysis, and installed. If, during the test, piping system restraints are determined to be inadequate or are damaged, corrective restraints should be installed and another test should determine whether the vibrations have been reduced to an acceptable level. If no snubber piston travel is measured at those stations indicated in Item II.1.D of the acceptance criteria, the corrective action to be taken to ensure that the snubber is operable should be described.	
II.2.A.(ii) Equivalent Static Load Method. An equivalent static load method is acceptable if: (1) There is justification that the system can be realistically represented by a simple model and the method produces conservative results in responses. Typical examples or published results for similar systems may be submitted in support of the use of the simplified method. (2) The design and simplified analysis account for the relative motion between all points of support. (3) To obtain an equivalent static load of equipment or components which can be represented by a simple model, a factor of 1.5 is applied to the peak acceleration of the applicable floor response spectrum. A factor of less than 1.5 may be used with	A direct integration time-history method is used.

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
adequate justification. In addition, for equipment which can be modeled adequately as a one-degree-of-freedom system, the use of a static load equivalent to the peak of the floor response spectra is acceptable. For piping supported at only two points, the use of a static load equivalent to the peak of the floor response spectra is also acceptable.	
II.2.D.(i) Response Spectra Method. When the response spectra method is adopted for seismic analysis, the maximum structural responses due to each of the three components of earthquake motion should be combined by taking the square root of the sum of the squares of the maximum codirectional responses caused by each of the three components of earthquake motion at a particular point of the structure or of the mathematical model.	A direct integration time-history method is used.
II.2.E. Combination of Modal Responses. SRP Section 3.7.2 and RG 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis," present criteria and guidance for modal response combination methods acceptable to the staff.	The fuel assembly seismic analysis is based on the direct integration time-history method. No modal responses are generated for the core plates.
II.2.F. Analytical Procedures for Piping Systems. The seismic analysis of Category I piping may use either a dynamic analysis or an equivalent static load method. The acceptance criteria for the dynamic analysis or equivalent static load methods are described in subsection II.2.A of this SRP section.	Not applicable to the fuel assembly.
II.2.G. Multiply-Supported Equipment and Components With Distinct Inputs. Equipment and components in	Not applicable to the fuel assembly.

SRP 3.9.2.	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
some cases are supported at several points by either a single structure or two separate structures. The motions of the primary structure or structures at each of the support points may be quite different. A conservative and acceptable approach for equipment items supported at two or more locations is to use an upper-bound envelope of all the individual response spectra for these locations to calculate maximum inertial responses of multiply-supported items. In addition, the relative displacements at the support points should be considered. Conventional static analysis procedures are acceptable for this purpose. The maximum relative support displacements can be obtained from the structural response calculations or, as a conservative approximation, from the floor response spectra. For the latter option, the maximum displacement of each support (Sd) is predicted by: where Sa is the spectral acceleration in "g's" at the high frequency end of the spectrum curve (which, in turn, is equal to the maximum floor acceleration), g is the gravity constant, and ω is the fundamental frequency of the primary support structure in radians per second. The support displacements can then be imposed on the supported item in the most unfavorable combination. The responses due to the inertia effect and relative displacements should be combined by the absolute sum method. In the case of multiple supports located in a single structure, an alternate acceptable method using the floor response spectra determines dynamic responses due to the worst single floor response spectrum selected from a set of floor response spectra at various floors and applied identically to all the floors	

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
provided there is no significant shift in frequencies of the spectra peaks. In addition, the support displacements should be imposed on the supported item in the most unfavorable combination by static analysis procedures. Further criteria and methods for the evaluation of multiple support arrangement analysis issues are described in SRP Sections 3.7.2 and 3.7.3. These methods can result in overestimation of seismic responses. Acceptable alternate response spectrum analysis methods that provide more realistic estimation of seismic responses are discussed in subsection II.9 of SRP Section 3.7.3. In lieu of the response spectrum approach, time histories of support motions may be used as excitations to the systems. Because of the increased analytical effort compared to the response spectrum techniques, usually only a major equipment system would warrant a time history approach. The time history approach does, however, provide more realistic results in some cases as compared to the response spectrum envelope method for multiply-supported systems.	
II.2.I. Torsional Effects of Eccentric Masses. For Seismic Category I systems, if the torsional effect of an eccentric mass like a valve operator in a piping system is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for significance will have to be determined case by case.	There are no torsional effects of eccentric masses for the fuel assembly.
II.2.J. Category I Buried Piping Systems. For Category I buried piping systems, the following items should be	Not applicable to the fuel assembly.

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
considered in the analysis: (i) The inertial effects due to an earthquake upon buried piping systems should be adequately considered in the analysis. Use of the procedures described in the references is acceptable. (ii) The effects of static resistance of the surrounding soil on piping deformations or displacements, differential movements of piping anchors, bent geometry and curvature changes, etc., should be adequately considered. Use of the procedures described in the references is acceptable. (iii) When applicable, the effects of local soil settlements, soil arching, etc., also should be considered in the analysis.	
II.2.K. Interaction of Other Piping with Category I Piping. To be acceptable, each non-Category I piping system should be designed to be isolated from any Category I piping system by either a constraint or barrier or should be located remotely from the seismic Category I piping system. If isolation of the Category I piping system is not feasible or practical, adjacent non-Category I piping should be analyzed according to the same seismic criteria applicable to the Category I piping system. For non-Category I piping systems attached to Category I piping systems, the dynamic effects of the non-Category I piping should be simulated in the modeling of the Category I piping. The attached non-Category I piping, up to the first anchor beyond the interface, also should be designed not to cause a failure of the Category I piping during an earthquake of SSE intensity.	Not applicable to the fuel assembly.

SRP 3.9.2.	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.A. The results of vibration & stress calculations should consist of the following:	Not applicable to the fuel assembly.
II.3.A.(i) Dynamic responses to operating transients at critical locations of the internal structures should be determined and, in particular, at the locations where vibration sensors will be mounted on the reactor internals. For each location, the maximum response, the modal contribution to the total response, (in case of cyclic or resonant behavior), and the response causing the maximum stress amplitude should be calculated.	
II.3.A.(ii) - The damping factors for different modes should be properly selected and substantiated. In prior submissions, utilities have cited NRC damping guidance for very low frequency seismic analyses as justification for high damping factors for mid-to-high frequency analyses. RG 1.20 corrects this guidance and requires that damping factors used in structural dynamic modeling be based on mid- to high-frequency measurements or rigorous analyses conducted on structures typical of the reactor internal structure modeled.	
II.3.B.(ii).(1).(d) - Whether the size of the scale model is sufficiently large to allow investigation of small relevant details in geometry (e.g., branch line openings).	A full-size scale model was tested.
II.3.B.(ii).(1).(e) - Validation of the SMT results by measurements in nuclear power plants.	A full-size scale model was tested.

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B.(ii).(2) CFD - If CFD simulations are used to develop unsteady forcing functions, the following areas should be considered.	No CFD simulations were used for the fuel assembly models.
II.3.B.(ii).(2).(a) - Include acoustic/vibration coupling to simulate enhancement of flow instabilities (if any).	No CFD simulations were used to develop unsteady forcing functions.
II.3.B.(ii).(2).(b) Grid size sensitivity tests.	
II.3.B.(ii).(2).(c) The Courant number requirement should be met.	
II.3.B.(ii).(2).(d) There should be unsteady simulations using Large Eddy Simulation (LES) or Direct Numerical Simulation (DNS) at high Reynolds number flow and including compressibility effects to model any coupling of the flow with the acoustic waves in the fluid (self-excitation or lock-in effects).	
II.3.B.(ii).(2).(e) Real gas simulation should be used (i.e., use state equation of steam as real gas).	
II.3.B.(ii).(2).(f) The simulation procedures should be validated on similar (i.e., complex and high Reynolds number) flow situations.	
II.3.B.(ii).(3) - Acoustic Modeling of Steam System: If an acoustic model of the steam system (the steam within the MSLs and the RPV) computes fluctuating pressures within the RPV and on BWR steam dryers inferred from measurements of fluctuating pressures within the MSLs connected to the RPV, the following areas should be considered.	No acoustic modeling of steam system is computed for the fuel assembly at SSE load conditions.

SRP 3.9.2.	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B.(ii).(3).(a) - There should be at least two measurement locations on each MSL in a BWR; however, three measurement locations on the MSLs improve input data to an acoustic model, particularly if the locations are spaced logarithmically, reducing uncertainty in describing the waves coming from and going into the RPV. With two or three measurement locations, there should be no acoustic sources between the measurement locations, unless justified.	Not applicable to pressurized water reactors (PWR).
II.3.B.(ii).(3).(b) - Strain gages (at least four gages circumferentially oriented and placed at equal distance along the circumference) may be used to relate the hoop strain in the MSL to the internal pressure. Strain gages should be calibrated according to the MSL dimensions (diameter, thickness, and static pressure). Alternatively, pressure measurements made with transducers flush-mounted against the MSL internal surface may be used. The effects of flow turbulence on any direct pressure measurements should be considered, however.	No acoustic modeling of steam system is computed for the fuel assembly at SSE load conditions.
II.3.B.(ii).(3).(c) - The speed of sound in any acoustic models should not be changed from plant to plant but rather be a function of temperature and steam quality.	
II.3.B.(ii).(3).(d) - Reflection coefficients at any boundary between steam and water should be based on rigorous modeling or on direct measurement. The uncertainty of the reflection coefficients should be clearly defined.	

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3.B.(ii).(3).(e) - Any sound attenuation coefficients should be a function of steam quality (variable between the chimney and reactor dome) rather than constant throughout a steam volume (like the volume within the RPV).	
II.3.B.(ii).(3).(f) - Once validated, the same speed of sound, attenuation coefficient, and reflection coefficient should be used in other plants; however, different flow conditions (temperature, pressure, quality factor) may require adjustments of these parameters.	
II.3.B.(ii).(4) Response-deduction method: based on a derivation of response characteristics from plant or SMT data, forcing functions should be formulated; however, as such functions may not be unique and are also expected to depend on material properties and loss factors, the computational procedures and the basis for selection of the representative forcing functions should be described together with all bias errors and uncertainties (see subsection II.3.B.(ii)(1) of this SRP section, "Scale Model Tests," for guidelines on inferring forcing functions from plant or scale model testing data). Alternately, the applicant/licensee may use other approaches to formulate the forcing function. However, sufficient supporting justification should be provided to demonstrate that the selected approach is technically sound and realistically predicts the forcing function. In addition, an assessment of bias errors and uncertainties should be provided.	No response-deduction method is computed for the fuel assembly at SSE load condition.
II.3.C.(iii) If the forcing functions are not predetermined,	The LOCA forcing functions of the reactor internal model were predetermined by

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
either a special analysis of response signals measured from reactor internals of similar design may predict amplitude and modal contributions or parameter studies useful for extrapolating the results from tests of internals or components of similar designs based on composite statistics may be used. The latter approach should be used only when the expectation that flow-induced vibration or acoustic resonance will not occur for the operation conditions covering the extrapolated range of the forcing functions is shown beyond doubt.	Westinghouse's LOCA group.
II.4. For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20, including vibration prediction, vibration monitoring, adverse flow effects (flow-induced acoustic and structural resonances, data reduction, bias errors and uncertainty analysis, and walkdown and surface inspections. The test program to demonstrate design adequacy of the reactor internals should include, but not necessarily be limited to, the following:	Not applicable to the fuel assembly SSE qualification.
II.4.A. The vibration testing should be conducted with the fuel elements in the core or with dummy elements with equivalent dynamic effects and flow characteristics.	This acceptance criterion does not apply to the analysis of the fuel assembly SSE qualification.

