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Comanche Peak Nuclear Power Plant, Units 3 & 4
COL Application

Part 2, FSAR

Update Tracking Report

(Technical Correction Version)

Revision 0

Revision History

Revision	Date	Update Description
0	03/31/2009	Original Issue Updated Chapters: Ch.1, 2, 3, 6, 8, 9, 11, 12 and 19 Incorporated responses to following RAIs: No.1

Chapter 1

Chapter 1 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
CTS-00529	1.9	1.9-16	Correct COLA/FSAR Status	Add "with exceptions" to "Conformance" in RG 4.15.	0

CP COL 1.9(1)

Table 1.9-202

Comanche Peak Nuclear Power Plant Units 3 & 4 Conformance with Division 4 Regulatory Guides

RG Number	RG Title	Revision/Date	COLA/FSAR Status	Corresponding Chapter/Section
4.7	General Site Suitability Criteria for Nuclear Power Stations	Revision 2 April 1998	Conformance	2.1 2.4.12 2.4.13 2.5.5
4.15	Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) – Effluent Streams and the Environment	Revision 2 July 2007	Conformance with exceptions (QA requirements meet existing active radiological monitoring program for CPNPP Units 1 and 2.)	~~11.3~~ 11.5

CTS-00529

Chapter 2

Chapter 2 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
CTS-00655	2.4.12.2.4	2.4-46	Editorial correction	Change “X” to “XX”.	0
CTS-00513 RCOL2_ 2.4.13-1 through RCOL2_ 2.4.13-7	2.4.12.2.4 2.4.12.2.5 2.4.12.3.1 2.4.12.5 2.4.13	2.4-46 through 2.4-64	To reflect information provided during acceptance review	Re-write section reflecting RAI #1.	0
CTS-00515	2.5.2.5.1	2.5-110 through 2.5-113	To reflect information provided during acceptance review	Add three pages to clarify discussion.	0
CTS-00516	2.5.2.6.1.1 2.5.2.6.1.2	2.5-113 2.5-117	To reflect information provided during acceptance review	Revise Subsection reflecting commitment to NRC.	0
CTS-00514	2.5.4.5.4	2.5-177 2.5-179	To reflect information provided during acceptance review	Revise Subsection reflecting commitment to NRC.	0
CTS-00517	2.5.4.8	2.5-187	To reflect information provided during acceptance review	Revise Subsection reflecting commitment to NRC.	0
CTS-00515	2.5.7	2.5-227 2.5-228	To reflect information provided during acceptance review	Add references 2.5-432 through 2.5-436	0
CTS-00515	2.5.7	2.5-228	To reflect information provided during acceptance review	Add reference 2.5-432.	0
CTS-00515	List of Tables List of Figures	2-xxxii 2-xlviii	Commitment to NRC	Add Tables 2.5.2-230 through 2.5.2-235. Add Figures 2.5.2-240 through 2.5.2-246.	0
CTS-00516	List of Tables List of Figures	2-xxxii 2-xlviii	Commitment to NRC	Add Tables 2.5.2-236 and 2.5.2-237. Add Figures 2.5.2-247 through 2.5.2-252.	0
CTS-00515	Tables 2.5.2-230 through 2.5.2-237	-	To reflect information provided during acceptance review	Add new Tables.	0
CTS-00516	Figures 2.5.2-240 through 2.5.2-250	-	To reflect information provided during acceptance review	Add new Figures	0

groundwater was encountered during excavation or construction of CPNPP Units 1 and 2; therefore, there was no dewatering at the site during or after construction of the units (Reference 2.4-214).

2.4.12.2.4 On-Site/Vicinity Groundwater Level Fluctuations

Beginning in October through November 2006, a groundwater investigation was initiated as part of the subsurface study to evaluate hydrogeologic conditions for the CPNPP Units 3 and 4. As part of this groundwater investigation, 47 monitoring wells were installed at 20 locations within the undifferentiated fill/regolith and Glen Rose Formation on-site. Figure 2.4.12-208 shows the monitor well locations. Details regarding well construction are presented in Table 2.4.12-208. RCOL2_2.4.13-4

Due to the variable nature of groundwater reported at the CPNPP site, the well clusters were installed across CPNPP Units 3 and 4 from west to east of the reactor areas to define the groundwater bearing capabilities and properties of the zones likely to be affected, and to identify the hydraulic connectivity between the zones, if any. Monitoring wells were designated as follows, where XX denotes the well or cluster number for the three zones: CTS-00655

A-zone wells: Regolith or undifferentiated fill monitoring wells (MW-12XXa) were installed if greater than 10 ft of soil was encountered above hollow-stem auger refusal.

B-zone wells: Shallow bedrock monitoring wells (MW-12XXb) were generally completed in the upper 40 to 65 ft of bedrock in an apparent zone of alternating stratigraphy; i.e., claystone, mudstone, limestone, and shale sequences.

C-zone wells: Bedrock monitoring wells (MW-12XXc) were generally completed in deeper bedrock zones consisting of alternating stratigraphy and competent bedrock.

Following well development, water levels were measured from November 2006 to November 2007 (Figure 2.4.12-209) to characterize seasonal trends in groundwater levels and to identify preferential flow pathways surrounding CPNPP Units 3 and 4. The hydrographs for this groundwater data are presented on Figure 2.4.12-209 for each of the three zones investigated. Overall, the hydrographs show that water levels in the deeper Glen Rose Formation do not fluctuate and remain at a constant level near the base of the well, indicating that this water is not actual groundwater. Hydrographs from the shallow bedrock wells show a slow and steady increase of water levels over time with no fluctuations, also suggesting water levels are related to infiltration from the overlying soils and not actual groundwater. Available historical information on groundwater and groundwater trends in the Glen Rose Formation was presented in Subsection 2.4.12.2.3.

Four quarterly groundwater gradient maps were developed for each of the zones investigated. The gradient maps are discussed below for each zone.

Water Levels and Potentiometric Elevations in the Regolith (A – Zone)

Groundwater steadily increased from December 2006 to July 2007. Water levels remained constant or decreased slightly from August 2007 to November 2007. Overall, the water level trend in the regolith monitoring wells appeared to coincide with rainfall totals at the site indicating surface water recharge from infiltration. RCOL2_2.4.13-4

Monitoring well MW-1211a was installed on the northeast portion of CPNPP Units 3 and 4 in undifferentiated fill material. Water levels in this monitoring well were consistent with the normal pool elevation of SCR (775 ft msl) indicating possible hydraulic communication between the former drainage swale and SCR.

Representative potentiometric surface maps for the four quarters (Figure 2.4.12-210 [Sheets 1 through 4]) show that the general shallow groundwater movement in the vicinity of CPNPP Units 3 and 4 mimics the surface topography, with an apparent groundwater divide along the long axis of the site peninsula. On the northern portion of the peninsula, a northerly flow toward SCR is observed, and a southerly flow toward the Safe Shutdown Impoundment (SSI) is observed on the south side of the site peninsula.

Water Levels and Potentiometric Elevations in the Shallow Bedrock (B – Zone)

Nine of the 16 wells completed in this zone contained no, or negligible, amounts of water for up to eight months before exhibiting measurable water (greater than 1 ft). These wells exhibited a slow to steady recharge, with no indication of reliable equilibrium conditions over the monitoring period.

Six monitoring wells screened in shallow bedrock exhibited no, or slight, changes in water level over the monitoring period. One of these wells (MW-1211b) was installed on the northeast portion of CPNPP Units 3 and 4 in the undifferentiated fill material. During installation, an effort was made to install this well in bedrock; however, due to the thickness and nature of the undifferentiated fill material, the boring was terminated at the bedrock surface (approximately 75 ft below ground surface [bgs]). Water level measurements for this well were consistent with those of regolith monitoring well MW-1211a and the normal pool elevation of SCR over the monitoring period.

One monitoring well screened in the shallow bedrock exhibited variable water levels, with no indication of reliable equilibrium conditions when compared to other wells with similar screened zones. Monitoring well MW-1217b, located near the center point of CPNPP Unit 3 exhibited an approximate 15 ft increase in water level from December 2006 to March 2007 followed by a decline of 5 ft through May 2007. From May 2007 to November 2007, this well exhibited a water level increase of approximately 7 ft.

Representative potentiometric surface maps (Figure 2.4.12-210 [Sheets 5 through 8]) show groundwater movement in the vicinity of CPNPP Units 3 and 4 flows to the east in the general direction of the dip of the Glen Rose Formation.

Water Levels and Potentiometric Elevations in the Bedrock Monitoring Wells (C - Zone)

Of the 13 groundwater monitoring wells screened in bedrock, eight contained no, or negligible, amounts of water over the monitoring period and five exhibited a slow to steady recharge, with no indication of reliable equilibrium conditions indicating perched groundwater at these locations. RCOL2_2.4.13-4

Representative potentiometric surface maps for the four quarters (Figure 2.4.12-210 [Sheets 9 through 12]) show that the groundwater movement in the vicinity of CPNPP Units 3 and 4 flows to the east in the general direction of the dip of the Glen Rose Formation. Neligible groundwater has been guaged in the C-zone wells representing essentially dry conditions. Consequently, this zone is not considered a groundwater bearing unit. RCOL2_2.4.13-4

2.4.12.2.5 Aquifer Characteristics

Groundwater has been identified within the undifferentiated fill, regolith and bedrock beneath the CPNPP Units 3 and 4 sites; therefore, this subsection provides characteristics of these zones. During construction, the undifferentiated fill material and regolith are expected to be removed ~~and replaced with engineered fill material~~in the power block area. The foundation elevation is estimated to be approximately 782 ft msl on the bedrock. Groundwater currently measured in the soil zones (undifferentiated fill material and regolith) and the Glen Rose Formation is considered “perched” and will be ~~dewatered~~removed during construction activities. Characteristics of the Glen Rose Formation indicate that it is not a groundwater bearing unit and a permanent dewatering system will not be required. RCOL2_2.4.13-4

2.4.12.2.5.1 Porosity

Soil Zones

The soils occurring on the CPNPP site are described in the Hood and Somervell counties soil survey information provided by the USDA Natural Resources Conservation Service’s on-line Soil Data Mart website (Reference 2.4-259). A total of 18 soil mapping phases representing 17 soil series occur within the CPNPP site boundary. Descriptions of each soil series are provided in Table 2.4.12-210 and the location of the soil mapping phases are shown on Figure 2.4.12-211.

The two soil types mapped in the vicinity of the CPNPP Units 3 and 4 build areas include the Tarrant – Bolar association and Tarrant – Purves association. Physical properties for these soil types indicate clay content ranges of 20 to 60 percent, moist bulk densities of 1.10 gram per cubic centimeter (g/cc) to 1.55 g/cc, saturated hydraulic conductivities between 4.2 x 10-5 centimeters per second (cm/sec) and 1.4 x 10-3 cm/sec, and available water capacities of 0.05 inch per inch (in/in) to 0.18 in/in (Reference 2.4-260).

Units 3 and 4. Of the six wells tested, two were screened in the regolith, one was screened in an undifferentiated fill/regolith zone, and three were screened in the shallow bedrock zone. Hydraulic conductivity for the wells screened in the regolith or undifferentiated fill/regolith zone ranged from 2.93 x 10^{-5} cm/s to 5.00 x 10^{-4} cm/s. Hydraulic conductivity for the wells screened in the shallow bedrock ranged from 6.29 x 10^{-6} cm/s to 1.037 x 10^{-5} cm/s.

A step test and 72-hr pumping test were performed on aquifer pump test well RW-1 in April of 2007. To investigate groundwater communication with SCR, pump test well RW-1 was installed in an area of undifferentiated fill within a former drainage swale on the northeast portion of CPNPP Units 3 and 4. The step test was performed to determine the pumping rate for the 72-hr pumping test. Data for the step test and 72-hr pumping test were analyzed using the Cooper-Jacob Step Test and Theis Recovery Test methods. The results of the 72-hr pump test estimated hydraulic conductivity at 1.70 x 10^{-3} cm/s during pumping and 3.5 x 10^{-3} cm/s during recovery.

Groundwater elevations used in the groundwater velocity calculations for the subsurface materials (undifferentiated fill, regolith and bedrock or a combination thereof) were chosen based on proximity to the CPNPP Units 3 and 4 installation centerlines and distances to SCR. Monthly groundwater gradients, velocities, and travel times are presented in Table 2.4.12-211.

Soil distribution characteristics for radiological isotopes (i.e., Co_{60}, Cs_{137}, Fe_{55}, I_{129}, Ni_{63}, Pu_{239}, Tc_{99}, U_{235}) were determined from soil and water samples collected along the preferred groundwater flow path. This data is discussed in detail in Subsection 2.4.13 to assist in the development of transport calculations for fate and transport analyses in the event of accidental releases of effluents to groundwater.

2.4.12.3.1 Groundwater Pathways

Although the discussions of groundwater movement is a reasonable scenario for groundwater flow, it is assumed that the actual groundwater is subject to three-dimensional control structures (horizontal, vertical, and any secondary porosity that may be present) and does not have uniform flow across the site.