SRP 3.9.2.	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Testing without fuel elements in the core may be acceptable if testing in this mode is demonstrably conservative.	
II.4.C. Testing to evaluate potential adverse flow effects on reactor internal components should include the steam dryer and MSL valves. The instrumentation directly mounted on the steam dryer should include pressure sensors, strain gages, and accelerometers. The MSLs also should be instrumented to collect data to determine steam pressure fluctuations to identify the presence of flow-excited acoustic resonances and to allow the analysis of those pressure fluctuations to calculate MSL valve loading and vibration and steam dryer loading and stress. Accelerometers should be mounted on the main steam valves to record the presence and the level of any flow-excited acoustic resonance or vibration.	This acceptance criterion does not apply to the analysis of the fuel assembly SSE qualification.
II.4.E. Testing should include all of the flow modes of normal operation and upset transients. The proposed set of flow modes is acceptable if it provides a conservative basis for determining the dynamic response of the tested components and is reviewed on request. The power ascension program for startup testing should include specific hold points with sufficiently long duration to allow data recording and reduction, comparisons with predetermined limit loading, and inspections and walkdowns for steam, feedwater, and condensate systems. The test program also should include details of actions to be taken if acceptance criteria are not satisfied. Further information on test procedure is addressed in RG 1.20.	No fuel assembly testing is performed for upset transient flow conditions. Not applicable to fuel assembly SSE qualification.

SRP 3.9.2.	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4.H. The applicant/licensee is expected to provide a summary evaluation of plant startup and power ascension to the staff within 90 days of plant startup. If full licensed power is not achieved in that time period, the applicant/licensee is expected to provide a supplemental report within 30 days after achieving full licensed power.	This request is for plant startup and power ascension, and does not directly apply to the fuel assembly analyses SSE qualification.
II.5.C. Any system structural partitioning and directional decoupling in the dynamic system modeling should be justified.	There is no structural partitioning or directional decoupling in the fuel dynamic system modeling.
II.6.C. Comparison of the response amplitude time variation and the frequency content from test and analysis for verification of the postulated forcing function.	Not applicable to the reactor internal and fuel assembly SSE qualification.
II.6.D. Comparison of the measured amplitudes, frequencies, and time variations of loads with those predicted by test-analysis combination method for validation of the predicted forcing function.	Not applicable to the reactor internal and fuel assembly SSE qualification.
II.6.G. Comparison of measurements and predictions of any adverse flow phenomena (e.g., flow-excited acoustic and/or structural resonances) for validation of the model(s) predicting the loading induced by the phenomena.	No flow-excited acoustic and/or structural resonance is induced by the SSE load.
II.7. For new applications, test specifications should be in accordance with ASME OM-S/G-1990, "Standards and Guides For Operation of Nuclear Power Plants," Part 3, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant	Not applicable to the fuel assembly.

SRP 3.9.2.	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Fuel Assembly**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Piping Systems," and Part 7, "Requirements for Thermal Expansion Testing of Nuclear Power Plant Piping Systems."	

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Pressurizer
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1. Relevant requirements of GDCs 1, 2, 4, 14, and 15 are met if vibration, thermal expansion, and dynamic effects testing are conducted during startup functional testing for specified high- and moderate-energy piping and their supports and restraints. The purposes of these tests are to confirm that the piping, components, restraints, and supports have been designed to withstand the dynamic loadings and operational transient conditions encountered during service as required by the code and to confirm that no unacceptable restraint of normal thermal motion occurs. An acceptable test program to confirm the adequacy of the designs should include the following:	Not applicable to HE seismic evaluation of the pressurizer.
II.1.A. - A list of systems to be monitored.	
II.1.B. - A list of the flow modes of operation and transients like pump trips, valve closures, etc. to which the components will be subjected during the test. (For additional guidance see RG 1.68). For example, the transients of the reactor coolant system heatup tests should include but not necessarily be limited to: (i) Reactor coolant pump start. (ii) Reactor coolant pump trip. (iii) Operation of pressure-relieving valves. (iv) Closure of a turbine stop valve.	
II.2.B - Determination of Number of Earthquake Cycles. The number of earthquake cycles during one seismic event, the maximum number of cycles for which applicable systems and components are designed, and the criteria and the applicant's procedures to establish these parameters are reviewed by the staff in	Not applicable to HE seismic evaluation of the pressurizer.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Pressurizer
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
accordance with the guidance of SRP Section 3.7.3.	
II.2.F - Analytical Procedures for Piping Systems. The seismic analysis of Category I piping may use either a dynamic analysis or an equivalent static load method.	Not applicable for pressurizer.
II.2.H - Use of Constant Vertical Static Factors. The use of constant vertical load factors as vertical response loads for the seismic design of all Category I systems, components, equipment, and their supports in lieu of a vertical seismic system dynamic analysis is acceptable only if the structure is demonstrably rigid in the vertical direction. The criterion for rigidity is that the lowest frequency in the vertical direction be more than 33 Hz.	The modeling and load analyses were carried out with use of vertical spectra as opposed to use of a constant vertical seismic load factor.
II.2.I - Torsional Effects of Eccentric Masses. For Seismic Category I systems, if the torsional effect of an eccentric mass like a valve operator in a piping system is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for significance will have to be determined case by case.	Not applicable for pressurizer.
II.2.J - Category 1 Buried Piping System	Not applicable for pressurizer.
II.2.K - Interaction of Other Piping with Category I Piping	Not applicable for pressurizer.
II.2.L - Criteria Used for Damping. RG 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," provides acceptable values which may be used. The methods for analysis of damping should be consistent with those described in SRP Section 3.7.2.	For Westinghouse qualified RCS (i.e., reactor pressure vessel, steam generators and Pressurizer), a damping value of 4 % was used rather than 3 % as shown in RG 1.61 (SSER 7, Section 3.9.3.2) (WCAP 7921-AR, May 1974).

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Pressurizer
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3 - To meet the requirements of GDCs 1 and 4, the following guidelines, in addition to RG 1.20 "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and initial Startup Testing", apply to the analysis solutions to predict vibration of reactor internals for prototype plants.	Not applicable for Pressurizer.
II.4. - For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20,	Not applicable for pressurizer.
II.5 - For requirements of GDCs 2, 4, 14, and 15 dynamic system analyses should confirm the structural design adequacy of the reactor internals and the reactor coolant piping (unbroken loops) to withstand the dynamic loadings of the most severe LOCA in combination with the SSE.	Not applicable for pressurizer.
II.6 - For requirements of GDC 1, as to the correlation of tests and analyses of reactor internals, the applicant should address the following items to ensure the adequacy and sufficiency of the test and analysis results.	Not applicable for pressurizer.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Pressurizer
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.6.A - Comparison of the measured response frequencies with the analytically obtained natural frequencies of the reactor internals for validation of the mathematical models used in the analysis. Comparison of the measured and predicted damping factors as a function of natural frequencies for validation of the damping assumed in the analysis.	
II.6.B. - Comparison of the analytically obtained mode shapes with the shape of measured motion for identification of the modal combination or verification of a specific mode.	
II.6.C. - Comparison of the response amplitude time variation and the frequency content from test and analysis for verification of the postulated forcing function.	
II.6.D. - Comparison of the measured amplitudes, frequencies, and time variations of loads with those predicted by test-analysis combination method for validation of the predicted forcing function.	
II.6.E. - Comparison of the maximum responses from test and analysis for verification of stress levels.	
II.6.F. - Comparison of the mathematical model for dynamic system analysis under operational flow transients and under combined LOCA and SSE loadings for similarities.	
II.6.G. - Comparison of measurements and predictions of any adverse flow phenomena (e.g., flow-excited	

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Pressurizer**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
acoustic and/or structural resonances) for validation of the model(s) predicting the loading induced by the phenomena.	
II.7: - For new applications, test specifications should be in accordance with ASME OM-S/G-1990, "Standards and Guides For Operation of Nuclear Power Plants," Part 3, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant Piping Systems," and Part 7, "Requirements for Thermal Expansion Testing of Nuclear Power Plant Piping Systems."	Not applicable for pressurizer.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - Relevant requirements of GDCs 1, 2, 4, 14, and 15 are met if vibration, thermal expansion, and dynamic effects testing are conducted during startup functional testing for specified high- and moderate-energy piping and their supports and restraints. The purposes of these tests are to confirm that the piping, components, restraints, and supports have been designed to withstand the dynamic loadings and operational transient conditions encountered during service as required by the code and to confirm that no unacceptable restraint of normal thermal motion occurs.	Not applicable to RCP seismic analysis.
II.2.A.(i).(4) - Maximum relative displacements among supports of Category I systems and components is considered.	Relative seismic displacements between supports are not considered for the RCP seismic analysis. The RCP supports are represented in the RCP seismic analysis model as a single stiffness matrix, which is reported in the RCP design specification. It is assumed that support locations are sufficiently rigid with respect to one another that no significant relative displacements would be present.
II.2.A.(ii).(1) through (3) - "Equivalent Static Analysis":	Dynamic analysis was performed.
II.2.B - The number of earthquake cycles during 1 seismic event, the maximum number of cycles for which applicable systems and components are designed, and the criteria and the applicant's procedures to establish these parameters are reviewed by the staff in accordance with guidance of SRP Section 3.7.3.	HE is considered a faulted condition earthquake event for which no fatigue evaluation would be required.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C - The fundamental frequencies of components and equipment selected preferably should be less than ½ or more than twice the dominant frequencies of the support structure to avoid resonance. Use of equipment frequencies within this range is acceptable if the equipment is adequately designed for the applicable loads.	The RCP is designed for the applicable loads defined in the design specification and the HE faulted load condition.
II.2.D.(i) - When the response spectra method is adopted for seismic analysis, the maximum structural responses due to each of the 3 components of earthquake motion should be combined by taking the SRSS of the maximum codirectional responses caused by each of the 3 components of earthquake motion at a particular point of the structure or the mathematical model.	The RCP seismic analysis combines 2-dimensional earthquake effects and does not combine 3-dimensional earthquake effects. Additionally, the RCP seismic AOR does not combine the maximum co-directional responses caused by the components of earthquake motion. Instead, the RCP seismic analysis first adds the greater absolute value of the X and Z horizontal response of each mode to the absolute value of the Y vertical response of the corresponding mode [H_1+V_1, H_2+V_2, H_n+V_n], then combines the resulting values using the SRSS method: $\{(H_1+V_1)^2+(H_2+V_2)^2+\ldots(H_n+V_n)^\wedge 2\}^{1/2}$. $H_1\ldots H_n$ = absolute horizontal response for modes 1…n, $V_1\ldots V_n$ = absolute vertical response for modes 1…n
II.2.D.(ii) - Requirement is for time history analysis method.	Seismic response spectra analysis was performed.
II.2.E - Criteria and guidance acceptable to the staff for modal response combination methods are presented in SRP Section 3.7.2 and RG 1.92"Combining Modal Responses and Spatial Components in Seismic Response Analysis".	The modal response combination for the RCP seismic analysis is not in accordance with RG 1.92. The response combination for the RCP seismic analysis is as follows: Total response = $\{(H_1+V_1)^2+(H_2+V_2)^2+\ldots(H_n+V_n)^\wedge 2\}^{1/2}$. where, $H_1\ldots H_n$ = absolute horizontal response for modes 1…n, $V_1\ldots V_n$ = absolute vertical response for modes 1…n The combination method above combines the directional spatial response using a 2-dimensional absolute sum method and the modal response using the SRSS method.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.F - Requirement is for seismic analysis of Category I piping.	Not applicable to RCP seismic analysis.
II.2.G - Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motions of the primary structure or structures at each of the support points may be quite different. A conservative and acceptable approach for equipment items supported at two or more locations is to use an upper-bound envelope of all the individual response spectra for these locations to calculate the maximum inertial responses of multiply-supported items. In addition, the relative displacements at the support points should be considered.	The RCP seismic analysis does not consider different spectra as input at multiple support locations. The RCP seismic model represents the RCP supports as one stiffness matrix and applies the response spectra input to the support (i.e., stiffness matrix). It is assumed that support locations are sufficiently rigid with respect to one another, and relatively close, such that no significant differences in support motion would be present.
II.2.H - The use of constant vertical load factors such as vertical response loads for the seismic design of all Category I systems, components, equipment, and their supports in lieu of vertical seismic system dynamic analysis is acceptable only if the structure is demonstrated to be rigid in the vertical direction. The criterion for rigidity is that the lowest frequency in the vertical direction be more than 33 Hz.	A seismic response spectrum analysis was used to evaluate the vertical seismic response of the RCP.
II.2.J.(i) through (iii) - Requirement is for Category I buried piping systems.	Not applicable to the RCP seismic analysis.
II.2.K - Requirement is for the interaction of other piping with Category I piping.	Not applicable to the RCP seismic analysis.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.L - RG 1.61 "Damping Values for Seismic Design of Nuclear Power Plants," provides acceptable values which may be used. The methods for analysis of damping should be consistent with those described in SRP Section 3.7.2.	HE seismic analysis considers 4% damping. The HE damping value is different from the 3% damping value per RG 1.61 (SSER 7, Section 3.9.3.2) (WCAP 7921-AR, May 1974).
II.3 - To meet the requirements of GDCs 1 and 4, the following guidelines, in addition to RG 1.20 "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and initial Startup Testing", apply to the analysis solutions to predict vibration of reactor internals for prototype plants.	Not applicable to RCP seismic analysis.
II.4 - For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20.	Not applicable to RCP seismic analysis.
II.5 - Requirements are for reactor internals and reactor coolant piping.	Not applicable to RCP HE seismic analysis.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.6 - For requirements of GDC 1, as to the correlation of tests and analyses of reactor internals, the applicant should address the following items to ensure the adequacy and sufficiency of the test and analysis results.	Not applicable to RCP HE seismic analysis.
II.6.A - Comparison of the measured response frequencies with the analytically obtained natural frequencies of the reactor internals for validation of the mathematical models used in the analysis. Comparison of the measured and predicted damping factors as a function of natural frequencies for validation of the damping assumed in the analysis.	
II.6.B. Comparison of the analytically obtained mode shapes with the shape of measured motion for identification of the modal combination or verification of a specific mode.	
II.6.C. - Comparison of the response amplitude time variation and the frequency content from test and analysis for verification of the postulated forcing function.	
II.6.D. - Comparison of the measured amplitudes, frequencies, and time variations of loads with those predicted by test-analysis combination method for validation of the predicted forcing function.	
II.6.E. - Comparison of the maximum responses from test and analysis for verification of stress levels.	

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.6.F. - Comparison of the mathematical model for dynamic system analysis under operational flow transients and under combined LOCA and SSE loadings for similarities.	
II.6.G. - Comparison of measurements and predictions of any adverse flow phenomena (e.g., flow-excited acoustic and/or structural resonances) for validation of the model(s) predicting the loading induced by the phenomena.	
II.7 - For new applications, test specifications should be in accordance with ASME OM-S/G-1990, "Standards and Guides For Operation of Nuclear Power Plants," Part 3, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant Piping Systems," and Part 7, "Requirements for Thermal Expansion Testing of Nuclear Power Plant Piping Systems."	Not applicable to RCP seismic analysis.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Internals and Reactor Vessel**
SRP Acceptance Criteria	**DCPP Design / Licensing Basis**
II.2. A. (i).(3) - Investigation of a sufficient number of modes to ensure participation of all significant modes. The criterion for sufficiency is that the inclusion of additional modes does not result in more than a 10-percent increase in responses.	Direct integration time-history method was used.
II.2. A.(ii) – Equivalent Static Load Method	Direct integration time-history method was used.
II.2.C. - Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment selected preferably should be less than ½ or more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if the equipment is adequately designed for the applicable loads.	Direct integration time-history method was used.
II.2.E - Combination of Modal Responses. SRP Section 3.7.2 and RG 1.92,"Combining Modal Responses and Spatial Components in Seismic Response Analysis," present criteria and guidance for modal response combination methods acceptable to the staff.	Direct integration time-history method was used.
II.2 F - Analytical Procedures for Piping Systems. The seismic analysis of Category I piping may use either a dynamic analysis or an equivalent static load method.	Not applicable to reactor internals and reactor vessel.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Internals and Reactor Vessel**
SRP Acceptance Criteria	**DCPP Design / Licensing Basis**
II.2.H - The use of constant vertical load factors as vertical response loads for the seismic design of all Category I systems, components, equipment, and their supports in lieu of a vertical seismic system dynamic analysis is acceptable only if the structure is demonstrably rigid in the vertical direction. The criterion for rigidity is that the lowest frequency in the vertical direction be more than 33 Hz.	Direct integration time-history method was used.
II.2.I - Torsional Effects of Eccentric Masses. For Seismic Category I systems, if the torsional effect of an eccentric mass like a valve operator in a piping system is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for significance will have to be determined case by case.	Not applicable to reactor internals and reactor vessel.
II.2.J - Category 1 Buried Piping System	Not applicable to reactor internals and reactor vessel.
II.2.K.- Interaction of Other Piping with Category I Piping	Not applicable to reactor internals and reactor vessel.
II.3 - To meet the requirements of GDCs 1 and 4, the following guidelines, in addition to RG 1.20 "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and initial Startup Testing", apply to the analysis solutions to predict vibration of reactor internals for prototype plants.	Not applicable to the HE seismic evaluation of reactor internals and reactor vessel.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs – Mechanical Equipment (Westinghouse) - Reactor Internals and Reactor Vessel
SRP Acceptance Criteria	**DCPP Design / Licensing Basis**
II.4 - For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20,	Not applicable to the HE seismic evaluation of reactor internals and reactor vessel.
II.5.D.- The effects of flow upon the mass and flexibility properties of the system should be addressed.	The Reactor Equipment System Model (RESM) does not consider effects of flow upon the mass and flexibility properties of the system.
II.7. For new applications, test specifications should be in accordance with ASME OM-S/G-1990, "Standards and Guides For Operation of Nuclear Power Plants," Part 3, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant Piping Systems," and Part 7, "Requirements for Thermal Expansion Testing of Nuclear Power Plant Piping Systems."	Not applicable to the HE seismic evaluation of reactor internals and reactor vessel.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Steam Generator**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.A.(i).(4) - Consideration of maximum relative displacements among supports of Category I systems and components.	Relative seismic displacements between supports on the steam generator are not considered in the seismic analyses. It has been assumed that the separate support locations are sufficiently rigid with respect to each other and no significant relative displacements would be present.
II.2.A.(ii).(1) through (3) - Equivalent Static Load Method	Response spectrum method is used.
II.2 C - Basis for Selection of Frequencies. To avoid resonance, the fundamental frequencies of components and equipment selected preferably should be less than 1/2 or more than twice the dominant frequencies of the support structure. Use of equipment frequencies within this range is acceptable if the equipment is adequately designed for the applicable loads.	The fundamental frequencies of these members are not "selected" but are calculated based on their simulated mass and stiffness.
II.2.D.(ii) - Time History Method	Response spectra method was used.
II.2.F - Analytical Procedures for Piping Systems. The seismic analysis of Category I piping may use either a dynamic analysis or an equivalent static load method.	Not applicable to the steam generators.
II.2.G - Multiply-Supported Equipment and Components with Distinct Inputs. Equipment and components in some cases are supported at several points by either a single structure or two separate structures. The motions of the primary structure or structures at each of the support points may be quite different.	The seismic analysis of the steam generator is performed using the (single point) response spectrum method.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Steam Generator**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.H - Use of Constant Vertical Static Factors. The use of constant vertical load factors as vertical response loads for the seismic design of all Category I systems, components, equipment, and their supports in lieu of a vertical seismic system dynamic analysis is acceptable only if the structure is demonstrably rigid in the vertical direction. The criterion for rigidity is that the lowest frequency in the vertical direction be more than 33 Hz.	Response spectrum analysis was performed to evaluate the vertical seismic response.
II.2.I - Torsional Effects of Eccentric Masses. For Seismic Category I systems, if the torsional effect of an eccentric mass like a valve operator in a piping system is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for significance will have to be determined case by case.	Not applicable to steam generators.
II.2.J - Category 1 Buried Piping System	Not applicable to steam generators.
II.2.K - Interaction of Other Piping with Category I Piping	Not applicable to steam generators.
II.3 - To meet the requirements of GDCs 1 and 4, the following guidelines, in addition to RG 1.20 “Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and initial Startup Testing”, apply to the analysis solutions to predict vibration of reactor internals for prototype plants.	Not applicable to the HE seismic evaluation of steam generators.
II.4 - For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing	Not applicable to the HE seismic evaluation of steam generators.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Steam Generator
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20.	
II.6 - For requirements of GDC 1, as to the correlation of tests and analyses of reactor internals, the applicant should address the following items to ensure the adequacy and sufficiency of the test and analysis results.	Not applicable to the HE seismic evaluation of steam generators.
II.6.A - Comparison of the measured response frequencies with the analytically obtained natural frequencies of the reactor internals for validation of the mathematical models used in the analysis. Comparison of the measured and predicted damping factors as a function of natural frequencies for validation of the damping assumed in the analysis.	
II.6.B. Comparison of the analytically obtained mode shapes with the shape of measured motion for identification of the modal combination or verification of a specific mode.	
II.6.C. - Comparison of the response amplitude time variation and the frequency content from test and analysis for verification of the postulated forcing function.	