Two postulated groundwater pathway scenarios, Unit 3 to SCR (through the regolith and the undifferentiated fill) and Unit 4 to SCR (through the undifferentiated fill and regolith), represent the most conservative pathways from a two reactor site where groundwater flow is possible in different directions from each unit. Both flow paths use a conservative straight-line flow path approach, using the shortest distance and the highest measured hydraulic conductivity. A straight line flow path would be considered the most conservative as the actual groundwater pathways are expected to be tortuous, resulting in longer transport times, and hydraulic conductivities (K_h) of the fractures/joints would be ~~(or are) expected to be~~ lower than the highest measured on-site. The straightline distance CTS-00656 from Unit 3 to SCR is 530 ft and the straight line distance from Unit 4 to SCR is 607 ft. The steepest measured gradient for the undifferentiated fill material from Unit 3 to SCR is 0.104 ft/ft and from Unit 4 to SCR is 0.109 ft/ft. To calculate the travel time in the undifferentiated fill material from each of the units to SCR, the highest measured hydraulic conductivity of 5.00 X 10^{-4} cm/s was used. Table 2.4.12-211 provides the calculated travel times based on monthly measured gradients. These pathways are discussed further in 2.4.13. RCOL2_2.4.13-5

Based on the average effective porosity of 0.20 and the parameters stated above, the groundwater travel time from CPNPP Unit 3 to SCR in the undifferentiated fill/regolith is 720.9 days and the travel time in the undifferentiated fill/regolith from Unit 4 to SCR is 782.6 days.

The undifferentiated fill is expected to be removed ~~and the plant~~during construction to achieve a final plant grade elevation of 822 ft ~~would then be situated near~~msl approximately equivalent to the top of the Glen Rose Formation (shallow bedrock or B-zone). The foundation elevation is estimated to be a 782 ft msl and the basement elevation is estimated to be at 785 ft msl. Therefore, an alternative conceptual model of transport through the shallow bedrock limestone was developed using the straight-line pathway and Darcy's equation. Using the average porosity of limestone, 0.14, the highest hydraulic conductivity, 1.37 ~~X~~x 10^{-5} cm/s, and the steepest gradient measured from the monthly gauging events (Table 2.4.12-211), the travel time from Unit 3 to SCR through the bedrock ~~is~~was estimated to be 19,615.0 days and the travel time from Unit 4 to SCR through the bedrock ~~is~~was estimated to be 22,737.6 days. These pathways are discussed in Subsection 2.4.13. RCOL2_2.4.13-5 CTS-00657 RCOL2_2.4.13-5

The current soil and rock material comprising the hydrologic A-zone (undifferentiated fill and regolith) and B-zones (shallow bedrock) discussed in Subsection 2.4.12.2.4 will be removed for construction of plant foundations, resulting in the removal of the perched groundwater from the power block area. Post-construction surface water infiltration to the Glen Rose Formation limestone will be reduced with the construction of surface water impoundments and an improved drainage system throughout the CPNPP Units 3 and 4 site. The grading and drainage plan and placement of engineered fill material are designed to preclude surface water infiltration into the limestone on which the foundation will be constructed. RCOL2_2.4.13-4

Based on the excavation of the ~~site down to the plant grade of 822 ft and subsequent removal of virtually all soil material,~~perched zones in the A-zone and B-zones in power block area; the impermeable nature of the Glen Rose Formation, and the absence of any water wells producing from the Glen Rose Formation in the CPNPP Units 3 and 4 site area, impact to present and projected groundwater users is not anticipated. The ~~two~~ postulated groundwater pathway scenarios discussed in this subsection and further in Subsection 2.4.13, project SCR to be the nearest receptor. ~~If radionuclides were to reach SCR, their concentration is expected to be diluted by the volume of water contained in the reservoir and the impact to future water users is expected to be SMALL.~~ RCOL2_2.4.13-5

Evaluation of the accident effects of a contaminant release to groundwater from CPNPP Units 3 and 4 is discussed in detail in Subsection 2.4.13.

2.4.12.3.2 Nearby Groundwater Users

While no use of groundwater at the CPNPP site is planned, consideration is given for the movement of groundwater beneath the site because of pumping. Potable-use wells at CPNPP are completed in the Twin Mountains Formation, a confined aquifer below the impermeable Glen Rose Formation. Most domestic wells in the area are completed in the Twin Mountains Formation (Table 2.4.12-212). The on-site wells completed in the Twin Mountains Formation are not considered capable of reversing groundwater flow beneath the CPNPP Unit 3 and 4 site. There are no domestic or public water supply wells within a 0.5-mi. radius of the site that are completed in the Glen Rose Formation. (Figure 2.4.12-204). No off-site wells are considered capable of reversing groundwater flow beneath the site, or vice versa, based on the geographic positions of these wells (i.e., the distance of the domestic wells from the power block area and their completion in the Twin Mountain Formation).

2.4.12.4 Monitoring or Safeguard Requirements

Accident effects are discussed in Subsection 2.4.13 and the radiation protection program is discussed in Section 12.5. Additionally, analysis of the relationship of the CPNPP groundwater to seismicity and the potential for related soil liquefaction and the potential for undermining of safety-related structures is discussed in Section 2.5.

2.4.12.5 Site Characteristics for Subsurface Hydrostatic Loading

According to the Design Control Document (DCD) for the US-APWR, the design maximum groundwater elevation is 1 ft below plant grade. The CPNPP plant grade elevation is 822 ft msl; therefore, the design maximum groundwater elevation is 821 ft msl relative to the current elevation of the Glen Rose Formation. The Glen Rose Formation is an impermeable limestone that confines the groundwater in the underlying Twin Mountains Formation aquifer. Not all of the wells completed in the Glen Rose Formation were sampled; however, the wells that were sampled and purged, purged dry and water did not return for several days to weeks. All deep Glen Rose wells have been reported as "dry" or reported with less than 1-foot of water. This indicates the water gauged in the wells is a result of moisture from the rock and is not considered actual groundwater. The Twin Mountains Formation is at least 230 ft below the Glen Rose Formation; therefore, the installation and operation of a permanent dewatering system is not planned. ~~Dewatering during construction is expected to be required but, is not expected to be critical to the integrity of safety-related structures~~A dewatering system will not be required during construction. Normal construction practices will be employed to remove water from seepage and rainfall. As discussed in Subsection 2.5.4, ~~true~~ groundwater ~~table elevation~~ at the plant area is anticipated to be below the elevation of ~~about~~ 760 ft. and~~, in addition to the impermeable~~

CTS-00658

RCOL2_2.4.13-4

~~nature of the Glen Rose Formation,~~ the design maximum groundwater elevation is expected to be satisfied. CTS-00513

2.4.13 Accidental Releases of Radioactive Liquid Effluent in Ground and Surfacewaters

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CP COL 2.4(1) Add the following at the end of the DCD Subsection 2.4.13.

Historical and projected groundwater flow paths were evaluated in Subsection 2.4.12 to characterize groundwater movement from the nuclear island area to a point of exposure. Due to the higher groundwater velocity and faster travel time in the shallow soils (regolith/undifferentiated fill), this flow path is expected to be the bounding pathway of radionuclide migration. This pathway represents the most rapid transport for water released by a liquid tank failure. Figure 2.4.12-203 depicts subsurface conditions that control the movement of groundwater beneath the CPNPP Unit 3 and 4 site. Based on groundwater flow directions (Figure 2.4.12-208, Sheets 1, 4, 7, and 10), different flow paths are applicable from Units 3 and 4 to the nearest surfacewater body (SCR). Subsection 2.4.12 provides the locations and users of surface water in the CPNPP site area.

~~The Twin Mountains Formation is the nearest aquifer used for public supply. Since the Twin Mountains Formation is separated from the shallow soils by approximately 238 ft of the dense, impermeable limestone contained in the Glen Rose Formation, this pathway was not evaluated at the CPNPP Unit 3 and 4 site.~~ RCOL2_2.4.13-4

A conceptual model of radionuclide transport through groundwater to the nearest surfacewater body is described below. ~~The US-APWR DCD Subsection 11.2.3.2 evaluates the consequences of postulated failure of the holdup tanks, the waste holdup tanks, and the boric acid tanks. Subsection 11.2.3 indicates cubicles containing tanks of radioactive liquid are steel-lined up to a height of the full tank. In the event that the tank fails, the potential for groundwater contamination is greatly reduced. Consequently, release points are not identified.~~ RCOL2_2.4.13-7

2.4.13.1 Identification of Source Term and Soil/Water Distribution of Liquid Effluent

RCOL2_2.4.13-6a

In performing the evaluation of Postulated Radioactive Releases Due to Liquid-Containing Tank Failures the following tanks were considered in determining which tank would have the highest concentration and the largest volume of radionuclides:

Holdup Tank - located in the Auxiliary Building (A/B), a Seismic Category II building.

Waste Holdup Tank - located in the A/B

Boric Acid Evaporator - located in the A/B

Boric Acid Tank - located in the A/B

Volume Control Tank -located in the Reactor Building (R/B). a Seismic Category I Building. RCOL2_2.4.13-6a

Auxiliary Building Sump Tank - located in the A/B

Reactor Building Sump Tank - located in the R/B

Primary Makeup Water Tank - located outside

Refueling Water Storage Auxiliary Tank - located outside

Chemical Drain Tank - located in the A/B

The Volume Control Tank, the Chemical Drain Tank, and Sump Tanks were eliminated from consideration based on having smaller volumes and having radionuclide contents lower than the Boric Acid Tank (BAT). The Primary Makeup Water Tank was eliminated from consideration based upon the fact that the Primary Makeup Water Tank stores demineralized water from the Treatment System. and low level radioactive condensate water from the Boric Acid Evaporator. Condensate water contains low levels of radionuclide concentrations. including tritium. Additionally, the Refueling Water Storage Auxiliary Tank (RWSAT) was eliminated from consideration because it stores refueling water. Prior to refueling, tank water is supplied to the refueling cavity where the reactor coolant radionuclide concentration dilutes with refueling cavity water. Radionuclide concentration of cavity water is reduced by the purification system of the Chemical and Volume Control System (CVCS) and the Spent Fuel Pit Cooling and Purification System (SFPCS) during refueling operations. Upon refueling completion, part of the cavity water is returned to this tank where the radionuclide concentration is low. Accordingly. the impact of RWST or Primary Makeup Water Storage Tank failure is small.

After eliminating the tanks described above, the remaining tanks left to consider for the failure analysis are those in the A/B, which is a seismic category II Building. As shown in US-APWR DCD Figure 1.2-29, these tanks are located on the lowest elevation of the ~~Auxiliary Building~~A/B. In selecting the appropriate tank for the failure analysis, NUREG-0133 and the RATAF Code for Pressurized Water Reactors were utilized. The concentration of the radioactive liquid in the tanks, such as the Boric Acid Evaporator, the Holdup Tank, and the BAT, are larger than the Waste Holdup Tank since they receive reactor coolant water extracted from the Reactor Coolant System. Since the enrichment factor of 50 is considered for the liquid phase of the Boric Acid Evaporator. the radioactive concentrations in the liquid phase of the Boric Acid Evaporator, and in the BAT (which receives the enriched liquid from the Boric Acid Evaporator) becomes large when compared to the other tanks. The BAT has been selected since its volume is larger than the liquid phase of the Boric Acid Evaporator. Credit is taken for the removal effect by demineralizers or other treatment equipment for the liquid radioactive waste prior to entering the tank. No chelating agents are used in the plant system design in order to provide chemical control of the reactor coolant. Only a very small amount RCOL2_2.4.13-6a of chelating agents is used in the sampling system for analysis. The sampling drain, which contains only a small amount of chelating agents is directly sent to the dedicated chemical drain tank and treated separately. There are no chelating agents in the tank and therefore, no effect on the source used in the accidental release analysis. RCOL2_2.4.13-3

The source term concentrations considered for these tanks are identified in DCD Table 11.2-17 and show the radioactivity concentrations closest to the nearest potable water supply. The BAT is located in the northeast (NE) corner of the A/B (see DCD Figure 12.3-1). The A/B basemat elevation is at approximately 785 ft msl. The BAT elevation is expected to be at 798 ft msl. Ground level at the site is expected to be at 822 ft msl. The BAT contained the largest concentration and volume of radionuclides that was closest to the effluent concentration limits for Cs-134 and Cs-137, yet well below the 10 CFR 20, Appendix B limits. Isotope concentrations less than 1.0 x 10^{-3} in fraction of concentration limits are excluded from the evaluation. Since credit cannot be taken for liquid retention by unlined building foundations, it is assumed that 80 percent of the contents of each tank is released to the environment, consistent with the guidance in BTP 11-6, March 2007. In releasing the contents of one tank, it is assumed that 80 percent of the tank volume is discharged and the dilution factor of each tank is 4.4 x 10^{10} gallons. RCOL2_2.4.13-6b RCOL2_2.4.13-1

In performing the tank failure analysis, no credit is taken for the distribution of radiological liquid waste to the surrounding subsurface media and groundwater., ~~which is below grade. With the failure of a liquid tank inside the Auxiliary Building and subsequent liquid release to the environment, radionuclides enter the subgrade soils below the surrounding grade. A conservative model assumes the effluent liquid completely fills the soil pore space in an area large enough to contain the tank contents. Radionuclides are then released to the groundwater and transported to SCR where the volume of water contained in the reservoir is expected to dilute their concentration and eliminate impact to potential future water users. The overburden soils continually receive the average annual on-site precipitation. The precipitation that does not runoff or is lost to evapotranspiration infiltrates through the unsaturated zone and contributes to groundwater transport to SCR.~~ RCOL2_2.4.13-7

While groundwater functions as the transport media for fugitive radionuclides, interaction of individual radionuclides with the soil matrix delays their movement. The solid/liquid distribution coefficient, K~~d~~$_d$, is, by definition, an equilibrium constant that describes the process wherein a species (e.g., a radionuclide) is partitioned by adsorption between a solid phase (soil) and a liquid phase (groundwater). Soil properties affecting the distribution coefficient include the texture of soils (sand, loam, clay, or organic soils), the organic matter content of the soils, pH values, the soil solution ratio, the solution or pore water concentration, and the presence of competing cations and complexing agents. Because of its dependence on many soil properties, the value of the distribution coefficient for a specific radionuclide in soils can range over several orders of magnitude under different conditions. The measurement of distribution CTS-00659 coefficients of radionuclides within the preferential groundwater pathways allows further characterization of the rate of movement of fugitive radionuclides in groundwater.