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs - Mechanical Equipment (Westinghouse) - Steam Generator**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.6.D. - Comparison of the measured amplitudes, frequencies, and time variations of loads with those predicted by test-analysis combination method for validation of the predicted forcing function.	
II.6.E. - Comparison of the maximum responses from test and analysis for verification of stress levels.	
II.6.F. - Comparison of the mathematical model for dynamic system analysis under operational flow transients and under combined LOCA and SSE loadings for similarities.	
II.6.G. - Comparison of measurements and predictions of any adverse flow phenomena (e.g., flow-excited acoustic and/or structural resonances) for validation of the model(s) predicting the loading induced by the phenomena.	
II.7 - For new applications, test specifications should be in accordance with ASME OM-S/G-1990, "Standards and Guides For Operation of Nuclear Power Plants," Part 3, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant Piping Systems," and Part 7, "Requirements for Thermal Expansion Testing of Nuclear Power Plant Piping Systems."	Not applicable to the HE seismic evaluation of steam generators.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs - Mechanical Equipment (non-RCS)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - Relevant requirements of GDCs 1, 2, 4, 14, and 15 are met if vibration, thermal expansion, and dynamic effects testing are conducted during startup functional testing for specified high- and moderate-energy piping and their supports and restraints. The purposes of these tests are to confirm that the piping, components, restraints, and supports have been designed to withstand the dynamic loadings and operational transient conditions encountered during service as required by the code and to confirm that no unacceptable restraint of normal thermal motion occurs.	The seismic analysis for SSE - Hosgri is focused on the methods for dynamic analysis. This section is applicable with regards to thermal expansion and vibration during startup. There is no issue with respect to the HE.
II.2.A.(i).(4) - Consideration of maximum relative displacements among supports of Category I systems and components.	Mechanical equipment anchorage locations (except piping and raceway system supports) do not span a structural separation joint, or are in close proximity to an adjacent structure. The equipment support points are close so that the relative displacements between the support anchorages are small and negligible. Therefore, the support relative displacements are not considered in the dynamic analysis of mechanical equipment and components.
II.2.A.(ii).(2) - The design and simplified analysis account for the relative motion between all points of support.	See response above.
II.2.B - Determination of Number of Earthquake Cycles. The number of earthquake cycles during one seismic event, the maximum number of cycles for which applicable systems and components are designed, and the criteria and the applicant's procedures to establish these parameters are reviewed by the staff in accordance with the guidance of SRP Section 3.7.3.	Not applicable to seismic analysis of equipment and components.
II.2.F – Analytical Procedure for Piping Systems	Not applicable to seismic qualification of equipment and components.

SRP 3.9.2	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (non-RCS)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.G – Multiply-Supported Equipment and Components With Distinct Inputs.	Seismic evaluation of equipment and components use single supported location input.
II.2.H - The use of constant vertical load factors as vertical response loads for the seismic design of all Category I systems, components, equipment, and their supports in lieu of a vertical seismic system dynamic analysis is acceptable only if the structure is demonstrably rigid in the vertical direction. The criterion for rigidity is that the lowest frequency in the vertical direction be more than 33 Hz.	Seismic evaluations use vertical required response spectra instead of static vertical load factors.
II.2.I – Torsional Effects of Eccentric Masses. For Seismic Category I systems, if the torsional effect of an eccentric mass like a valve operator in a piping system is judged to be significant, the eccentric mass and its eccentricity should be included in the mathematical model. The criteria for significance will have to be determined case by case.	Not applicable to seismic qualification of equipment and components.
II.2.J – Category 1 Buried Piping System	Not applicable to seismic qualification of equipment and components.
II.2.K – Interaction of Other Piping with Category I Piping	Not applicable to seismic qualification of equipment and components.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs - Mechanical Equipment (non-RCS)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.L - Criteria Used for Damping – RG 1.61, "Damping Values for Seismic Design of Nuclear Power Plants" provides acceptable values which may be used. The methods for analysis of damping should be consistent with those described in SRP Section 3.7.2	For Westinghouse qualified RCS (i.e., reactor pressure vessel, steam generators and pressurizer), a damping value of 4 % was used rather than 3 % as shown in RG 1.61 (SSER-7, Section 3.9.3.2) (WCAP-7921-AR, May 1974). A damping value of 5 % was used for Westinghouse qualified electrical equipment. For PG&E qualified equipment, a damping value of 4 % was used for HE rather than 3 % as shown in RG 1.61 for SSE (DCM T-10, Table 4.3-1). SSER 18, Section 3.4.1.1 indicates that NRC has acknowledged that the damping values shown in Table 3.7 of FSARU have been used for the HE reanalysis. For the integrated head assembly (IHA), a damping value of 6.85% per RG 1.61, Revision 1, was used and has been approved by the NRC in License Amendments 208(DPR-80) and 210 (DPR-82). For Control Rod Drive Mechanism (CRDM), a damping value of 5% was used and has been approved by the NRC in License Amendments 207(DPR-80) and 209 (DPR-82).
II.3 – To meet the requirements of GDCs 1 and 4, the following guidelines, in addition to RG 1.20 "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and initial Startup Testing", apply to the analysis solutions to predict vibration of reactor internals for prototype plants.	Not applicable to seismic qualification of equipment and components.

SRP 3.9.2	**Dynamic Testing and Analysis of SSCs - Mechanical Equipment (non-RCS)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.4 – For requirements of GDCs 1 and 4, the preoperational vibration and stress test program for the internals of a prototype reactor, for existing reactors under consideration for power uprate, and for non-prototype reactors whose valid or conditional prototypes have experienced structural failures due to adverse flow effects in any plant (e.g., steam dryer cracking and valve failures) should conform to the requirements for a prototype test as specified in RG 1.20,	Not applicable to seismic qualification of equipment and components.
II.6 - For requirements of GDC 1, as to the correlation of tests and analyses of reactor internals, the applicant should address the following items to ensure the adequacy and sufficiency of the test and analysis results.	Not applicable to seismic qualification of mechanical equipment and components.
II.6.A - Comparison of the measured response frequencies with the analytically obtained natural frequencies of the reactor internals for validation of the mathematical models used in the analysis. Comparison of the measured and predicted damping factors as a function of natural frequencies for validation of the damping assumed in the analysis.	
II.6.B. Comparison of the analytically obtained mode shapes with the shape of measured motion for identification of the modal combination or verification of a specific mode.	

SRP 3.9.2	Dynamic Testing and Analysis of SSCs - Mechanical Equipment (non-RCS)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.6.C. - Comparison of the response amplitude time variation and the frequency content from test and analysis for verification of the postulated forcing function.	
II.6.D. - Comparison of the measured amplitudes, frequencies, and time variations of loads with those predicted by test-analysis combination method for validation of the predicted forcing function.	
II.6.E. - Comparison of the maximum responses from test and analysis for verification of stress levels.	
II.6.F. - Comparison of the mathematical model for dynamic system analysis under operational flow transients and under combined LOCA and SSE loadings for similarities.	
II.6.G. - Comparison of measurements and predictions of any adverse flow phenomena (e.g., flow-excited acoustic and/or structural resonances) for validation of the model(s) predicting the loading induced by the phenomena.	
II.7. For new applications, test specifications should be in accordance with ASME OM-S/G-1990, "Standards and Guides For Operation of Nuclear Power Plants," Part 3, "Requirements for Preoperational and Initial Start-Up Vibration Testing of Nuclear Power Plant Piping Systems," and Part 7, "Requirements for Thermal Expansion Testing of Nuclear Power Plant Piping Systems."	Not applicable to seismic qualification of equipment and components.

SRP 3.9.3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Pipe Supports, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 – Loading Combinations, System Operating, Transients, and Stress Limits	DCPP is designed, except for the RVHVS and RVLIS, to the USAS B31.1 Code and not the ASME section III code. Pipe support loads and stresses are evaluated for normal, upset, emergency and faulted conditions. Since the USAS B31.1 Code only addresses criteria for normal and upset condition limits, PG&E supplemented the requirements of the USAS B31.1 Code to address emergency and faulted conditions with criteria consistent with the philosophy of the ASME Code, Section III for emergency and faulted conditions. RVHVS and RVLIS piping system supports, for the replacement reactor vessel closure head/integrated head assembly, are designed in accordance with the ASME Code, 2001 Edition through 2003 Addenda, Section III, Subsection NF and Appendix F.
II.2.A - Design and Installation of Pressure Relief Devices. Where more than one valve is installed on the same pipe run, the sequence of valve openings to be assumed in analyzing for the stress at any piping location should be that sequence which is estimated to induce the maximum instantaneous value of stress at that location.	This section is not applicable to pipe support design, except for loads due to pressure relief devices.
II.2.B – Design and Installation of Pressure Relief Devices. Stresses should be evaluated, and applicable stress limits should be satisfied for all components of the pipe run and connecting systems and the pressure relief valve station, including	The stresses due to the applicable loads from pressure relief devices have been evaluated for compliance with the stress limits addressed in item II.1 above.

SRP 3.9.3	**ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Pipe Supports, non-Reactor Coolant Loop (non-RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
supports and all connecting welds between these components.	
II.2.C – Design and Installation of Pressure Relief Devices. In meeting the stress limit requirements, the contribution from the reaction force and the moments resulting from that force should include the effects of a Dynamic Load Factor (DLF) or should use the maximum instantaneous values of forces and moments for that location as determined by the dynamic hydraulic / structural system analysis. This requirement should be satisfied in demonstrating satisfaction of all design limits at all locations of the pipe run and the pressure relief valve for Class 1, 2, and 3 piping. A DLF of 2.0 may be used in lieu of a dynamic analysis to determine the DLF.	The subjects are related to piping and not pipe supports. See SRP 3.9.3 "Piping non-Reactor Coolant Loop (non-RCL)."
II.3.A - Component supports of active pumps and valves should be considered in context with the other features of the functionality assurance and seismic qualification program as presented in SRP Section 3.10. If the component support deformation can be expected to affect the operability requirements of the supported component, then deformation limits should also be specified. Such deformation limits should be compatible with the operability	DCPP design/licensing basis does not specify support deformation limits. All supports active in a seismic load case, (i.e., rigid supports and snubbers) are generally modeled using the default rigid stiffness in the piping stress analysis computer program. Pipe supports are designed to have a natural frequency in the restrained direction of over 20 Hz, unless the support stiffness is included in the piping analysis.

SRP 3.9.3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Pipe Supports, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
requirements of the supported components. These deformation limits should be incorporated into the functionality assurance and seismic qualification program. In establishing allowable equipment deformations, the possible movements of the support base structures must be taken into account.	