The site-specific K_d coefficients were selected based upon radionuclides listed in 10 CFR Part 20, Appendix B, Table 2. Three soil borings were chosen for sampling characteristics. Soil and groundwater samples were collected from monitoring wells MW-1201 (located southwest of the Unit 4 nuclear island), MW-1208 (located east of the Unit 3 nuclear island), and MW-1219 (located northeast of the Unit 4 nuclear island) (Figure 2.4.12-207). Soil samples from each monitoring well were collected, based on the availability of recovered soils, at depths ranging from approximately 18 to 54 feet below ground surface. Dry wells exhibiting very slow recharge, and the aquifer testing observations wells were not considered for sampling. Soil boring samples gathered from the two hydraulically upgradient wells and hydraulically downgradient wells were submitted to Argonne National Laboratory for analysis of the radionuclides listed in FSAR Section 2.4.13 based upon the radionuclides listed in 10 CFR Part 20, Appendix B and those radionuclides that would be expected to exist in the tanks were considered for the failure analysis. The soil boring samples were submitted for laboratory analysis of soil distribution characteristics for specific radiological isotopes (i.e., Co-60, Cs-137, Fe-55, I-129, Ni-63, Pu-242, Sr-90, Tc-99, U-235). Results of the K_d analyses are presented in Table 2.4.13-201. ~~Site-specific groundwater flow velocities and travel times are presented in Table 2.4.12-211. Hydraulic conductivities, porosity, and bulk density of the subsurface soils and bedrock are described in Subsection 2.4.12.2.4. Groundwater pathways are discussed in Subsection 2.4.12.3.~~ RCOL2_2.4.13-2 RCOL2_2.4.13-2 RCOL2_2.4.13-2

~~The consistency between the results of the three samples across the CPNPP Unit 3 and 4 site submitted for Kd analysis indicate that radionuclides would be delayed in their movement through the groundwater pathway to SCR. If radionuclides were to reach SCR, their concentration is expected to be diluted by the volume of water contained in the reservoir and impact to potential future water users is expected to be SMALL.~~

~~Analysis of the consequences of postulated tank failures to the environment is discussed in Subsection 11.2.3.2.~~

Since the A/B is where the BAT, the Holdup Tank and the Waste Holdup Tanks are to be located at Units 3 and 4, appropriate values were evaluated for "nuclides of interest" (Table 2.4.13-201) based on transport to SCR without retardation or retention through subsurface media. Thus, using the conservative transport time analysis, and considering nuclide decay times, those nuclides which could be expected to challenge 10 CFR Part 20, Appendix B, concentration limits were considered. The BAT was selected as the tank that had the greatest volume and largest concentration of radionuclides. Cs-137 and Cs-134 were nuclides of interest in the BAT since credit is taken for removal equipment and demineralizer beds. Cs-137 was one of the nuclides selected for K_d analysis Movement of Cs-134 through the subsurface media would be similar to Cs-137 as they have chemically and radiologically similar characteristics. The purpose of the K_d analysis was to estimate the potential migration of accidental releases from the footprint areas of the proposed new units. The K_d results presented in Table 2.4.13-201 indicate that the radionuclides would be delayed in their movement through the groundwater pathway to SCR. The tank failure analysis assumed no distribution of contaminants (no K_d coefficients used) based upon the site-specific hydrogeological characteristics. It is conservatively assumed that the contaminants would transport along the groundwater pathway horizontally to SCR without retardation or retention in the subsurface media, and that there would be no groundwater dilution prior to reaching SCR. RCOL2_2.4.13-2

2.4.13.2 Development of Alternate Conceptual Model and Site-Specific Geological and Hydrogeological Parameters RCOL2_2.4.13-5

The alternative conceptual models were used to determine a bounding set of plausible groundwater flow paths by considering the nearest surface water body, SCR, current groundwater elevations measured in wells near the proposed power block area, the measured pool elevation of SCR (gradient to the SCR) and a conservative pathway from a postulated release point to SCR.

CPNPP Units 3 and 4 are to be constructed on the Glen Rose Formation. The Glen Rose limestone is essentially impermeable, ranging from 217 to 271 ft thick, and is underlain by the Twin Mountains Formation, which contains the first aquifer beneath the site. Figures 2.5.5-202 and 2.5.5-203 provides a generalized cross section of the pre-construction site conditions. The groundwater flow pathways were developed based on groundwater measured in monitoring wells in the CPNPP Unit 3 and 4 plant area and measured elevations in SCR. Wells were installed across the site in zones to define the groundwater bearing capabilities and properties of the zones, and identify the hydraulic connectivity between the zones, if any. The well zones are defined as A-Zone (regolith or undifferentiated fill material), B-Zone (shallow bedrock) and C-Zone (deeper bedrock) and are described in Subsection 2.4.12.2.4. RCOL2_2.4.13-4

The process used to develop alternative conceptual models of groundwater flow included the following:

- Groundwater flow pathways were developed based on groundwater measured in monitoring wells in the Units 3 and 4 plant area, measured elevations in SCR, surface topography, and observed water levels over time.
- Groundwater measured in all three zones was considered perched based on measurements. Groundwater in the A-zone regolith was attributed to surface water infiltration. Groundwater measured in the undifferentiated fill near SCR was attributed to SCR.
- Groundwater in the B-zone was not continuous across the site Non-equilibrium conditions and the reported dry wells in the B-zone wells

indicated that the groundwater was perched. Groundwater located in fill areas near SCR was found to be in communication with SCR. RCOL2_2.4.13-4

- Negligible groundwater was gauged in the C-zone wells, representing essentially dry conditions. Consequently, this zone was not considered a groundwater bearing unit.
- In Subsection 2.4.12.3.1, two postulated groundwater pathways scenarios are described through the regolith or undifferentiated fill as straight line pathways from Unit 3 to SCR and Unit 4 to SCR. These represent the most conservative pathways from a two reactor site where groundwater flow is possible in different directions from each unit. Although the undifferentiated fill is expected to be removed in the power block area, it is expected to remain in place near the SCR.

2.4.13.3 Potential Effects of Construction on Groundwater Flow Paths

RCOL2_2.4.13-4

The current soil and rock material comprising the hydrologic A-zone (undifferentiated fill and regolith), and the B-zone (shallow bedrock) will be removed for construction of plant foundations, resulting in the removal of the perched groundwater from the plant area. Post-construction surface water infiltration to the Glen Rose Formation limestone will be reduced with the construction of surface water impoundments and an improved drainage system throughout the Units 3 and 4 site. The grading and drainage plan and placement of engineered fill material are designed to preclude surface water buildup near the plant foundation, reducing the possibility of surface water infiltration into the limestone on which the foundation will be constructed.

During construction, the undifferentiated fill material and regolith will be removed in the power block area, and replaced with engineered fill material. A dewatering system will not be used but rainfall and seepage will be removed during construction.

2.4.13.4 Vertical Liquid Effluent Release Pathway

RCOL2_2.4.13-6c

Both SCR and the Units 1 and 2 restricted potable water supplies wells were considered as receptors. The Units 1 and 2 potable water supply wells are restricted access potable water supply wells completed in the Twin Mountains Formation aquifer. The nearest unrestricted potable water supplies completed in the Glen Rose Formation are approximately 4 miles south of the CPNPP site. and the nearest unrestricted potable water supply wells completed in the Twin Mountains Formation is approximately 0.5 mi south of the site (see FSAR Subsection 2.4.12.3.2 and Figures 2.4.12-204 and 2.4.12-206). The restricted potable water supply wells in Units 1 and 2 (see Figure 2.4.1-213) were not considered as possible receptors based upon the following:

The BAT is at elevation 798 ft msl, while the Auxiliary Building basemat elevation is at 786 ft msl. Since the Auxiliary Building is a Seismic Category II Building, it is RCOL2_2.4.13-6c assumed that a crack will form in the building during a seismic event, and the radioactive liquid would travel vertically into the surrounding formation. At this basemat elevation of 785 ft msl, the hydrogeologic formation is in the deeper portion of the Glen Rose Formation, which consists primarily of impermeable limestone. For the release to reach the Twin Mountains Formation, which is approximately 150 feet below the Glen Rose Formation, the liquid release would have to travel completely through the Glen Rose Formation. Units 1 and 2 performed an analysis and provided a model of this vertical release path (Reference 2.4-214). The results of the model indicate that the only radionuclide that would travel the length of the Glen Rose Formation was Cs-137, and that it would take approximately 400 years to reach the Twin Mountains Formation. The closest Units 1 and 2 potable water supply well is approximately 1.25 miles away (Figure 2.4.1-213) from either the Unit 3 or Unit 4 Auxiliary Building (Figure 2.4.12-208). Considering that the liquid release would be in the Glen Rose Formation and the travel time vertically to the Twin Mountains formation is approximately 400 years for Cs-137 (one of the radionuclides considered in the Units 3 and 4 tank failure analysis), it is concluded that the vertical pathway to the Twin Mountains Formation is not plausible and accordingly, was eliminated as a pathway. RCOL2_2.4.13-6c

Because the Units 1 and 2 restricted potable water supplies were eliminated, the time for Cs-137 to travel through the Glen Rose Formation is approximately 400 years, and the nearest unrestricted potable water supply is approximately four miles south of the CPNPP site, the SCR receptor is considered the only plausible horizontal groundwater flow release path. The deeper bedrock is not conductive to groundwater travel due to the impermeable limestone layer. Therefore, the alternate conceptual models chosen were to transport the liquid radioactive release through the undifferentiated fill/regolith and shallow bedrock in a straight-line pathway to SCR (as described in FSAR 2.4.12.3.1).

2.4.13.5 Horizontal Liquid Effluent Release Pathway

RCOL2_2.4.13-5

Site-specific groundwater flow velocities and travel times are presented in Table 2.4.12-211. Hydraulic conductivities, porosity, and bulk density of the subsurface soils and bedrock are described in Subsection 2.4.12.2.4. Groundwater pathways are discussed in Subsection 2.4.12.3. Four postulated groundwater pathway scenarios, Unit 3 to SCR (through the regolith/ undifferentiated fill and through shallow bedrock) and Unit 4 to SCR (through the undifferentiated fill/regolith and through shallow bedrock) were evaluated. In all four cases, the location of the most limiting tank. the Boric Acid Tank, was the northeast corner of the Auxiliary Building. The four pathways represent the most conservative straight-line flow paths, or worse-case scenarios. The basis for selecting these pathway scenarios is discussed below.

Actual groundwater flow from the postulated release point to SCR is expected to be tortuous and result in longer transport times. To define a conservative worse-case scenario, a simplified, straight-line pathway through the two media was utilized. This simplified approach was selected rather than simulating flow through a complex, three-dimensional flow path. The limestone in C-zone beneath the foundation is considered impermeable. Although groundwater was identified within the undifferentiated fill/regolith and bedrock beneath the CPNPP Units 3 and 4 sites, the groundwater was considered "perched" as evidenced by the lack of equilibrium in the groundwater monitoring wells. The four scenarios are presented in Table 2.4.12-211. Determination of the actual tortuous pathway utilizing a three-dimensional analysis would be less conservative than the theorized pathways through the undifferentiated fill/regolith (Scenarios 1 and 3) or the shallow bedrock limestone (Scenarios 2 and 4). RCOL2_2.4.13-5

To further add conservatism, the highest measured hydraulic conductivity and steepest measured gradient were used in the velocity calculations for transport time to SCR. Actual hydraulic conductivity would be variable along the actual groundwater pathways and would result in a lower effective hydraulic conductivity for the groundwater flow path. The four scenarios and the calculated travel times are:

- Scenario 1 estimates the groundwater travel time between the northeast corner of the Unit 3 Auxiliary Building and SCR through the undifferentiated fill/regolith. Groundwater levels from groundwater monitoring well MW-1217a, a screened well in the regolith/undifferentiated fill zone, and the surface water elevation of SCR were used. The steepest measured groundwater gradient within the undifferentiated fill material was 0.104 ft/ft. Based on the average effective porosity of 0.20 and a hydraulic conductivity of 5.00 x 10^{-4} cm/s, the velocity was estimated to be 0.7350 ft/day. Using these parameters, the groundwater travel time was 720.9 days (approximately 2 years).