SRP 3.9.3	**ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures. – Piping, non-Reactor Coolant Loop (non-RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - Loading Combinations, System Operating Transients, and Stress Limits. The design and service loading combinations and associated stress limits should be in accordance with ASME Code Section III Class 1, 2, and 3 component requirements.	DCPP piping, except for the RVHVS and RVLIS, is qualified to ANSI B31.1 Code and not ASME Code. The USAS B31.1 Code only addresses criteria for normal and upset condition limits. PG&E supplemented the requirements of the USAS B31.1 Code to address emergency and faulted conditions with criteria consistent with the philosophy of the ASME Code, Section III for emergency and faulted conditions [Letter from J. D. Shiffer (PG&E) to G. W. Knighton (NRC), dated June 13, 1985, PG&E Letter DCL-85-212 and response to Allegation or Concern Number 1698 in SSER 33]. RVHVS and RVLIS piping system supports for the replacement reactor vessel closure head/integrated head assembly are designed in accordance with the ASME Code, 2001 Edition through 2003 Addenda, Section III, Subsection NF and Appendix F.
II.3.A – Component supports of active pumps and valves	The subjects are related to pipe supports and not piping. See SRP 3.9.3 "Pipe Supports (non-RCS)."
II.3.B (i) – Criteria for Snubber functionality – Structural Analysis and Systems Evaluation.	The subjects are related to pipe supports and not piping. See SRP 3.9.3 "Pipe Supports (non-RCS)."
II.3.B (ii) – Criteria for Snubber functionality – Characterization of Mechanical properties.	The subjects are related to pipe supports and not piping. See SRP 3.9.3 "Pipe Supports (non-RCS)."
II.3.B (iii) – Criteria for Snubber functionality – Design Specifications.	The subjects are related to pipe supports and not piping. See SRP 3.9.3 "Pipe Supports (non-RCS)."
II.3.B (iv) – Criteria for Snubber functionality – Use of additional Snubbers.	The subjects are related to pipe supports and not piping. See SRP 3.9.3 "Pipe Supports (non-RCS)."

SRP 3.9.3	ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures. – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - Loading Combinations, System Operating Transients, and Stress Limits. The design and service loading combinations and associated stress limits should be in accordance with ASME Code Section III Class 1, 2, and 3 component requirements.	DCPP piping, except for the RVHVS and RVLIS, is qualified to ANSI B31.1 Code and not ASME Code. The load combinations for the Normal, Upset, and Faulted conditions are specified in piping qualification calculations. DCPP criteria combines the LOCA loading with Hosgri loading. The adequacy of the reactor coolant piping to withstand LOCA loading in combination with Hosgri is documented in the DCPP CAP (reference SAP Notification 50404966).
II.2 – Design and Installation of Pressure Relief Devices. The applicant should use design criteria for pressure relief installations specified in Appendix O, ASME Code, Section III, Division 1, "Rules for the Design of Safety Valve Installations."	There are no pressure relief devices on the RCL piping. The pressure relief devices for the RCS are via relief and safety valves attached to lines off the pressurizer. Therefore it is not applicable to RCL piping.
II.3 – Component Supports. Component supports should meet stress limits for all loading combinations found in ASME Code Section III Class 1, 2, and 3 component requirements, RG 1.124, RG 1.130, and Subsection NF of the ASME Code.	There are no pipe supports on the RCL piping. The primary equipment supports are addressed by a separate SRP comparison table.

<table>
<tr><td>SRP 3.9.3</td><td>ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Mechanical Equipment (Non-RCS)</td></tr>
<tr><th>SRP Acceptance Criteria</th><th>DCPP Design/Licensing Basis</th></tr>
<tr><td>II.1. Loading Combinations, System Operating Transients, and Stress Limits. The design and service loading combinations, including system operating transients, and the associated design and service stress limits considered for each component and its supports should be sufficiently defined to provide the basis for design of Code Class 1, 2, and 3 components and component supports, and core support structures for all conditions.

The acceptability of the combination of design and service loadings (including system operating transients), applicable to the design of Class 1, 2, and 3 components and component supports, and core support structures, and of the designation of the appropriate design or service stress limit for each loading combination, is judged by comparison with positions stated in Appendix A, and with appropriate standards acceptable to the staff, developed by professional societies and standards organizations.</td><td>The HE has been identified as Service Level D (faulted plant condition) (DCM T-10, Section 3.2.2).

In accordance with Table 1 of SRP 3.9.3, Appendix A, the SSE loading combinations, system operating transients, and stress limits are listed in the following;

<table>
<tr><th>Plant Event</th><th>System Operating Condition</th><th>Service Loading Condition</th><th>Service Stress Limit</th></tr>
<tr><td>DBPB or MS/FWBP + SSE</td><td>Faulted</td><td>Sustained Loads + DBPB or MS/FWPB + SSE</td><td>D</td></tr>
<tr><td>LOCA + SSE</td><td>Faulted</td><td>Sustained Loads + LOCA + SSE</td><td>D</td></tr>
</table>

Where:
DBPB – Design Basis Pipe Breaks
MS/FWBP – Main Steam and Feedwater Pipe Breaks

The Hosgri Earthquake (Service Stress Limit D) loading combination for PG&E supplied equipment (Table 4.3-2);

$HE+P_n+D+N+O$,

Where:
HE = Hosgri Earthquake
P_n = Pressure, Normal
D = Dead weight
N = Nozzle
O = Operating</td></tr>
</table>

SRP 3.9.3	ASME Code Class 1, 2, and 3 Components and Component Supports and Core Support Structures – Mechanical Equipment (Non-RCS)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
	The HE loading combination for Westinghouse supplied equipment (DCM T-10, Table 4.4-1); Deadweight + Pressure ± Hosgri + Nozzle/Piping Loads + Operating Loads PG&E is in the process of performing evaluations for the combination of HE seismic loads with LOCA for RCS loop piping and certain primary equipment to address a nonconforming condition (reference DCPP CAP SAP Notifications 50403189 and 50403377).
II.2.A Thru II.2.C - Design and Installation of Pressure Relief Devices.	Not applicable to the HE seismic equipment qualification.
II.3.A. Component supports of active pumps and valves should be considered in context with the other features of the functionality assurance and seismic qualification program as presented in SRP Section 3.10. If the component support deformation can be expected to affect the operability requirements of the supported component, then deformation limits should also be specified. Such deformation limits should be compatible with the operability requirements of the supported components. These deformation limits should be incorporated into the functionality assurance and seismic qualification program. In establishing allowable equipment deformations, the possible movements of the support base structures must be taken into account.	The component support deformation and possible movements of the support base structures are not applicable to the seismic qualification of DCPP ASME code Class 1, 2, and 3 component supports.
II.3.B Component supports criteria for snubber functionality assurance.	Not applicable to seismic equipment qualification.

SRP 3.9.3	**ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Fuel Assembly**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. - Design and Installation of Pressure Relief Devices. The applicant should use design criteria for pressure relief installations specified in Appendix O, ASME Code, Section III, Division 1, "Rules for the Design of Safety Valve Installations." In addition, the following criteria are applicable:	Not applicable to the fuel assembly.
II.3.A. - Component supports of active pumps and valves should be considered in context with the other features of the functionality assurance and seismic qualification program as presented in SRP Section 3.10. If the component support deformation can be expected to affect the operability requirements of the supported component, then deformation limits should also be specified. Such deformation limits should be compatible with the operability requirements of the supported components. These deformation limits should be incorporated into the functionality assurance and seismic qualification program. In establishing allowable equipment deformations, the possible movements of the support base structures must be taken into account.	Not applicable to the fuel assembly.
II.3.B. - Criteria for snubber functionality assurance	Not applicable to the fuel assembly.

SRP 3.9.3	**ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - NSSS Primary Equipment Supports (PES)**
SRP Acceptable Criteria	**DCPP Design/Licensing Basis**
II.1 Loading Combinations, System Operating Transients, and Stress Limits - The design and service loading combinations, including system operating transients, and the associated design and service stress limits considered for each component and its supports should be sufficiently defined to provide the basis for design of Code Class 1, 2, and 3 components and component supports, and core support structures for all conditions. The acceptability of the combination of design and service loadings (including system operating transients), applicable to the design of Class 1, 2, and 3 components and component supports, and core support structures, and of the designation of the appropriate design or service stress limit for each loading combination, is judged by comparison with positions stated in Appendix A, and with appropriate standards acceptable to the staff, developed by professional societies and standards organizations.	The load combinations for the Normal, Upset, and Faulted conditions are specified in FSARU Table 5.2-8, "Loading Combinations and Acceptance Criteria For Primary Equipment Supports." DCPP design basis does not include the HE seismic event in the primary faulted loading. The primary faulted load combination is the SRSS combination of DDE seismic and LOCA. The HE is treated as a separate faulted load combination and is not combined with LOCA. PG&E is in the process of performing evaluations for the combination of HE seismic loads with LOCA for RCS loop piping and certain primary equipment to address a nonconforming condition (reference DCPP CAP SAP Notifications 50403189 and 50403377). DCPP was designed to 1969 AISC Specification.
II.2 Design and Installation of Pressure Relief Devices - The applicant should use design criteria for pressure relief installations specified in Appendix O, ASME Code, Section III, Division 1, "Rules for the Design of Safety Valve Installations."	Pressure relief devices are not part of the NSSS component supports.

SRP 3.9.3	**ASME Code Class 1, 2, and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - NSSS Primary Equipment Supports (PES)**
SRP Acceptable Criteria	**DCPP Design/Licensing Basis**
II.3. Component Supports - Component supports should meet stress limits for all loading combinations found in ASME Code Section III Class 1, 2, and 3 component requirements, RG 1.124, RG 1.130, and Subsection NF of the ASME Code.	The DCPP NSSS primary equipment supports were designed to and meet the criteria of the AISC Code, Parts 1 and 2, 1969 Edition.

SRP 3.9.3	**ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Pressurizer**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. - Design and Installation of Pressure Relief Devices.	Not applicable to the Pressurizer.
II.3. - Component Supports.	Refer to SRP 3.9.3 for NSSS PES.

SRP 3.9.3	**ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1 - The design and service loading combinations, including system operating transients, and the associated design and service stress limits considered for each component and its supports should be sufficiently defined to provide the basis for design of Code Class 1, 2, 3, components and component supports, and core support structures for all conditions. The acceptability of the combination of design and service loadings, applicable to the design of Class 1, 2, and 3 components and components supports, and core support structures, and of the designation of the appropriate design or service stress limit for each loading combination, is judged by comparison with positions stated in Appendix A, and with appropriate standards acceptable to the staff, developed by professional societies and standards organizations. (The criteria is evaluated in separate rows below) The design criteria of internal parts of components such as valve discs, seats, and pump shafting should comply with applicable Code or Code Case criteria. In those instances where no Code criteria exist, the design criteria are acceptable if they ensure the structural integrity of the part such that no safety-related functions are impaired.	See responses below to Appendix A criteria.
II.2 - Criteria is for design and installation of pressure relieve devices.	Not applicable to RCP seismic analysis.

SRP 3.9.3	ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3 - Criteria are for components supports designs.	Not applicable to RCP seismic analysis.
II.3.A - Criteria are for components supports.	Not applicable to RCP seismic analysis.
II.3.B.(i) through (iv): Criteria is for snubber functionality assurance.	Not applicable to RCP seismic analysis.
Appendix A Section 4A: Code Class 1, 2, and 3 components and components supports, and core support structures, shall be designed to satisfy the appropriate subsections of the Code as required in 10 CFR 50.55a, including limitations on pressure, and including the criteria of this appendix. Design loadings shall be established in the design specification. The design limits of the appropriate subsection of the Code shall not be exceeded for the design loadings specified. Fatigue evaluations are required by the Code for all Class 1 components. Fatigue evaluations should also be completed for all Code Class 2 and 3 components and components supports, and core support structures that are subject to thermal cyclic effects of dynamic cyclic effects. To avoid fatigue failure during the life of the plant, unisolable sections of the piping connected to the reactor coolant system that are subject to stresses from temperature stratification or temperature oscillations as well as other typical piping stresses,	The RCP seismic analysis evaluates for the design loads defined in the RCP design specification such that the appropriate subsections of the Code are satisfied. The design specification defines the DDE only and not the HE. An analysis has been performed that has shown that the 4% damped HE is bounded by the 2% damped DDE. Fatigue evaluations are not applicable to the RCP HE seismic analysis because the HE event is considered a faulted condition, which does not require a fatigue evaluation.

SRP 3.9.3	**ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
should be identified and designed to withstand combined stresses caused by various loads and the worst temporal and spatial distributions of temperature to be encountered in service.	
Appendix A Section 4B: The identification of individual loads and the appropriate combination of these loads (i.e., sustained loads, loads due to system operating transients (SOT), OBE, SSE, LOCA, DBPB, MS/FWPB and their dynamic effects) should be in accordance with Section "1.3" [4C]. The appropriate method for combining of these loads should be in accordance with NUREG-0484, "Methodology for Combining Dynamic Loads."	The RCP AOR evaluated the 4% HE faulted conditions against the Level D limits and does not evaluate the HE plus LOCA faulted condition against the Level D limits. The RCP AOR evaluated the HE faulted condition by comparing the RCP responses for the HE to the 2% DDE responses. From the comparison, it was concluded that the 2% DDE bounded the HE responses. The DDE was evaluated for the 2% DDE faulted condition and the 4% DDE plus LOCA faulted condition. For the 4% DDE plus LOCA condition, the 4% DDE responses were combined with the LOCA responses using the SRSS method, which is consistent with NUREG-0484.
Appendix A Section 4C(i): Code Class 1, 2, and 3 components, component supports, and core support structures shall meet a service limit not greater than Level A when subjected to sustained loads resulting from normal plant/system operation.	HE is considered a faulted condition earthquake event, which would not be included in Level A criteria.
Appendix A Section 4C(ii): Code Class 1, 2, and 3 components, component supports, and core support structures shall meet a service limit not greater than Level B when subjected to the appropriate combination of loadings resulting from (1) sustained loads, (2) specified plant/system operating transients (SOT), (3) the OBE.	HE is considered a faulted condition earthquake event, which would not be included in Level B criteria.

SRP 3.9.3	ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Appendix A Section 4C(iii): Code Class 1, 2, and 3 components, component supports, and core support structures shall meet a service limit not greater than Level C when subjected to the appropriate combination of loadings resulting from (1) sustained loads, (2) the DBPB. The DBPB includes loads from the postulated pipe break, itself, and also any associated system transients or dynamic effects resulting from the postulated pipe break.	HE is considered a faulted condition earthquake event, which would not be included in Level C criteria.
Appendix A Section 4C(iv): Code Class 1, 2, and 3 components, component supports, and core support structures shall meet a service limit not greater than Level D when subjected to the appropriate combination of loadings resulting from (1) sustained loads, (2) either the DBPB, MS/FWPB, or LOCA, and (3) and SSE. The DBPB, MS/FWPB, and LOCA include loads from the postulated pipe breaks, themselves, and also any associated system transients or dynamic effects resulting from the postulated pipe break.	The RCP AOR does not evaluate the HE plus LOCA faulted condition against the Level D limits, which is required if the HE is considered the SSE. The RCP AOR only evaluated the HE faulted condition, which was done by comparing the RCP responses to the 2% DDE faulted condition responses. From the comparison, it was concluded that the 2% DDE bounded the HE responses. The DDE was evaluated for the 2% DDE faulted condition and the 4% DDE plus LOCA faulted condition.
Appendix A Section 5B: Criteria is for operability and functional capability of snubbers.	Not applicable to RCP seismic analysis.
Appendix A Section 5C: Criteria is for operability and functional capability of Class 1, 2, and 3 piping components.	Not applicable to RCP seismic analysis.
Appendix A Section 6 A & B	Not applicable to RCP seismic analysis.

SRP 3.9.3	**ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Reactor Coolant Pump (RCP)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Appendix A Section 7A(i): The design options provided by the code and related design criteria specified in the code required design specification should be summarized in sufficient detail in the safety analysis report to permit comparison with this appendix.	HE is not discussed or defined in the DCPP RCP design specification.
Appendix A Section 7(ii) through (iv)	Not applicable to RCP seismic analysis.

SRP 3.9.3	**ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Reactor Vessel**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.3. Component Supports - Component supports should meet stress limits for all loading combinations found in ASME Code Section III Class 1, 2, and 3 component requirements, RG 1.124, RG 1.130, and Subsection NF of the ASME Code.	Refer to SRP 3.9.3 for NSSS PES functional area for details.

SRP 3.9.3	**ASME Code Class 1, 2 and 3 Components and Component Supports, and Core Support Structures – Mechanical Equipment (Westinghouse) - Steam Generator**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2. Design and Installation of Pressure Relief Devices. The applicant should use design criteria for pressure relief installations specified in Appendix O, ASME Code, Section III, Division 1, "Rules for the Design of Safety Valve Installations."	Not applicable to steam generators.

SRP 3. 10	Seismic and Dynamic Qualification of Mechanical and Electrical Equipment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.1.- Meet the requirements and recommendations of ANSI/IEEE 344-1987	Requalification of the equipment for HE was performed according to the guidance in IEEE Standard 344-1975. New electrical equipment and instruments requiring seismic qualification are qualified to comply with IEEE Standard 344-1987.
II.1.A.xiii – Selection of damping values for equipment to be qualified should be made in accordance with RG 1.61 and ANSI/IEEE Std 344-1987. Higher damping values may be used if justified by documented test data with proper identification of the source and mechanism.	For Westinghouse qualified RCS (i.e., reactor pressure vessel, steam generators and pressurizer), a damping value of 4 % was used rather than 3 % as shown in the RG 1.61 (SSER-7, Section 3.9.3.2) (WCAP-7921-AR, May 1974). The value of 4 % was justified in actual plant tests by Westinghouse and was accepted by the NRC (DCM T-10, Section 3.4.5). A damping value of 5 % was used for Westinghouse qualified electrical equipment. For PG&E qualified equipment, a damping value of 4 % was used for HE rather than 3 % as shown in RG 1.61 for SSE (DCM T-10, Table 4.3-1). SSER 18, Section 3.4.1.1 indicates that NRC has acknowledged that the damping values shown in Table 3.7 of the FSARU have been used for the HE reanalysis. For the IHA, a damping value of 6.85 % per RG 1.61, Rev. 1, was used and has been approved by the NRC in License Amendments 208 (DPR-80) and 210 (DPR-82). For CRDM, a damping value of 5% was used and has been approved by the NRC in License Amendments 207(DPR-80) and 209 (DPR-82).
II.1.A.xiv.(2).(c) - An analysis is performed to determine the pressure differential and the impact energy on the valve disc during a loss-of-coolant accident (LOCA) and to verify the design adequacy of the disc.	Analysis of the impact from a high-energy accident (i.e., LOCA) is not a design specification requirement, nor is an evaluation for seismic plus LOCA loading.
II.1.A.xiv.(2).(d) - An analysis is performed to determine the forcing functions of the axial and radial loads imposed on a pump rotor because of a LOCA, such that combined LOCA and vibratory effects on the shaft and rotor	This analysis is typically developed as part of a dynamic (i.e., rotor/shaft dynamics) evaluation of the pump. LOCA and seismic are two independent evaluations. Seismic analysis does not include specifically identified LOCA loading.

SRP 3. 10	Seismic and Dynamic Qualification of Mechanical and Electrical Equipment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
assembly can be evaluated.	
II.1.B.ii – The analytical results should include the required input motion to the mounted equipment as obtained and characterized in the manner stated on subsection II.1.A.iii above and combined stresses of the support structures should be in accordance with the criteria specified in SRP 3.9.3.	The required input motion to the mounting location of equipment are based on the ground response spectra associated with the HE and the building seismic models, acceleration response spectra have been developed for the various elevations and locations within those buildings housing Design Class I and certain Design Class II systems and components. The acceleration response spectra serve as inputs for the seismic qualification of mechanical, electrical, I&C, and HVAC equipment. The HE (Service Stress Limit D) loading combination for PG&E supplied equipment (DCM T-10, Table 4.3-2). $HE+P_n+D+N+O$, Where: HE = Hosgri Earthquake P_n = Pressure, Normal D = Dead weight N = Nozzle O = Operating The HE loading combination for Westinghouse supplied equipment (DCM T-10, Table 4.4-1); Deadweight + Pressure ± Hosgri + Nozzle/Piping Loads + Operating Loads PG&E is in the process of performing evaluations for the combination of HE seismic loads with LOCA for RCS loop piping and certain primary equipment to address a nonconforming condition (reference DCPP CAP SAP Notifications 50403189 and 50403377).
II.1.C – Verification of Seismic and Dynamic Qualification. The seismic and dynamic qualification testing performed in accordance with ANSI/IEEE Std 344-1987, as endorsed by	Based on 10 CFR 50.49 provisions in paragraphs (k) and (l), DCPP is required only to upgrade the qualification level of replacement equipment installed after the effective date of the rule (February 22, 1983).

SRP 3. 10	Seismic and Dynamic Qualification of Mechanical and Electrical Equipment
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
RG 1.100, Revision 2, as part of an overall qualification program should be performed in the sequence indicated in Section 6 of IEEE Std 323-1974 (endorsed with exceptions by RG 1.89).	Qualification of equipment installed prior to February 22, 1983, need only be to the level specified by IEEE 323-1971 supplemented by the Category II positions in NUREG-0588. New (i.e., nonreplacement) equipment installed after February 22, 1983, must be qualified to the level of IEEE 323-1974 and NUREG-0588 Category I. Generally, the industrial practice for the seismic qualification of equipment complies with the test sequence indicated in the Section 6 of IEEE Standard 323-1974.
II.3 – If the applicant proposes qualification by an experience-based approach, the details of the experience database, including applicable implementation methods and procedures to ensure structural integrity and functionality of the in-scope mechanical and electrical equipment, must meet the functionality of equipment for the defined load condition as presented in paragraphs 1 and 2 above.	The DCPP Seismic Category 1 equipment is seismically qualified by the following methods. • Analysis • Testing • Combination of Testing and Analysis. The experience-based approach was not used for seismic equipment qualification at DCPP.
II.6.A thru D	Not Applicable.