- Scenario 2 estimates the groundwater travel time between the northeast corner of the Unit 3 Auxiliary Building and SCR through the shallow bedrock. Groundwater levels from groundwater monitoring well MW-1217b, a screened well in the shallow bedrock zone, and the surface water elevation of SCR were used. The steepest measured groundwater gradient within the shallow bedrock zone was 0.0974 ft/ft Based on the average effective porosity of 0.14 and a hydraulic conductivity of 1.37 x 10^{-5} cm/s, the velocity was estimated to be 0.0270 ft/day. Using these parameters, the groundwater travel time was 19,615 days (approximately 54 years).

- Scenario 3 estimates the groundwater travel time between the northeast corner of the Unit 4 Auxiliary Building and SCR through the undifferentiated fill/regolith. Groundwater levels from groundwater monitoring well MW-1215a, a screened well in the regolith/undifferentiated fill zone, and the surface water elevation of SCR were used. The steepest measured gradient within the regolith undifferentiated fill material was 0.109 ft/ft. Based on an average effective porosity of 0.20 and a hydraulic conductivity of 5.00 x 10^{-4} cm/s, the velocity was estimated to be 0.7760 ft/

day. Using these parameters, the groundwater travel time was 782.6 days (approximately 2 years). RCOL2_2.4.13-5

- Scenario 4 estimates the groundwater travel time between the northeast corner of the Unit 4 Auxiliary Building and SCR through the shallow bedrock. Groundwater levels from groundwater monitoring well MW-1215b, a screened well in the shallow bedrock zone, and the surface water elevation of SCR were used. The steepest measured gradient within the shallow bedrock zone was 0.0962 ft/ft. Based on an average effective porosity of 0.14 and a hydraulic conductivity of 1.37 x 10^{-5} cm/s the velocity was estimated to be 0.0267 ft/day. Using these parameters, the groundwater travel time was 22,737.6 days (approximately 62 years).

Plausible groundwater flow paths were developed based on the groundwater gradient determined from groundwater elevations measured in the proposed plant area and the elevation of SCR, on surface topography, and on observed water levels over time. These pathways, together with conservative assumptions were then used to determine the range of travel times for the accidental release analysis scenarios.

2.4.13.6 Dilution Effects of Horizontal Liquid Effluent Release Pathway

RCOL2_2.4.13-1

The computer code model utilized in the tank failure was the RATAF computer code for pressurized water reactors that is provided in NUREG-0133. The RATAF code defines the Hydrological Travel time as the time it takes for the liquid waste of a failed tank to reach the nearest potable water supply or nearest surface water in an unrestricted area.

The tank failure analysis, as described in DCD Subsection 11.2.3.2, was performed in accordance with Standard Review Plan (SRP) 2.4.13 and takes no credit for the dilution effects of groundwater nor retention or retardation in the regolith, undifferentiated fill, or the Glen Rose Formation. Because there is no “unrestricted” potable water supply or surface water body in close proximity to the Comanche Peak site, the analysis was conservatively performed by considering the potential for the liquid radioactive release to reach either the Unit 1 and 2 restricted potable water supply wells or Squaw Creek Reservior (SCR). The vertical pathway to the Twin Mountains formation, where the Unit 1 and 2 potable water supplies exist, was eliminated from consideration. The horizontal pathway through the regolith/undifferentiated fill and shallow bedrock was assumed to be a straight line to SCR. In reality, actual grounwater flow form the postulated release point to SCR would be more tortuous, resulting in longer transport times. Therefore, a simplified, straight-line pathway through the two media identified is a more conservative, worse-case scenario than simulating flow through a complex, three-dimensional flow path. The A-zone undifferentiated fill or regolith, and the B-zone shallow bedrock geologic hydrogeologic characteristics indicate that the liquid release will not concentrate in these zones. It is conservatively assumed that the liquid release would travel with the groundwater through the impermeable limestone to SCR.

The BTP 11-6 tank failure analysis used an equivalent volume of water reported in SCR of 4.4 x 10^{10} gallons. This same dilution volume was used in the Units 1 and 2 Standard Review Plan (SRP) 2.4.13 and 10 CFR 100.20(c)(3) assessment. Additionally, it was conservatively assumed that the travel time to the SCR was 365 days. It was also assumed that there would be no retardation or retention by the subsurface strata, and that groundwater would not dilute the released liquid radioactive waste. A-Zone is undifferentiated fill or regolith material and the B Zone is shallow bedrock of the Glen Rose Formation. There will be no concentration of the release because there is no credible mechanism in these subsurface strata. Therefore, liquid radioactive waste is expected to move slowly and not concentrate in the subsurface media. It should also be noted that no credit is taken in the tank failure analysis for retardation or retention in the subsurface media, or dilution in the groundwater. RCOL2_2.4.13-1

2.4.13.7 Summary of Accidental Releases of Radioactive Liquid Effluent in Ground and Surface Waters

RCOL2_2.4.13-7

The tank failure analysis described in the US-APWR DCD Subsection 11.2.3.2 was performed in accordance with Branch Technical Position (BTP) 11-6 for the CPNPP Units 3 and 4. The computer code model used in the BTP 11-6 analysis was performed utilizing the RATAF computer code for pressurized water reactors that is provided in NUREG-0133 entitled "Preparation of Radiological Effluent Technical Specification for Nuclear Power Plants". The RATAF code defines the Hydrological Travel time as the time it takes for the liquid waste of a failed tank to reach the nearest potable water supply or nearest surface water in an unrestricted area. Although the nearest potable water supply and the nearest surface water body are located in the restricted areas of the CPNPP site, the potable water supply wells for the CPNPP Units 1 and 3 and SCR, respectively, were conservatively considered in this evaluation.

The BTP 11-6 tank failure analysis used an equivalent volume of water reported in SCR of 4.4 x 10^{10} gallons. This same dilution volume was used in the Units 1 and 2 Standard Review Plan (SRP) 2.4.13 and 10 CFR 100.20(c)(3) assessments. Additionally, in the BTP 11-6 tank failure analysis, it was conservatively assumed that the travel time to SCR was 365 days, that there is no retardation or retention by the subsurface strata, and that the groundwater did not dilute the released liquid radioactive waste. In the tank failure analysis, the dilution effects of SCR were considered and the concentrations provided in US-APWR DCD Table 11.2-17 show the calculated concentrations based upon the conservative travel time to the SCR of 365 days, with the dilution effects associated with SCR. In this BTP 11-6 evaluation model, it was determined that the BAT contained the largest quantity and concentration of radionuclides that could possibly challenge the 10 CFR 20, Appendix B limits, and that 80 percent of the contents with a 0.12 percent fuel defect level would be delivered to the SCR.

The BAT is located in the northeast (NE) corner of the A/B where the basemat is at an approximate elevation of 785 ft msl. Site specific hydrogeological data discussed in Subsection 2.4.12 and Units 1 and 2 FSAR Subsections 2.4.12 and

2.4.13 was then used to discuss whether the vertical travel path to the Twin Mountains Formation was credible and to evaluate the horizontal travel time of groundwater in the regolith and shallow bedrock of the Glen Rose Formation. The Glen Rose Formation limestone is considered impermeable beneath the CPNPP site, and groundwater measured in this limestone is considered "perched". However, in order to evaluate the effects of a postulated vertical release to the Twin Mountains aquifer, a conservative mathematical model with simplifying assumptions was used to model the dispersion of a liquid release through the Glen Rose Formation limestone as described in the CPNPP Units 1 and 2 FSAR Section 2.4.12. The results of this simplified analysis indicate that only one radionuclide, Cs-137, would penetrate the entire 150 feet depth of the Glen Rose Formation limestone to reach the Twin Mountains aquifer and it would take 400 years. Based upon this evaluation, and the results of the geologic and hydrogeologic investigations conducted at the CPNPP site, vertical transport of the liquid radioactive release through the Glen Rose Formation limestone to the deeper Twin Mountains aquifer is not considered probable. As a result, the vertical travel path was eliminated. Estimated velocity and travel times were calculated based upon CPNPP site specific data where it was determined that it would take 720.9 days or approximately 2 years for groundwater to reach SCR. Because vertical migration through the impermeable limestone is not probable, a straight-line flow pathway form the postulated release point to SCR was considered a worse-case scenario and used as the bounding condition for the CPNPP Units 3 and 4 site. Evaluation of the site-specific hydrogeological information (porosity, hydraulic conductivity, groundwater gradient, etc, including equations, assumptions and methods), it was determined that the most conservative time for a liquid release from the BAT release in the NE corner of the AIB to travel horizontally through the regolith and undifferentiated fill to reach SCR was approximately 2 years (720.9 days). RCOL2_2.4.13-7

Since the DCD Section 11.2.3.2 tank failure analysis conservatively chose a travel time of 365 days to reach SCR. The site-specific hydrogeologic data shows a travel time of approximately 2 years (720.9 days), no credit is taken for retardation or suspension in subsurface media, or dilution by the groundwater prior to reaching SCR. Therefore, it is concluded that the limits of 10 CFR 20, Appendix B are met for the BAT Cs-134 and Cs-137 liquid release, and the site-specific hydrogeology bounds the US-APWR DCD Section 11.2.3.2 tank failure release analysis assumptions for travel time and dilution effects of SCR. 10 CFR 20, Appendix B states: "The columns in Table 2 of this appendix captured "Effluents," "Air," and "Water," are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of §20.1302. The concentration values given in columns 1 and 2 of Table 2 are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (50 millirem of 0.5 millisieverts)." The receptor concentrations from the BAT of Cs-134 and Cs-137 in SCR do not exceed the limits of 10 CFR 20. Appendix B. Table 2, and thus the requirements of 10 CFR 20.1301, 20.1302 and 10 CFR 100 are satisfied.

average thickness of Layer C is greater than 60 ft and dips less than 1°. The average shear wave velocity of Layer C is greater than 6000 ft/sec, as determined from the 15 suspension log borings. Profiles for development of the GMRS and FIRS are detailed in Subsection 2.5.2.6 and provide the criteria for exclusion or inclusion of specific layers including fill concrete and compacted fill.

The deep profile was characterized from regional wells and maps. Strata that define the deep profile are based primarily on lithology and stratigraphic surfaces projected to the CPNPP site to estimate the elevation. Velocity data for the deep profile was limited to only a few wells and consisted primarily of compressional wave velocities except where shear wave velocity data was available from a single well as discussed in the following section on uncertainties. Basement was defined as the depth at which a shear wave velocity of 9200 ft/sec and greater was achieved. Basement was therefore defined as the top of the Ellenburger limestone located at a depth of about 5300 ft at the site. The Ellenburger is a regionally extensive unit with an estimated shear wave velocity of nearly 11,000 ft/sec.

2.5.2.5.1 Description of Site Response Analysis

CTS-00515

The site response analysis was conducted in three steps that are common to analyses of this type. First, the site geology and geotechnical properties were reviewed and used to generate multiple synthetic profiles of site characteristics. Second, sets of rock spectra were selected to represent rock ground motions corresponding to mean annual exceedence frequencies of 10^{-4}, 10^{-5}, and 10^{-6}. Finally, site response was calculated using an equivalent-linear technique, using the multiple synthetic profile and the sets of rock spectra representing input motions. These three steps are described in detail in the following sections.

2.5.2.5.1.1 Generation of Synthetic Profiles

To account for the epistemic and aleatory uncertainties in the site's dynamic properties, multiple of 60 synthetic profiles were generated using the stochastic model developed by Toro (Reference 2.5-432), with some modifications to account for the conditions at the Comanche Peak site. These synthetic profiles represent the site column from the top of the bedrock to the elevations where the GMRS and the various FIRS are defined (see Subsection 2.5.2.6). Bedrock is defined as having a shear-wave velocity of 9,200 fps, in order to achieve consistency with the new EPRI attenuation equations used for the rock hazard calculations (Reference 2.5-401). For each site column, this stochastic model uses as inputs the following quantities: (1) the median shear-wave velocity profile, which is equal to the base-case profile given in Table 2.5.2-227; (2) the standard deviation of ln(Vs) (the natural logarithm of the shear-wave velocity) as a function of depth, which is calculated from the values in Table 2.5.2-227; (3) the correlation coefficient between ln(Vs) in adjacent layers, which is taken from generic results for rock in Toro (Reference 2.5-432). Layer thickness was not randomized because the site's stratigraphy is very uniform.

The correlation coefficient between ln(Vs) in adjacent layers is estimated using the inter-layer correlation model from Toro (Reference 2.5-432) for USGS category A. In the log-normal randomization model used to calculate the synthetic Vs for each layer, it is possible for the synthetic Vs in the deeper formations to be greater than 9,200 fps. When this happens for a certain synthetic profile, the randomization scheme sets that Vs to 9,200 fps and defines the corresponding depth to be the depth to bedrock for that synthetic profile. CTS-00515

Figure 2.5.2-240 illustrates the Vs value for the first 10 synthetic profiles for the GMRS/FIRS1 site column. Figure 2.5.2-241 compares the median of these 60 Vs profiles to the Vs ± Variability values given in Table 2.5.2-227, indicating excellent agreement. The difference in the mean+sigma values below 800 m is a consequence of imposing the 9200 fps upper bound dictated by the bedrock Vs(see above). Figures 2.5-242 and 2.5-243 show analogous results for top portion the FIRS4 site column.