SRP 3.12	**ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports – Pipe Supports, non-Reactor Coolant Loop (non-RCL).**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.A Piping Analysis Methods	The subjects are related to piping and not pipe supports. See SRP 3.12 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.B Piping Modelling Techniques	The subjects are related to piping and not pipe supports. See SRP 3.12 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.C Piping Stress Analysis Criteria	The subjects are related to piping and not pipe supports. See SRP 3.12 "Piping, non-Reactor Coolant Loop (non-RCL)."
II.2.D.i. Applicable Codes. The design of ASME Code, Section III, Class 1, 2, and 3, piping supports should comply with the design criteria requirements of ASME Code, Section III, Subsection NF.	DCPP is not a Section III Plant; it is designed, except for the RVHVS and RVLIS, to the requirements of USAS B31.1 Code. PG&E supplemented the requirements of the USAS B31.1 Code to address emergency and faulted conditions with criteria consistent with the philosophy of the ASME Code, Section III, Subsection NF for emergency and faulted conditions. RVHVS and RVLIS piping system supports for the Replacement Reactor Vessel Closure Head/Integrated Head Assembly are designed in accordance with the ASME Code, 2001 Edition through 2003 Addenda, Section III, Subsection NF and Appendix F.
II.2.D.ii. Jurisdictional Boundaries. The jurisdictional boundaries between pipe supports and interface attachment points should comply with ASME Code, Section III, Subsection NF.	Pipe supports at DCPP, except for the RVHVS and RVLIS systems, are designed to comply with the requirements of USAS B31.1 1967. USAS B31.1 divides pipe support steel into two basic types: 1. "Supplementary Steel," which is to be designed in accordance with the standards of the AISC [1967 USAS B31.1, Paragraph 120.2.4]. (Per FSAR, Section 3.9.2.6, DCPP is committed to AISC, 7th Edition for design of supplementary steel). 2. B31.1 Steel, which is designed in accordance with the criteria given in B31.1. The RVHVS and RVLIS piping system supports for the Replacement Reactor Vessel Closure Head/Integrated Head Assembly are designed in accordance with

SRP 3.12	**ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports – Pipe Supports, non-Reactor Coolant Loop (non-RCL).**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
	the ASME Code, 2001 Edition through 2003 Addenda, Section III, Subsection NF and Appendix F.
II.2.D.iii. – Loads and Load Combinations. The criteria provided in SRP Section 3.9.3, Subsection II.1 are applicable.	DCPP is designed in general to the USAS B31.1 Code and not the ASME section III code. Pipe support loads and stresses are evaluated for normal, upset, emergency and faulted conditions. Since the USAS B31.1 Code only addresses criteria for normal and upset condition limits, PG&E supplemented the requirements of the USAS B31.1 Code to address emergency and faulted conditions with criteria consistent with the philosophy of the ASME Code, Section III for emergency and faulted conditions. RVHVS and RVLIS piping system supports for the Replacement Reactor Vessel Closure Head/Integrated Head Assembly are designed in accordance with the ASME Code, 2001 Edition through 2003 Addenda, Section III, Subsection NF and Appendix F.
II.2.D.v. – Use of Energy Absorbers and Limit Stops. The evaluation typically consists of iterative response spectra analyses of the piping and support system. The analyses will be reviewed on a case by case basis.	DCPP does not use Energy Absorbers and Limit Stops for PG&E Design Class I pipe supports.
II.2.D.viii. – Seismic Self-Weight Excitation. The acceptance criteria provided in SRP Section 3.9.3, are applicable for loads caused by the seismic excitation of the pipe support.	The effect of the frame's self-weight excitation has only been considered for completely new PG&E Design Class I pipe support designs performed and issued after June 1, 1984.
II.2.D.ix. – Design of Supplementary Steel. The design of structural steel for use as	DCPP in general is committed to AISC, 7th Edition for design of "Supplementary Steel," which is to be designed in accordance with the standards of the AISC [1967

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports – Pipe Supports, non-Reactor Coolant Loop (non-RCL).
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
pipe supports should comply with the ASME Code, Section III, Subsection NF.	USAS B31.1, Paragraph 120.2.4]. RVHVS and RVLIS piping system supports for the Replacement Reactor Vessel Closure Head/Integrated Head Assembly are designed in accordance with the ASME Code, 2001 Edition through 2003 Addenda, Section III, Subsection NF and Appendix F.
II.2.D.xii – Instrumentation Line Support Criteria. The acceptance criteria provided in ASME Code, Section III, Subsection NF are applicable.	DCPP is not a Section III Plant; it is designed to USAS B31.1 Code. AEC General Design Criteria for Nuclear Power Construction Permits (Published for Public Comment), July 1967, form the design basis requirements for the original design of the instrument tubing and supports.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II. SRP Acceptance Criteria	
II.2.A(i) Experimental Stress Analysis Methods. If experimental stress analysis methods are used in lieu of analytical methods for Seismic Category I ASME Code and non- Code piping system design, the applicant should provide sufficient information to show the validity of the design. It is recommended, prior to use of the experimental stress analysis methods, that details of the method as well as the scope and extent of its application, be submitted for approval. The experimental stress analysis methods provided in Appendix II to ASME Code, Section III, Division 1 are applicable.	No experimental stress analysis method has been used for piping stress analyses at DCPP.
II.2.A(ii) Modal Response Spectrum Method. The SRP acceptance criteria provided in SRP Section 3.9.2, Subsection II.2 are applicable.	Methodologies used for piping analysis do not combine all three component responses by the SRSS at a modal level. In addition, the combination of modal responses is performed using the SRSS method. The effects of closely spaced modes are not considered with the SRSS method. Refer to "Piping non Reactor Coolant Loop (non-RCL)" SRP 3.9.2, Subsection II.2 for details.
II.A(iii) Response Spectra Method - Independent Support Motion Method. This method may be used in lieu of the response spectra method when there is more than one supporting structure. The acceptance criteria provided in NUREG-1061, Volume 4 are applicable.	Seismic analysis for HE has not used as an Independent Support Motion Method.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.A(iv) Time History Method. The SRP acceptance criteria provided in SRP 3.7.2 Subsection II.6 are applicable.	The time history method has not been used for the HE.
II.2.A(v) - Inelastic Analysis Method. If inelastic analysis methods are used for the piping design, the applicant will provide sufficient information to show the validity of the analysis. It is recommended, prior to use of the inelastic analysis method that details of the method, as well as the scope and extent of its application and acceptance criteria, be submitted for approval. The inelastic analysis methods provided in SRP Section 3.9.1, Subsection II.4 are applicable.	An Inelastic Analysis Method has not been used for analyzed piping at DCPP.
II.2.A(vi) Small Bore Piping Method. The SRP acceptance criteria provided in SRP Section 3.9.2, Subsection II.2(A) are applicable	The simplified analysis of small bore piping (nominal pipe size of 2 inches or less) applies peak acceleration of the applicable building response spectra envelope (reference DCM M-40, Section 2.1).
II.2.A(viii) Category I Buried Piping , Conduits, and Tunnels. The acceptance criteria provided in SRP Section 3.7.3, Subsection II.12 are applicable.	See the response from SRP 3.7.3, Subsection II.12, "Buried Piping, Conduits, and Tunnels."
II.2.B(iv) Decoupling Criteria. The acceptance criteria provided in SRP Section 3.7.2, Subsection II.3(b) are applicable.	SRP has considered the ratio of mass for the decoupling criteria, whereas for piping analysis, the ratio of moment of inertia is used.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C(ii) Design Transients. The acceptance criteria provided in SRP Section 3.9.1, Subsection 11.1 are applicable.	Hosgri is a faulted condition. It is not evaluated for fatigue.
II.2.C(iii) Loadings and Load Combinations. The acceptance criteria provided in SRP Section 3.9.3, Subsection II.1 are applicable.	DCPP piping, except for the RVHVS and RVLIS, is qualified to USAS B31.1 Code and not the ASME section III Code. RVHVS and RVLIS piping systems for the Replacement Reactor Vessel Closure Head/Integrated Head Assembly are qualified to ASME B&PV Code Section III, Subsection NB/NC, 2001 Edition through 2003 Addenda.
II.2.C(v) Combination of Modal Responses. The acceptance criteria provided in SRP Section 3.9.2, Subsection II.2(E) are applicable	The combination of modal responses is performed using the SRSS method. However, the effects of closely spaced modes are not considered with the SRSS method.
II.2.C(vii) Fatigue Evaluation for ASME Code Class 1 Piping. The acceptance criteria in Section III of the ASME Code are applicable.	Hosgri is a faulted condition. It is not evaluated for fatigue.
II.2.C(viii) Fatigue Evaluation of Code Class 2 and 3 piping. The acceptance criteria in Section III of the ASME Code are applicable.	Fatigue evaluations are not applicable to faulted conditions for piping.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C(ix) Thermal Oscillations in Piping Connected to the RCS. The operating experience insights contained in NRC Bulletin (BL) 88-08 and supplements are applicable for the identification and evaluation of piping systems susceptible to thermal stratification, cycling, and striping.	The thermal oscillations in the piping system are not related to the HE.
II.2.C(x) Thermal Stratification. The operating experience insights contained in NRC BL 79-13 and BL 88-11 are applicable for the identification and evaluation of long runs of horizontal piping susceptible to thermal stratification.	The thermal stratification in the piping system is not related to the HE.
II.2.C(xii) Functional Capability. The acceptance criteria provided in NUREG-1367, "Functional Capability of Piping Systems," may be used to ensure piping functionality under level D loading conditions. Alternative criteria will be reviewed on a case by case basis.	NUREG-1367 was not used by DCPP.
II.2.C (xiii) Combination of Inertial and SAM Effects. The acceptance criteria provided in SRP Section 3.9.2, Subsection II.2(G) are applicable for enveloped support motion analysis. The acceptance criteria provided in NUREG-1061, Volume 4 are applicable for independent support motion analysis.	SRP acceptance criteria requires that the result from an inertia analysis and relative movement of the structure analysis are combined using absolute sum method, whereas DCPP has used SRSS method to combine the inertia analysis and relative movement of the structure.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C (xiv) – OBE as a Design Load. Appendix S to 10 CFR Part 50, "Earthquake Engineering Criteria for Nuclear Power Plants," allows the use of operating basis earthquake ground motion. The criteria is provided in paragraph IV.(a)(2). The detail criterion for use of such an option was provided in NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, Section 3.1.1.2."	Operating Basis Earthquake is not applicable to the Hosgri Faulted Condition Earthquake.
II.2.C (xv) - Welded Attachments. Support members, connections, or attachments welded to piping should be designed such that their failure under unanticipated loads does not cause failure at the pipe pressure boundary. The applicant may use Code Cases for the design of the welded attachments. Acceptable Code Cases are listed in RG 1.84.	DCPP did not use code cases from the referenced RG 1.84. However, welded attachments were evaluated using methodologies based on the Welding Research Council Bulletin 107 and also stress limits from the 1971 edition of the ASME Section III code, Subsection 3222.2.
II.2.C (xvi) – Modal Damping for Composite Structures. The applicant should perform thermal expansion analyses for piping systems that operate at temperatures above or below the stress-free reference temperature. The stress-free reference temperature for a piping system is typically defined as a temperature of 70 Degree F. The applicant should provide justification if	The piping analysis does not consider the modal damping of composite structures.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
thermal expansion analyses are not performed. The justification will be reviewed on a case by case basis. or attachments welded to piping should be designed such that their failure under unanticipated loads does not cause failure at the pipe pressure boundary. The applicant may use Code Cases for the design of the welded attachments. Acceptable Code Cases are listed in RG 1.84.	
II.2.C (xviii) – Intersystem LOCA. The acceptance criteria for the design of the piping system should be such that over pressurization of low-pressure piping systems due to RCPB isolation failure will not result in rupture of the low-pressure piping outside containment. The criteria provided in Staff Requirements Memoranda (SRM) dated June 26, 1990 in response to Commission Papers (SECY)-90-016 dated January 12, 1990 are applicable.	This criterion is not related to the HE.
II.2.C (xix) – Effects of Environment on Fatigue Design. The guidance provided in Regulatory Guide 1.207 is applicable.	Not applicable to RCL piping because the criterion is related to environmental fatigue and is not related to the HE.