The best-estimate values for the damping ratio and for the stiffness degradation (G/Gmax) are given in Table 2.5.2-227. Except for the fill at the top of the FIRS4 soil column, materials are assumed to behave linearly, with constant damping and G/Gmax=1. The uncertainty in damping is specified as 35%, (following the generic values in EPRI, Reference 2.5-387) and the uncertainty in G/Gmax for fill is specified as 15% at $3x10^{-3}$% strain (following the generic values given by Constantino (Reference 2.5-433). The correlation coefficient between ln(G/Gmax) and ln(damping) in the fill is specified as -0.75. This implies that in synthetic profiles where the fill has higher than average G/Gmax, the fill tends to have lower than average damping. The degradation and damping properties are treated as fully correlated among layers in the same geological unit, but independent between different units. Figure 2.5.2-244 shows the damping ratios for the Strawn formation in the 60 synthetic profiles corresponding to FIRS1. Similarly, Figure 2.5.2-245 shows the G/Gmax and damping ratios for the 60 synthetic profiles corresponding to FIRS4.

Each set of 60 synthetic profiles, consisting of Vs and unit weight vs. depth, depth to bedrock, stiffness, and damping curves, is used to calculate and quantify site response and its uncertainty, as described below.

2.5.2.5.1.2 Selection of Rock Input Motions

Rock input motions were selected for input to the site response calculations using the seismic hazard results presented in Subsection 2.5.2. Uniform hazard response spectra (UHRS) for rock conditions corresponding to mean annual exceedence frequencies of 10^{-4}, 10^{-5}, and 10^{-6} were used. The base spectrum for each mean annual exceedence frequency was a broad-banded (BB) spectrum, because deaggregation and fitting of high-and low-frequency (HF and LF) spectra indicated the same high-frequency amplitudes. These spectra are plotted in Figures 2.5.2-229 through 2.5.2-231 and are given in tabular form in Table 2.5.2-219. The development of these spectra is documented in Subsection 2.5.2.4.4. The effect of choosing a broad-banded spectrum was investigated by also computing response to the 10^{-4} HF spectrum, and comparing that response to the 10^{-4} BB spectrum, as described in the next subsection. CTS-00515

2.5.2.5.1.3 Site Response Calculations

The site response calculations for Comanche Peak were performed using the Random Vibration Theory (RVT) approach. In many respects, the inputs and assumptions are the same for an RVT analysis and for a time-history based analysis (e.g., an analysis with the program SHAKE, Reference 2.5-434). Both the RVT and time-history (SHAKE, Reference 2.5-434) procedures use a horizontally-layered half-space representation of the site and use an equivalent-linear representation of dynamic response to vertically propagating shear waves. Starting from the same inputs (in the form of response spectra), both procedures will lead to similar estimates of site response (see, for example, Rathje and Ozbey, Reference 2.5-435). The main advantage of the RVT approach is that it does not require the spectral matching of multiple time histories to a given rock response spectrum. Instead, the RVT approach uses a probabilistic representation of the ensemble of all input motions corresponding to that given response spectrum and then calculates the response spectrum of the ensemble of dynamic responses.

Site-response calculalions were performed for the three broad-banded (BB) bedrock motions, and for the 10^{-4} HF motion,as described in the previous section.

In addition to the rock response spectra, the RVT site-response calculations require the following inputs: (1) the strong-motion duration associated with each rock spectrum; and (2) the equivalent-strain ratio to use in the eqivalent-linear calculations (this input is required for both the time-history and RVT approaches) and depends on magnitude. The duration is calculated from the de-aggregation results in Subsection 2.5.2.4.4 (Table 2.5.2-220), using standard seismological relations between magnitude, seismic moment, corner frequency, and duration (see, for example, Rathje and Ozboy, Reference 2.5-435) and using stress-drop and crustal Vs values typical of the eastern United States. The effective strain ratio is calculated using the expression (M-1)/10 (Reference 2.5-434). Values smaller than 0.5 or greater than 0.65 were brought into the 0.5-0.65 range, which is the range recommended by Kramer (Reference 2.5-436). The calculated values of duration and effective strain ratio are given in Table 2.5.2-230.

For each site column and each rock-motion input, separate site response calculations were performed for the corresponding 60 synthetic profiles. These results for each combination of input motion and site column were then used to calculate the logarithmic mean and standard deviation of the amplification factor. Results for the various site columns, and for the 10^{-4}, 10^{-5}, and 10^{-6} BB inputs, are given in Figures 2.5.2-233 and 2.5.2-235 through 2.5.2-238. Tabular results are provided in Tables 2.5.2-231 through 2.5.2-235.

No graphs showing peak strain vs. depth are included here because all materials, except the fill at the top of the FIRS4 and FIRS4_CoV50 columns, are treated as behaving linearly (see "Generation of Synthetic Profiles" above). The logarithmic-mean (over the 60 synthetic profiles) values of the peak strain in the fill are approximately 0.004%, 0.01%, and 0.03%, for the 10^{-4}, 10^{-5}, and 10^{-6} inputs, respectively. CTS-00515

In addition, Figure 2.5.2-246 compares the median amplification factors obtained for GMRS/FIRS1 site column using the 10^{-4} HF and BB rock inputs. Although Figure 2.5.2-246 shows that the BB spectrum gives larger amplification factors for frequencies above 3 Hz, the effect of this difference on the 10^{-4} site hazard will be negligible because most of the 10-4 hazard at all frequencies comes from distant events (see Figures 2.5.2-221 and 2.5.2-222). These distant events will generate a BB rock spectrum. The effect of a difference in amplification factors at 10-5 would be somewhat larger (and would result in lower mean site spectra) because roughly 40% of the 10-5 hazard comes from local, small-magnitude events (see Figures 2.5.2-223 and 2.5.2~224). As a result, use of the BB amplification factors for all magnitude-distance combinations in the soil-hazard calculations (Subsection 2.5.2.6.1.1) yields slightly conservantive hazard results at 10^{-5}, resulting in slightly conservative estimates of the design spectrum.

2.5.2.5.1.4 Aleatory and Epistemic Uncertainity CTS-00515

The shallow profile has been extensively characterized from over 150 geotechnical borings and geologic mapping of the area. The profile has been stratified based on vertical changes in lithology that can be mapped laterally from boring to boring. Standard deviations for the top of each shallow profile layer are less than 2 ft for the upper 200 ft of the profile. The standard deviation for the layers defining the shallow profile from about 200 ft to about 500 ft range from about 1 to 5 ft. Velocity data for the shallow profile acquired from 15 suspension borings demonstrated a strong correlation between the layering and places where simulated down-hole travel time gradient “breaks” occurred.

The deep profile was developed from regional wells and results in a higher uncertainity in both the layering (stratigraphy) and velocity measurements. Shear wave velocity measurements were available from a single well located about 6 mi from the site and was limited to the Barnett Shale (a shale unit at a depth of about 5000 ft) for a total depth interval of about 4000 ft (about 5000 ft depth to about 9000 ft depth). This data was used to develop a linear extrapolation to estimate shear wave velocity from available pressure wave velocities from other wells to complete the deep profile. Thus, the epistemic uncertainty for the deep profile is much greater than for the shallow profile.

The deep profile lacks a statistical basis for estimating a robust standard deviation for all layer velocities. The coefficient of variation (CoV=standard deviation/mean) calculated as 31% for the Atoka formation demonstrated the highest CoV for all deep profile layers. Therefore, the variability in velocity was calculated at 31% for than 10^{-4}. Under these conditions, the GMRS is calculated from Equation 7 above as 0.45 x SA(10^{-5}). Table 2.5.2-228 shows the 10^{-5} ground motion at the seven spectral frequencies for which ground motion equations are available, and shows the GMRS calculated as 0.45 x SA(10^{-5}).

Figure 2.5.2-234 shows the horizontal GMRS spectrum taken from Table 2.5.2-228, plotted with the horizontal CSDRS. This shows that the GMRS down to 0.5 Hz is enveloped by the CSDRS. As a result, extensive fitting of spectral shapes between the seven spectral frequencies indicated in Table 2.5.2-213 is not undertaken.

A seismic hazard calculation was made using the site amplification factors for the GMRS and four FIRS conditions (FIRS2, FIRS3, FIRS4, and FIRS4-CoV50). These calculations were made at the seven spectral frequencies at which ground motion equations were available from the EPRI (2004) study (100 Hz, 25 Hz, 10 Hz, 5Hz, 2.5 Hz, 1Hz,and 0.5 Hz). The CAV filter was applied for these calculations, and at all spectral frequencies, the 1E-4 amplitudes were zero (i.e. the highest hazard at low amplitudes was less than 1E-4). As a result, the GMRS and FIRS amplitudes were determined from (for example) GMRS = 0.45 x SA(I0^{-5}) where SA(I0^{-5}) is the spectral acceleration for I0^{-5} annual frequency of exceedence. CTS-00516

The horizontal 1E-5 and GMRS spectra were calculated at 39 frequencies between 0.1 Hz and 100 Hz for the GMRS elevation. Because of the very flat appearance of the spectra at the seven spectral frequencies at which hazard calculations were made, log-log interpolation between available hazard values was used, with the exception of the following frequency ranges.

1 Hz to 5Hz: Within this frequeney range, a peak inside spectra occurs at 2.5 Hz, reflecting a site amplification at about 2 Hz. To reflect this amplification, the 1E-5 spectral amplitude at 2.5 Hz was broadened using rock spectral shapes from NUREG/CR-6728 and using the broad-banded values of M=7.7 and R=890 km for 1E-5 (on which the site amplification calculations were based). This is an acceptable approximation given that the rock spectrum is decreasing between 2.5 and 1 Hz.

0.5 Hz to 0.1 Hz: Below 0.5 Hz, the assumption was made that spectral accelerations are proportional to f down to 0.125 Hz (where f is frequency), and are proportional to f^2 between 0.125 Hz and 0.1 Hz. This is a common assumption for spectral shapes at low frequencies.

Spectra for the four FIRS conditions (FIRS2, FIRS3, FIRS4, and FIRS4-CoV50 were calculated in a similar way. Note that the FIRS3 spectra have peaks at about 2 Hz and 10 Hz, and that the FIRS4 and FIRS4-CoV50 spectra have peaks at about 1.5 Hz and 5 Hz. These peaks were broadened in an approximate way similar to the procedure used for the GMRS.

These GMRS and FIRS spectra are plotted in Figures 2.5.2-247 through 2.5.2.-251 with the 1E-5 spectrum for each condition also plotted. Table 2.5.2-236 shows the numerical values for the 1E-5 and GMRS spectra, and Table 2.5.2-237 shows the numerical values for the 1E-5 and FIRS spectra. CTS-00516

2.5.2.6.1.2 Vertical GMRS Spectrum

Vertical motions at the CPNPP Units 3 and 4 site are addressed by reviewing results in NUREG/CR-6728 for V/H ratios at deep soil sites, for both the western US (WUS) and the CEUS. Example results presented in the US-APWR DCD indicate that for earthquakes >40 km from a deep soil site, V/H ratios are expected to be less than unity for all frequencies (Figures J-31 and J-32 in Appendix J of the DCD). For the 10^{-5} ground motion, expected distances from deaggregation are greater than 100 km (Table 2.5.2-220). Any exceedance of unity occurs for high frequencies (>10 Hz) for short source-to-site distances. Also, for ground motions with peak horizontal accelerations <0.2g, the recommended V/H ratios for hard rock conditions are less than unity; see Table 4-5 of the DCD. The conclusion is that V/H ratios for the CPNPP Units 3 and 4 site will be less than unity for all spectral frequencies. Therefore, the vertical GMRS will be below the horizontal GMRS shown in Figure 2.5.2-233.

Figure 2.5.2-234 shows that the horizontal DCD spectrum exceeds the horizontal GMRS. The vertical DCD spectrum equals or does not exceed the horizontal DCD spectrum for frequencies above 3.5 Hz. The conclusion is that the vertical DCD spectrum will also exceed the vertical GMRS. Under this condition, the DCD minimum vertical design motion will govern the vertical response, just as the DCD minimum horizontal design motion will govern the horizontal response.

Vertical GMRS and FIRS spectra were developed using vertical-to-horizontal (V/H) ratios. NUREG/CR-6728 and RG 1.60 indicate proposed V/H ratios for design spectra for nuclear facilities, and these V/H ratios are plotted in Figure 2.5.2-252. The V/H ratios in Figure 2.5.2-252 taken from NUGREG/CR-6728 (the blue curve) are recommended for hard sites in the CEUS. The Comanche Peak site is a deep, soft-rock site with shales and limestones near the surface having shear-wave velocities of about 2600 fps, and the V/H ratios for this site condition will be similar to those for hard roick sites. CTS-00516

Based on these comparisons, it is concluded that the applicable V/H ratios at the Comanche Peak site will be ≤ 1.0 at all spectral frequencies between 100 Hz and 0.1 Hz. As a conservative assumption, the V /H ratio is assumed to be equal to 1.0 at all spectral frequencies. This assumption is also plotted in Figure 2.5.2-252.

The result of this assumption is that the spectra plotted in Figures 2.5.2-247 through 2.5.2-251 for the GMRS and four FIRS conditions apply to both the horizontal and vertical motions.

Tables 2.5.2-236 and 2.5.2-237 document (respectively) the 10^{-5} UHRS and GMRS, and the 10^{-5} UHRS and FIRS. Because V /H is assumed to be equal to unity, these spectra apply to both horizontal and vertical motions. CTS-00516

2.5.2.6.2 Foundation Input Response Spectrum

Site response analyses were conducted for an additional four cases (FIRS 2, FIRS 3, FIRS 4_CoV30, and FIRS 4_CoV50) to consider foundation input response spectra for specific conditions different from the GMRS elevation. These four cases are as follows:

FIRS 2 - Set at elevation 787 ft.

This FIRS represents generic site response conditions for structures resting on fill concrete layer in which the fill concrete thickness and horizontal extent away from the edge of the foundation is significant and thus modeled as a horizontally infinite layer.

- FIRS 2 analysis demonstrates that the response at the top of the fill concrete remains well below the minimum earthquake and does not apply to any specific structure.

The FIRS 2 profile consists of 5 ft of fill concrete placed over a sub-excavated stiff limestone (Layer C) surface at elevation 782 ft. Fill concrete with compressive strength ranging from 2,500 psi to 4,400 psi is considered by using a mean shear wave velocity of 6800 fps with a range of +/- 500 fps. See Table 2.5.2-227 for properties used for FIRS 2 analysis. Note that the site-specific soil-structure interaction analyses described in Subsection 3.7.2 model the fill concrete under the category 1 foundations as part of the structural model.

FIRS 3 - Set at Plant Grade elevation 822 ft.

The FIRS 3 profile considers the ground surface seismic response in areas of the site where cutting of the native soil is required to reach final Plant Grade elevation 822 ft.

- FIRS 3 analysis demonstrates that the response at Plant Grade elevation in regions of the site with native soil remains below the minimum earthquake. It does not represent the foundation subgrade elevation for any safety-related facilities identified, but could accommodate possible future shallow (at-grade) facilities.

The profile consists of stiff limestone at elevation 782 ft and overlying shale (Glen Rose Layer B1 and B2) and interbedded limestone/shale (Glen Rose Layer A) to Plant Grade elevation 822 ft. See Table 2.5.2-227 for properties used for FIRS 2 analysis.

FIRS 4 - Set at Plant Grade elevation 822 ft:

2.5.4.5.4 Backfill Material

Backfill is required between the foundation excavation sidewalls and lower structural walls of seismic category I and II facilities, the main power block structures, and the UHS. The volume of backfill is minimized by using steep or vertical excavation cuts.

No exclusions are placed on the use of limestone or sandstone derived from the mass grading to develop plant grade or foundation excavations. The total volume of excavation in the Units 3 and 4 power block and UHS areas greatly exceeds the volume of required backfill. Shale materials are not acceptable for backfill material in structural areas because of their fine-grained nature, high plasticity, and expansion potential. Testing of limestone and shale samples is discussed in Subsection 2.5.4.2. Dynamic properties assigned to engineered backfill are discussed in Subsection 2.5.4.7.4. The source of backfill to be used adjacent to category I structures will be the limestone and sandstone removed from the excavation and that there will be sufficient quantity of material from the excavation for that purpose. The acceptance criteria, test method, and frequency of verification for fill placement are provided for each fill application in Subsection 2.5.4.5.4.8. Continuous geotechnical engineering observation and inspection of all fill is required to certify and ensure that the fill is properly placed and compacted in accordance with project plans and specifications. CTS-00514

Clean sand may be used as a select granular backfill material around the buried structure walls. A discussion of the materials for engineered fill is provided in Subsection 2.5.4.5.4.1.1. All major seismic category I and II buildings and structure are founded directly on solid limestone or fill concrete (subsection 3.7.1.3). Recommendations for concrete fill under power block structure foundations are provided in Subsection 2.5.4.5.4.1.2. CTS-00514

Concrete fill may be used as backfill to replace unsuitable rock removed below elevation 782 ft as part of foundation preparations. The concrete fill foundation details are shown on Figure 2.5.4-217.

2.5.4.5.4.1 Material Properties and Sources

2.5.4.5.4.1.1 Fill

All engineered fill materials need to contain no rocks or hard lumps greater than three inches in size, and require to have at least 80 percent of material smaller than 1/2 inch in size. No organic, perishable, spongy, or other improper material such as debris, bricks, cinders, metal, wood, etc. shall be present in the fill. Three types of engineered fill materials are used at the site.

Structural Fill: Structural fill is used in the majority of excavated areas around Units 3 and 4 and north-facing fill slope areas adjacent to SCR, except where select free-draining materials are required (filter and drain curtain) immediately behind the retaining walls. The structural fill requirements include the following.

centerline of the pipe, or preferably to 12 in above the top of the pipe and compacted by hand, pneumatic tamper, or other approved means without damaging the pipe or the coatings.

- Be compacted to a relative compaction of 90 percent, except in the structural areas or within 12 in below the roadways and slabs, where 95 percent relative compaction governs (ASTM D1557).
- Above the pipe zone, general structural fill may be used with a similar degree of compaction as specified for the bedding materials.

Fill is derived from either off-site borrow areas or on-site cut areas and foundation excavations. The excavated materials from on-site areas require appropriate segregation, handling, and processing. Geotechnical testing is required for all fill materials to verify that their characteristics and properties meet the minimum requirements.

2.5.4.5.4.1.2 Fill Concrete

Fill concrete and flowable fill mix designs are required to be approved in advance to ensure that they meet the minimum strength requirements. Continuous field observation is needed to verify that the appropriate mixes are used. A systematic quality control sampling and testing program is required to assure that the fill concrete and flowable fill material properties are in compliance with the design specifications.

The fill concrete has a design compressive stregth of 3,000 psi that corresponds to a shear wave velocity of 6,400 ft/sec. The fill concrete mix design is required to be approved in advance to ensure it meets minimum strength requirements. The fill concrete will generally conform to ASTM C94/C94M-07, "Standard Specification for Ready-Mixed Concrete." A systematic quality control sampling and testing program ensures that material properties are in compliance with design specifications. Field inspections verily that the required mix is used and that test specimens are collected for testing. CTS-00514

Testing of fill concrete will be performed by a qualified testing laboratoty that has an established quality assurance program that conforms to NQA-1 requirements. The testing laboratory will implement a concrete fill quality control program that will include all aspects of the fill concrete program from the qualificatin of materials to confirmatory strength testing. Field testing will utilize preapproved procedures that conform to ASTM C31/C31-08a, “Standard Practice for Making and Curing Concrete Test Specimens in the Field.”

Strength verification laboratory tests will be performed to confirm that the compressive strength of the fill concrete is satisfactory. The tests will be conducted using cylindrical test specimens molded during construction and will conform to ASTM C39/C39M-05e2, “Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.” The specimens will be taken from different batches of fill concrete. The strength of the fill concrete willbe considered satisfactory if the average compressive strength from three cylinders molded at a location equals or exceeds the required strength and no individual strength test falls below the required value by more than 500 psi. If these acceptance criteria are not met, an evaluation of the acceptability of the fill concrete for its intended function will be performed before acceptance. CTS-00514

The fill concrete testing results, non-conformance related to fill concrete, and QA audits of fill concrete activities will be reviewed and dispositioned to ensure that the fill concrete meets the specified strength requirement.

These measures will ensure that the design properties of fill concrete achieved during construction activities.

2.5.4.5.4.2 Compaction Requirement

All engineered fill materials need to be compacted at a moisture content of ±2 percent of the optimum, and to a minimum relative compaction of 95 percent in the structural areas and 90 percent in non-structural areas. The maximum dry density and optimum moisture content is determined in accordance with ASTM D1557.

2.5.4.5.4.3 Clearing and Preparing Fill Areas

Prior to placing engineered fill or concrete fill, the excavation bottoms or the ground surfaces to receive fill need to be observed, probed, tested, and approved by qualified personnel as part of the quality control measures.

2.5.4.5.4.4 Placing, Spreading, and Compacting Fill Material

All fill materials need to be placed in horizontal layers not greater than eight inches in loose thickness. Each layer is required to be spread evenly and mixed thoroughly to obtain uniformity of material and moisture in each layer.

When the moisture content of the fill material is below that specified, water needs to be added until the moisture content is as specified. When the moisture content of the fill material is too high, the fill material needs to be aerated through blading, mixing, or other satisfactory methods until the moisture content is as specified.

After each fill layer has been placed, mixed, and spread evenly, it needs to be thoroughly compacted to the specified degree of compaction. Compaction needs to be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compacting equipment. Equipment is required to be of such design and nature that it is able to compact the fill to the specified degree of compaction. Compaction should be continuous over the entire area and the equipment should make sufficient passes to obtain the desired uniform compaction.

than 20 ft deep and greater than 20 ft deep. Shear modulus and damping values are based on assumed mean S-wave velocities of 650 fps for surface fill, 800 fps for shallow fill, and 1000 fps for deeper fill, Poisson's ratio of 0.35, and wet unit weight of 125 pcf. Based on a minimum shear modulus variation factor (C_V) of 1.0, the Upper and Lower bound ranges for shear moduli for compacted fill are between 5.7 ksi and 22.8 ksi for surface fill, between 8.7 ksi and 34.6 ksi for fill between 3 ft and 20 ft deep, and between 13.5 ksi and 54.0 ksi for fill greater than 20 ft deep. The broad range between Lower and Upper Bound values accommodates significant variation in fill properties that are larger than typically achieved by controlled fill materials and placement specified in Subsection 2.5.4.5.4.1.1. This approach conservatively captures reasonable ranges for fill properties. Low-strain damping ratios are assigned as 1.5 percent for fill less than and equal to 20 ft deep, and 1.1 percent for fill deeper than 20 ft. EPRI-based (Reference 2.5-387) shear modulus reduction and damping curves for the compacted fill are shown on Figure 2.5.2-232.

Verification of the seismic S-wave velocity of the compacted fill material placed underneath the seismic category I duct banks is required to confirm that the actual S-wave velocity values of the backfill materials are within the above described variability.

2.5.4.8 Liquefaction Potential

CP COL 2.5(1) Replace the content of DCD Subsection 2.5.4.8 with the following.

In accordance with the requirements of 10 CFR Parts 50 and 100, an analysis of soil liquefaction potential was performed for soils adjacent to and under the seismic category I and II structures according to guidelines provided in RG 1.198. US-APWR Key Site Parameters (DCD Table 2.0-1) allows no liquefaction potential for seismic category I structures.

Soil materials that are considered to be susceptible to liquefaction include loose saturated sands and non-plastic silts. Liquefaction is typically restricted to Holocene and late-Pleistocene age alluvial soils and hydraulically-placed sand fill in areas of moderate to high seismicity. The site is an area of very low seismicity. The results of the ground motion and site response analysis indicate that the peak ground acceleration (PGA) ranges between 0.045g and 0.07g. CTS-00517

All seismic category I and power block structures associated with Units 3 and 4 are founded on stable Glen Rose Formation limestone Layer C, as discussed in Subsection 2.5.4.3. The Glen Rose Formation rock is late Cretaceous in age, indurated, and not susceptible to liquefaction. As discussed in Subsection 2.5.4.1, no paleoseismic evidence of past liquefaction was observed at the site, or is documented within the 25 mi radius region surrounding the site.

The foundation base mats of all seismic category I and II structures are founded on a limestone layer (engineering Layer C), with the exception of seismic category I duct banks that are embedded in compacted fill adjcent to the nuclear island. CTS-00517

The fill materials placed within the excavated areas around Units 3 and 4 and in the north-facing fill slopes are not considered prone to liquefaction for the following reasons: CTS-00517

- All fill material consists of engineered compacted fill with a minimum relative compaction of 95 percent (ASTM D1557). The corrected/normalized standard penetration test N-Values are expected to be higher than 30 blows per foot, which is outside the range considered susceptible to soil liquefaction.
- The engineered compacted fill materials are not in a saturated state. The permanent groundwater table is well below the engineered compacted fill materials.
- To minimize any potential for buildup of hydrostatic pressures within the engineered compacted fill, adequate drainage is provided for all below-grade structures and retaining walls, and at the base of all fill slopes.

Thus, the engineered compacted fill does not meet the conditions stated in RG 1.206 or RG 1.198 that would cause suspicion of a potential for liquefaction, and no liquefaction analysis is necessary. Even in the unlikely event that the engineered compacted fill became completely saturated, the soil density is too high and the site PGA range is too low to suspect a potential for liquefaction.

Liquefaction is therefore not a hazard to CPNPP Units 3 and 4 seismic category I or major plant structures, and the site characteristics meet the US-APWR Standard Design criteria.

Soil liquefaction is also not anticipated within the engineered compacted fill surrounding Units 3 and 4 structures because 1) the permanent groundwater is below the lowest elevation of fill and 2) fill is placed with a high degree of material control and compaction, and 3) the CPNPP site is an area of low seismicity with low GMRS design motions, as described in Subsection 2.5.2.

2.5.4.9 Earthquake Site Characteristics

CP COL 2.5(1) Replace the content of DCD Subsection 2.5.4.9 with the following.