SRP 3.12	**ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II. SRP Acceptance Criteria	
II.2.A(i) Experimental Stress Analysis Methods. If experimental stress analysis methods are used in lieu of analytical methods for Seismic Category I ASME Code and non- Code piping system design, the applicant should provide sufficient information to show the validity of the design. It is recommended, prior to use of the experimental stress analysis methods, that details of the method as well as the scope and extent of its application, be submitted for approval. The experimental stress analysis methods provided in Appendix II to ASME Code, Section III, Division 1 are applicable.	No test or experimental stress analysis was used for the RCL piping stress analyses.
II.2.A(ii) Modal Response Spectrum Method. The SRP acceptance criteria provided in SRP Section 3.9.2, Subsection II.2 are applicable.	Methodologies used for piping analysis do not combine all three component responses by the SRSS at a modal level. In addition, the combination of modal responses is performed using the SRSS method. The effects of closely spaced modes are not considered with the SRSS method. Refer to "Piping, Reactor Coolant Loop (RCL)" SRP 3.9.2, Subsection II.2, for details.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.A(iii) Response Spectrum Method – Independent Support Motion Method. This method may be used in lieu of the response spectra method when there is more than one supporting structure. The acceptance criteria provided in NUREG-1061, Volume 4 are applicable.	The RCL piping seismic analysis has not used a multiply-supported method but rather an enveloped response spectrum method (enveloping spectra from various structure elevations) is used.
II.2.A(iv) - Time History Method. The SRP acceptance criteria provided in SRP Section 3.7.2, Subsection II.6 are applicable.	The seismic analyses use modal response spectrum analyses.
II.2.A(v) Inelastic Analysis Method. If inelastic analysis methods are used for the piping design, the applicant will provide sufficient information to show the validity of the analysis. It is recommended, prior to use of the inelastic analysis method that details of the method, as well as the scope and extent of its application and acceptance criteria, be submitted for approval. The inelastic analysis methods provided in SRP Section 3.9.1, Subsection II.4 are applicable.	No inelastic analysis methods were used.

SRP 3.12	**ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.A(vi) Small Bore Piping Method. The SRP acceptance criteria provided in SRP Section 3.9.2, Subsection II.2(A) are applicable	Small bore piping is not within the scope of the RCL piping analysis. It is addressed in "Piping, non-Reactor Coolant Loop (non-RCL)" SRP 3.12, Sub-section II.2.A (vi).
II.2.A(vii) Nonseismic/Seismic Interaction (II/I). The acceptance criteria provided in Section 3.9.2, Subsection II.2.(K) are applicable.	RCL piping is Category I piping and is evaluated for seismic. Nonseismic / Seismic Interaction (II/I) is addressed in "Piping, non-Reactor Coolant Loop (non-RCL)" SRP 3.9.2, Subsection II.2.(K).
II.2.A(viii) Category I Buried Piping , Conduits, and Tunnels. The acceptance criteria provided in SRP Section 3.7.3, Subsection II.12 are applicable.	There are no buried portions of the RCL piping.
II.2.B(iv) Decoupling Criteria. The acceptance criteria provided in SRP Section 3.7.2, Subsection II.3(b) are applicable	SRP has considered the ratio of mass for the decoupling criteria, whereas for piping analysis, the ratio of moment of inertia is used.
II.2.C(ii) Design Transients. The acceptance criteria provided in SRP Section 3.9.1, Subsection 11.1 are applicable.	Hosgri is a faulted condition. It is not evaluated for fatigue.

SRP 3.12	**ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C(iii) Loadings and Load Combinations. The acceptance criteria provided in SRP Section 3.9.3, Subsection II.1 are applicable.	DCPP piping, except for the RVHVS and RVLIS, is qualified to USAS B31.1 Code and not the ASME section III code. RVHVS and RVLIS piping systems for the Replacement Reactor Vessel Closure Head/Integrated Head Assembly are qualified to ASME B&PV Code Section III, Subsection NB/NC, 2001 Edition through 2003 Addenda. DCPP criteria combine the LOCA loading with Hosgri loading. The adequacy of the reactor coolant piping to withstand LOCA loading in combination with Hosgri is documented in the DCPP CAP (reference CAP SAP Notifications 50403189 and 50403377).
II.2.C(v) - Combination of Modal Responses. The acceptance criteria provided in SRP Section 3.9.2, Subsection II.2(E) are applicable	The combination of modal responses is performed using the SRSS method. However, the effects of closely spaced modes are not considered with the SRSS method.
II.2.C(vii) – Fatigue Evaluation for ASME Code Class 1 Piping. The acceptance criteria in Section III of the ASME Code are applicable.	Hosgri is a faulted condition. It is not evaluated for fatigue.
II.2.C(viii) – Fatigue Evaluation of Code Class 2 and 3 piping. The acceptance criteria in Section III of the ASME Code are applicable.	Fatigue evaluations are not applicable to faulted conditions for piping.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C(ix) Thermal Oscillations in Piping Connected to the RCS. The operating experience insights contained in NRC Bulletin (BL) 88-08 and supplements are applicable for the identification and evaluation of piping systems susceptible to thermal stratification, cycling, and striping.	The thermal oscillations in the piping system are not related to the HE.
II.2.C(x) Thermal Stratification. The operating experience insights contained in NRC BL 79-13 and BL 88-11 are applicable for the identification and evaluation of long runs of horizontal piping susceptible to thermal stratification.	The thermal stratification in the piping system is not related to the HE.
II.2.C(xi) Safety Relief Valve Design, Installation, and Testing. The acceptance criteria provided in SRP Section 3.9.3, Subsection II.2 are applicable.	There are no pressure relief devices on the RCL piping. The pressure relief devices for the RCS are via relief and safety valves attached to lines off the pressurizer. Therefore it is not applicable to RCL piping.
II.2.C(xii) Functional Capability. The acceptance criteria provided in NUREG-1367, "Functional Capability of Piping Systems," may be used to ensure piping functionality under level D loading conditions. Alternative criteria will be reviewed on a case by case basis.	NUREG-1367 was not used by DCPP.

SRP 3.12	ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C (xiii) Combination of Inertial and SAM Effects. The acceptance criteria provided in SRP Section 3.9.2, Subsection II.2(G) are applicable for enveloped support motion analysis. The acceptance criteria provided in NUREG-1061, Volume 4 are applicable for independent support motion analysis.	SRP acceptance criteria requires that the result from an inertia analysis and relative movement of the structure analysis are combined using absolute sum method, whereas DCPP has used SRSS method to combine the inertia analysis and relative movement of the structure.
II.2.C (xiv) OBE as a Design Load. Appendix S to 10 CFR Part 50, "Earthquake Engineering Criteria for Nuclear Power Plants," allows the use of operating basis earthquake ground motion. The criteria is provided in paragraph IV.(a)(2). The detail criterion for use of such an option was provided in NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design, Section 3.1.1.2."	Operating Basis Earthquake is not applicable to the Hosgri Faulted Condition Earthquake.
II.2.C (xv) - Welded Attachments. Support members, connections, or attachments welded to piping should be designed such that their failure under unanticipated loads does not cause failure at the pipe pressure boundary. The applicant may use Code Cases for the design of the welded attachments. Acceptable Code Cases are listed in RG 1.84.	RCL piping has no welded attachments on the piping.

SRP 3.12	**ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C (xvi) – Modal Damping for Composite Structures. The applicant should perform thermal expansion analyses for piping systems that operate at temperatures above or below the stress-free reference temperature. The stress-free reference temperature for a piping system is typically defined as a temperature of 70 Degree F. The applicant should provide justification if thermal expansion analyses are not performed. The justification will be reviewed on a case by case basis. or attachments welded to piping should be designed such that their failure under unanticipated loads does not cause failure at the pipe pressure boundary. The applicant may use Code Cases for the design of the welded attachments. Acceptable Code Cases are listed in RG 1.84.	Modal damping for component structures is not used.

SRP 3.12	**ASME Code Class 1, 2, and 3 Piping Systems, Piping Components, and Supports- Piping-Reactor Coolant Loop (RCL)**
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
II.2.C (xviii) – Intersystem LOCA. The acceptance criteria for the design of the piping system should be such that over pressurization of low-pressure piping systems due to RCPB isolation failure will not result in rupture of the low-pressure piping outside containment. The criteria provided in Staff Requirements Memoranda (SRM) dated June 26, 1990 in response to Commission Papers (SECY)-90-016 dated January 12, 1990 are applicable.	This criterion is not related to the HE.
II.2.C (xix) – Effects of Environment on Fatigue Design. The guidance provided in Regulatory Guide 1.207 is applicable.	This criterion is related to environmental fatigue and is not related to the HE.

SRP 5.4	Reactor Coolant System Component & Subcomponent Design – Piping, non-Reactor Coolant Loop (non-RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Specific SRP acceptance criteria, acceptable to meet the relevant requirements of the NRC's regulations identified in the SRP sections are provided in the specific SRP sections. The acceptance criteria for this section of the SRP pertaining to the piping other than RCL such as main steam, feedwater, and aux feedwater piping refer back to sections of the SRP such as 3.9.2, 3.9.3, and 3.12. There were no specific requirements or acceptance criteria in this section, only references to other sections.	The assessments are performed under the applicable SRP sections referenced in this SRP. Refer to the referenced sections for details.

SRP 5.4	Reactor Coolant System Component & Subcomponent Design – Piping, Reactor Coolant Loop (RCL)
SRP Acceptance Criteria	**DCPP Design/Licensing Basis**
Specific SRP acceptance criteria, acceptable to meet the relevant requirements of the NRC's regulations identified in the SRP sections are provided in the specific SRP sections. The acceptance criteria for this section of the SRP pertaining to the RCL piping and supports refers back to sections of the SRP such as 3.9.1, 3.9.2, 3.9.3, etc. There were no specific requirements or acceptance criteria regarding seismic in this section, only references to other sections.	The assessments are performed under the applicable SRP sections referenced in this SRP. Refer to the referenced sections for details.