This subsection briefly summarizes the derivation of the site GMRS and Safe Shutdown Earthquake (SSE) that are detailed in Subsection 2.5.2.6.

The CPNPP Units 3 and 4 site is in a stable continent area with relatively low regional stress and low regional seismicity, as described in Subsections 2.5.1 and 2.5.2, and summarized in Subsection 2.5.4.1. Design ground motions are also relatively low.

A performance-based, site-specific GMRS was developed in accordance with the methodology provided in RG 1.208. This methodology and the GMRS are

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Table 2.5.2-230

Calculation of Duration and Effective Strain Ratio for Rock Input Motions Considered in Site Response Calculations

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Case	Magnitude M	Distance R (km)	Seismic Moment Mo (dyn-cm)	Corner Frequency fc (Hz)	Duration T (sec)	Eff Strain Ratio
1E-4 HF	7.2	450	7.08E+26	0.09	33.04	0.62
1E-4 BB	7.6	820	2.82E+27	0.06	57.70	0.65
1E-5 BB	7.7	860	3.98E+27	0.05	61.74	0.65
1E-6 BB	7.8	860	5.62E+27	0.05	64.02	0.65

Table 2.5.2-231
Amplification Factors for the GMRS/FIRS1 Site Column

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-	Amplification Factor for 10^{-4}		Amplification Factor for 10^{-5}		Amplification Factor for 10^{-6}	
Freq (Hz)	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.
0.1	1.13	0.06	1.13	0.07	1.13	0.07
0.125	1.16	0.08	1.16	0.09	1.16	0.09
0.15	1.20	0.11	1.20	0.11	1.20	0.11
0.2	1.31	0.17	1.31	0.16	1.31	0.16
0.3	1.47	0.18	1.46	0.17	1.46	0.17
0.4	1.45	0.17	1.43	0.17	1.43	0.17
0.5	1.39	0.18	1.37	0.18	1.37	0.18
0.6	1.38	0.16	1.36	0.16	1.36	0.16
0.7	1.40	0.15	1.37	0.14	1.38	0.14
0.8	1.43	0.12	1.40	0.12	1.40	0.12
0.9	1.43	0.11	1.39	0.10	1.39	0.10
1	1.45	0.12	1.37	0.11	1.37	0.11
1.25	1.66	0.17	1.61	0.17	1.61	0.17
1.5	1.82	0.19	1.75	0.19	1.74	0.19
2	1.80	0.13	1.72	0.13	1.72	0.13
2.5	1.53	0.14	1.42	0.14	1.41	0.14
3	1.22	0.15	1.14	0.16	1.12	0.16
4	0.94	0.13	0.86	0.14	0.83	0.15
5	0.87	0.12	0.78	0.13	0.74	0.14
6	0.85	0.14	0.75	0.15	0.71	0.18
7	0.80	0.16	0.69	0.17	0.64	0.21
8	0.74	0.15	0.63	0.17	0.56	0.21
9	0.71	0.15	0.59	0.17	0.52	0.21
10	0.72	0.16	0.58	0.17	0.50	0.23
12.5	0.74	0.21	0.57	0.23	0.49	0.31
15	0.73	0.19	0.55	0.22	0.47	0.29
20	0.63	0.14	0.45	0.16	0.34	0.24
25	0.58	0.12	0.39	0.14	0.28	0.20
30	0.55	0.11	0.38	0.12	0.26	0.17
35	0.55	0.11	0.38	0.11	0.26	0.16
40	0.55	0.11	0.39	0.11	0.26	0.14
45	0.56	0.10	0.40	0.10	0.27	0.13
50	0.58	0.10	0.42	0.10	0.28	0.13
60	0.66	0.09	0.49	0.09	0.33	0.12
70	0.78	0.08	0.60	0.09	0.40	0.11
80	0.91	0.08	0.72	0.09	0.48	0.11
90	1.03	0.08	0.83	0.09	0.56	0.11
100	1.12	0.08	0.91	0.09	0.62	0.11

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Table 2.5.2-232
Amplification Factors for the FIRS2 Site Column

	Amplification Factor for 10^{-4}		Amplification Factor for 10^{-5}		Amplification Factor for 10^{-6}	
Freq (Hz)	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.
0.1	1.12	0.06	1.12	0.07	1.12	0.06
0.125	1.14	0.08	1.14	0.08	1.14	0.08
0.15	1.18	0.11	1.18	0.11	1.18	0.11
0.2	1.27	0.16	1.27	0.16	1.27	0.16
0.3	1.43	0.18	1.43	0.18	1.43	0.18
0.4	1.44	0.17	1.44	0.17	1.44	0.17
0.5	1.40	0.18	1.40	0.18	1.40	0.18
0.6	1.37	0.15	1.38	0.15	1.38	0.15
0.7	1.37	0.13	1.37	0.13	1.38	0.13
0.8	1.39	0.10	1.39	0.10	1.39	0.10
0.9	1.41	0.11	1.41	0.11	1.40	0.11
1	1.45	0.14	1.41	0.13	1.41	0.13
1.25	1.64	0.19	1.65	0.19	1.65	0.19
1.5	1.83	0.18	1.83	0.18	1.83	0.18
2	1.73	0.14	1.73	0.13	1.72	0.13
2.5	1.39	0.16	1.37	0.15	1.36	0.15
3	1.10	0.17	1.10	0.17	1.08	0.17
4	0.85	0.14	0.84	0.14	0.81	0.15
5	0.80	0.15	0.78	0.16	0.74	0.17
6	0.79	0.17	0.76	0.18	0.72	0.20
7	0.73	0.19	0.70	0.21	0.64	0.25
8	0.67	0.20	0.63	0.22	0.56	0.28
9	0.65	0.20	0.60	0.23	0.52	0.29
10	0.65	0.20	0.60	0.23	0.51	0.29
12.5	0.67	0.25	0.61	0.29	0.52	0.37
15	0.64	0.23	0.56	0.27	0.48	0.36
20	0.55	0.15	0.45	0.20	0.34	0.28
25	0.52	0.14	0.40	0.17	0.28	0.25
30	0.51	0.14	0.39	0.18	0.27	0.25
35	0.50	0.14	0.39	0.17	0.27	0.25
40	0.51	0.13	0.40	0.15	0.27	0.20
45	0.52	0.12	0.41	0.13	0.28	0.18
50	0.54	0.11	0.43	0.13	0.29	0.17
60	0.61	0.11	0.50	0.12	0.34	0.15
70	0.72	0.10	0.61	0.11	0.41	0.14
80	0.85	0.10	0.73	0.11	0.49	0.14
90	0.97	0.10	0.84	0.11	0.57	0.14
100	1.05	0.10	0.93	0.11	0.63	0.14

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Table 2.5.2-233
Amplification Factors for the FIRS3 Site Column

	Amplification Factor for 10^{-4}		Amplification Factor for 10^{-5}		Amplification Factor for 10^{-6}	
Freq (Hz)	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.
0.1	1.12	0.08	1.12	0.08	1.12	0.08
0.125	1.14	0.11	1.14	0.11	1.14	0.11
0.15	1.18	0.14	1.18	0.14	1.18	0.14
0.2	1.27	0.19	1.27	0.19	1.27	0.19
0.3	1.39	0.19	1.39	0.19	1.39	0.19
0.4	1.39	0.16	1.39	0.16	1.39	0.16
0.5	1.37	0.17	1.36	0.18	1.36	0.18
0.6	1.35	0.16	1.35	0.16	1.35	0.17
0.7	1.35	0.13	1.35	0.13	1.36	0.13
0.8	1.40	0.12	1.40	0.12	1.40	0.12
0.9	1.44	0.12	1.44	0.12	1.43	0.12
1	1.46	0.14	1.41	0.13	1.41	0.13
1.25	1.60	0.20	1.60	0.20	1.60	0.20
1.5	1.78	0.18	1.78	0.18	1.78	0.18
2	1.66	0.15	1.66	0.15	1.66	0.15
2.5	1.37	0.22	1.35	0.20	1.34	0.20
3	1.13	0.21	1.12	0.20	1.10	0.21
4	0.89	0.16	0.87	0.17	0.85	0.17
5	0.84	0.18	0.83	0.18	0.79	0.20
6	0.84	0.20	0.83	0.21	0.79	0.23
7	0.82	0.25	0.80	0.26	0.75	0.30
8	0.80	0.28	0.77	0.30	0.72	0.34
9	0.83	0.32	0.79	0.35	0.74	0.39
10	0.88	0.33	0.84	0.36	0.79	0.41
12.5	0.94	0.29	0.90	0.33	0.86	0.38
15	0.81	0.30	0.76	0.34	0.69	0.41
20	0.68	0.25	0.59	0.31	0.51	0.40
25	0.59	0.19	0.48	0.24	0.37	0.33
30	0.55	0.16	0.43	0.19	0.32	0.27
35	0.53	0.16	0.43	0.18	0.31	0.26
40	0.54	0.15	0.43	0.18	0.31	0.25
45	0.55	0.15	0.45	0.17	0.32	0.23
50	0.57	0.14	0.47	0.16	0.34	0.22
60	0.65	0.13	0.55	0.15	0.39	0.20
70	0.77	0.13	0.67	0.14	0.47	0.20
80	0.91	0.13	0.80	0.14	0.57	0.19
90	1.03	0.13	0.92	0.14	0.66	0.19
100	1.12	0.12	1.01	0.14	0.73	0.19

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Table 2.5.2-234
Amplification Factors for the FIRS4 Site Column

	Amplification Factor for 10^{-4}		Amplification Factor for 10^{-5}		Amplification Factor for 10^{-6}	
Freq (Hz)	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.
0.1	1.12	0.06	1.13	0.06	1.13	0.06
0.125	1.15	0.08	1.15	0.08	1.15	0.08
0.15	1.19	0.10	1.19	0.10	1.19	0.10
0.2	1.29	0.15	1.29	0.15	1.29	0.15
0.3	1.45	0.18	1.46	0.18	1.46	0.18
0.4	1.44	0.17	1.44	0.17	1.45	0.17
0.5	1.37	0.17	1.37	0.18	1.38	0.18
0.6	1.35	0.16	1.36	0.16	1.38	0.17
0.7	1.38	0.14	1.39	0.14	1.43	0.16
0.8	1.45	0.13	1.46	0.14	1.50	0.17
0.9	1.49	0.14	1.49	0.14	1.54	0.19
1	1.54	0.15	1.51	0.15	1.57	0.21
1.25	1.79	0.19	1.82	0.19	1.92	0.24
1.5	1.98	0.22	2.02	0.23	2.14	0.29
2	1.92	0.15	1.99	0.19	2.14	0.26
2.5	1.62	0.23	1.69	0.28	1.80	0.31
3	1.42	0.30	1.52	0.35	1.58	0.35
4	1.50	0.47	1.53	0.44	1.52	0.40
5	1.85	0.48	1.77	0.43	1.57	0.40
6	2.04	0.40	1.82	0.39	1.44	0.45
7	1.87	0.38	1.61	0.42	1.24	0.49
8	1.63	0.40	1.38	0.44	1.06	0.52
9	1.41	0.40	1.19	0.42	0.90	0.45
10	1.23	0.32	1.04	0.33	0.79	0.36
12.5	1.09	0.26	0.93	0.27	0.71	0.31
15	1.05	0.27	0.87	0.28	0.65	0.34
20	0.91	0.26	0.70	0.29	0.49	0.35
25	0.82	0.22	0.61	0.24	0.41	0.29
30	0.78	0.20	0.58	0.21	0.38	0.25
35	0.77	0.20	0.58	0.20	0.38	0.23
40	0.77	0.19	0.59	0.19	0.38	0.21
45	0.78	0.18	0.60	0.18	0.40	0.20
50	0.81	0.18	0.64	0.18	0.42	0.19
60	0.92	0.17	0.74	0.17	0.49	0.18
70	1.09	0.17	0.90	0.16	0.60	0.18
80	1.29	0.17	1.08	0.16	0.72	0.18
90	1.46	0.17	1.25	0.16	0.83	0.17
100	1.58	0.16	1.37	0.16	0.92	0.17

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Table 2.5.2-235
Amplification Factors for the FIRS4_CoV50 Site Column

	Amplification Factor for 10^{-4}		Amplification Factor for 10^{-5}		Amplification Factor for 10^{-6}	
Freq (Hz)	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.	Median	Logarithmic Std. Dev.
0.1	1.13	0.06	1.14	0.06	1.14	0.06
0.125	1.15	0.08	1.16	0.08	1.16	0.08
0.15	1.19	0.10	1.20	0.10	1.20	0.10
0.2	1.29	0.15	1.30	0.15	1.31	0.15
0.3	1.46	0.18	1.47	0.18	1.48	0.19
0.4	1.44	0.17	1.45	0.17	1.48	0.20
0.5	1.38	0.18	1.39	0.18	1.44	0.23
0.6	1.36	0.16	1.39	0.18	1.45	0.25
0.7	1.40	0.15	1.43	0.18	1.51	0.25
0.8	1.47	0.14	1.52	0.20	1.60	0.27
0.9	1.51	0.15	1.56	0.22	1.65	0.28
1	1.57	0.17	1.59	0.23	1.69	0.30
1.25	1.84	0.21	1.94	0.28	2.04	0.33
1.5	2.06	0.28	2.13	0.32	2.20	0.30
2	2.05	0.28	2.11	0.30	2.10	0.28
2.5	1.76	0.36	1.75	0.35	1.73	0.33
3	1.55	0.44	1.51	0.39	1.48	0.38
4	1.47	0.49	1.40	0.44	1.31	0.47
5	1.61	0.50	1.48	0.48	1.21	0.44
6	1.66	0.45	1.42	0.42	1.12	0.48
7	1.52	0.41	1.31	0.45	1.02	0.50
8	1.40	0.39	1.18	0.42	0.93	0.51
9	1.33	0.36	1.12	0.42	0.87	0.52
10	1.27	0.35	1.06	0.40	0.80	0.51
12.5	1.13	0.30	0.92	0.33	0.69	0.43
15	1.04	0.28	0.84	0.31	0.61	0.41
20	0.88	0.25	0.67	0.28	0.46	0.36
25	0.82	0.23	0.60	0.25	0.40	0.35
30	0.79	0.23	0.58	0.25	0.38	0.31
35	0.76	0.21	0.57	0.21	0.37	0.27
40	0.76	0.21	0.58	0.20	0.37	0.24
45	0.78	0.20	0.60	0.19	0.38	0.22
50	0.81	0.20	0.63	0.18	0.41	0.21
60	0.92	0.20	0.73	0.18	0.48	0.19
70	1.09	0.19	0.89	0.18	0.58	0.19
80	1.28	0.19	1.06	0.18	0.70	0.19
90	1.45	0.19	1.23	0.18	0.81	0.18
100	1.57	0.19	1.35	0.18	0.90	0.18

Table 2.5.2-236

1E-5 and GMRS Amplitudes for GMRS Elevation, Horizontal and Vertical

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Horizontal and vertical amplitudes for GMRS elevation		
Frequency	1E-5 UHRS	GMRS
100	7.43E-02	3.34E-02
90	7.48E-02	3.37E-02
80	7.54E-02	3.39E-02
75	7.57E-02	3.41E-02
70	7.61E-02	3.42E-02
60	7.68E-02	3.46E-02
50	7.78E-02	3.50E-02
40	7.89E-02	3.55E-02
30	8.04E-02	3.62E-02
25	8.14E-02	3.66E-02
20	8.53E-02	3.84E-02
15	9.05E-02	4.07E-02
12.5	9.40E-02	4.23E-02
10	9.85E-02	4.43E-02
9	9.99E-02	4.49E-02
8	1.01E-01	4.57E-02
7.5	1.02E-01	4.61E-02
7	1.03E-01	4.65E-02
6	1.05E-01	4.74E-02
5	1.08E-01	4.86E-02
4	1.31E-01	5.91E-02
3	1.51E-01	6.78E-02
2.5	1.55E-01	6.98E-02
2	1.55E-01	6.99E-02
1.8	1.54E-01	6.92E-02
1.5	1.43E-01	6.42E-02
1.25	1.28E-01	5.76E-02
1	1.09E-01	4.91E-02
0.9	1.08E-01	4.86E-02
0.8	1.07E-01	4.80E-02
0.7	1.05E-01	4.74E-02
0.6	1.04E-01	4.67E-02
0.5	1.02E-01	4.59E-02
0.4	8.16E-02	3.67E-02
0.3	6.12E-02	2.75E-02
0.2	4.08E-02	1.84E-02
0.15	3.06E-02	1.38E-02
0.125	2.55E-02	1.15E-02
0.1	1.63E-02	7.34E-03

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Table 2.5.2-237
1E-5 and FIRS Amplitudes for FIRS Elevations, Horizontal and Vertical

	FIRS2		FIRS3		FIRS4		FIRS4-CoV50	
Frequency	1E-5 UHRS	FIRS2	1E-5 UHRS	FIRS3	1E-5 UHRS	FIRS4	1E-5 UHRS	FIRS4-CoV50
100	3.31E-02	1.49E-02	3.73E-02	1.68E-02	5.45E-02	2.45E-02	5.45E-02	2.45E-02
90	3.33E-02	1.50E-02	3.79E-02	1.71E-02	5.53E-02	2.49E-02	5.53E-02	2.49E-02
80	3.35E-02	1.51E-02	3.86E-02	1.74E-02	5.63E-02	2.53E-02	5.62E-02	2.53E-02
75	3.36E-02	1.51E-02	3.90E-02	1.76E-02	5.68E-02	2.56E-02	5.67E-02	2.55E-02
70	3.38E-02	1.52E-02	3.95E-02	1.78E-02	5.74E-02	2.58E-02	5.72E-02	2.57E-02
60	3.40E-02	1.53E-02	4.04E-02	1.82E-02	5.87E-02	2.64E-02	5.84E-02	2.63E-02
50	3.44E-02	1.55E-02	4.16E-02	1.87E-02	6.02E-02	2.71E-02	5.98E-02	2.69E-02
40	3.48E-02	1.57E-02	4.31E-02	1.94E-02	6.22E-02	2.80E-02	6.17E-02	2.77E-02
30	3.53E-02	1.59E-02	4.51E-02	2.03E-02	6.49E-02	2.92E-02	6.41E-02	2.88E-02
25	3.57E-02	1.61E-02	4.64E-02	2.09E-02	6.66E-02	3.00E-02	6.57E-02	2.96E-02
20	3.74E-02	1.68E-02	5.32E-02	2.40E-02	7.33E-02	3.30E-02	7.35E-02	3.31E-02
15	3.98E-02	1.79E-02	6.11E-02	2.75E-02	8.29E-02	3.73E-02	8.49E-02	3.82E-02
12.5	4.13E-02	1.86E-02	6.54E-02	2.94E-02	8.96E-02	4.03E-02	9.30E-02	4.18E-02
10	4.33E-02	1.95E-02	6.98E-02	3.14E-02	9.86E-02	4.44E-02	1.04E-01	4.68E-02
9	4.38E-02	1.97E-02	6.77E-02	3.04E-02	1.11E-01	5.00E-02	1.12E-01	5.04E-02
8	4.44E-02	2.00E-02	6.52E-02	2.93E-02	1.24E-01	5.59E-02	1.20E-01	5.42E-02
7.5	4.47E-02	2.01E-02	6.38E-02	2.87E-02	1.31E-01	5.90E-02	1.25E-01	5.61E-02
7	4.51E-02	2.03E-02	6.23E-02	2.80E-02	1.38E-01	6.20E-02	1.29E-01	5.80E-02
6	4.59E-02	2.06E-02	5.88E-02	2.65E-02	1.52E-01	6.83E-02	1.37E-01	6.18E-02
5	4.68E-02	2.11E-02	5.45E-02	2.45E-02	1.65E-01	7.43E-02	1.45E-01	6.53E-02
4	5.51E-02	2.48E-02	6.33E-02	2.85E-02	1.48E-01	6.64E-02	1.40E-01	6.32E-02
3	6.17E-02	2.77E-02	7.01E-02	3.16E-02	1.24E-01	5.57E-02	1.30E-01	5.87E-02
2.5	6.28E-02	2.83E-02	7.11E-02	3.20E-02	1.08E-01	4.84E-02	1.21E-01	5.45E-02
2	6.49E-02	2.92E-02	7.34E-02	3.30E-02	1.08E-01	4.84E-02	1.18E-01	5.31E-02
1.8	6.50E-02	2.93E-02	7.34E-02	3.30E-02	1.05E-01	4.71E-02	1.14E-01	5.12E-02
1.5	6.13E-02	2.76E-02	6.91E-02	3.11E-02	9.65E-02	4.34E-02	1.04E-01	4.66E-02
1.25	5.57E-02	2.51E-02	6.27E-02	2.82E-02	8.61E-02	3.87E-02	9.13E-02	4.11E-02
1	4.80E-02	2.16E-02	5.40E-02	2.43E-02	7.29E-02	3.28E-02	7.65E-02	3.44E-02
0.9	4.75E-02	2.14E-02	5.33E-02	2.40E-02	7.14E-02	3.21E-02	7.46E-02	3.36E-02
0.8	4.69E-02	2.11E-02	5.25E-02	2.36E-02	6.97E-02	3.14E-02	7.25E-02	3.26E-02
0.7	4.63E-02	2.08E-02	5.16E-02	2.32E-02	6.79E-02	3.06E-02	7.02E-02	3.16E-02
0.6	4.55E-02	2.05E-02	5.06E-02	2.28E-02	6.58E-02	2.96E-02	6.77E-02	3.05E-02
0.5	4.47E-02	2.01E-02	4.95E-02	2.23E-02	6.35E-02	2.86E-02	6.48E-02	2.92E-02
0.4	3.58E-02	1.61E-02	3.96E-02	1.78E-02	5.08E-02	2.29E-02	5.18E-02	2.33E-02
0.3	2.68E-02	1.21E-02	2.97E-02	1.34E-02	3.81E-02	1.71E-02	3.89E-02	1.75E-02
0.2	1.79E-02	8.05E-03	1.98E-02	8.91E-03	2.54E-02	1.14E-02	2.59E-02	1.17E-02
0.15	1.34E-02	6.03E-03	1.49E-02	6.68E-03	1.91E-02	8.57E-03	1.94E-02	8.75E-03
0.125	1.12E-02	5.03E-03	1.24E-02	5.57E-03	1.59E-02	7.14E-03	1.62E-02	7.29E-03
0.1	7.15E-03	3.22E-03	7.92E-03	3.56E-03	1.02E-02	4.57E-03	1.04E-02	4.67E-03

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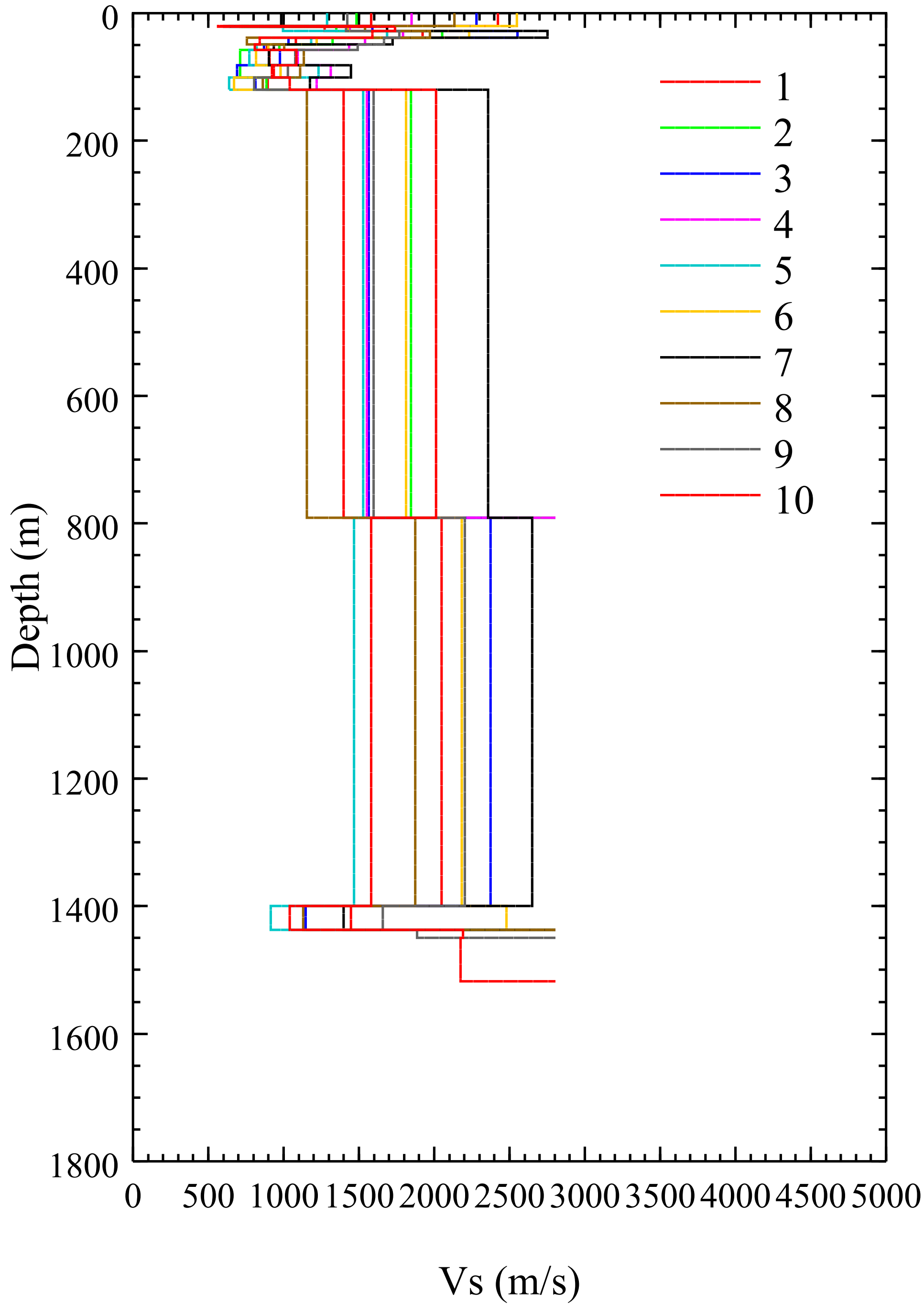
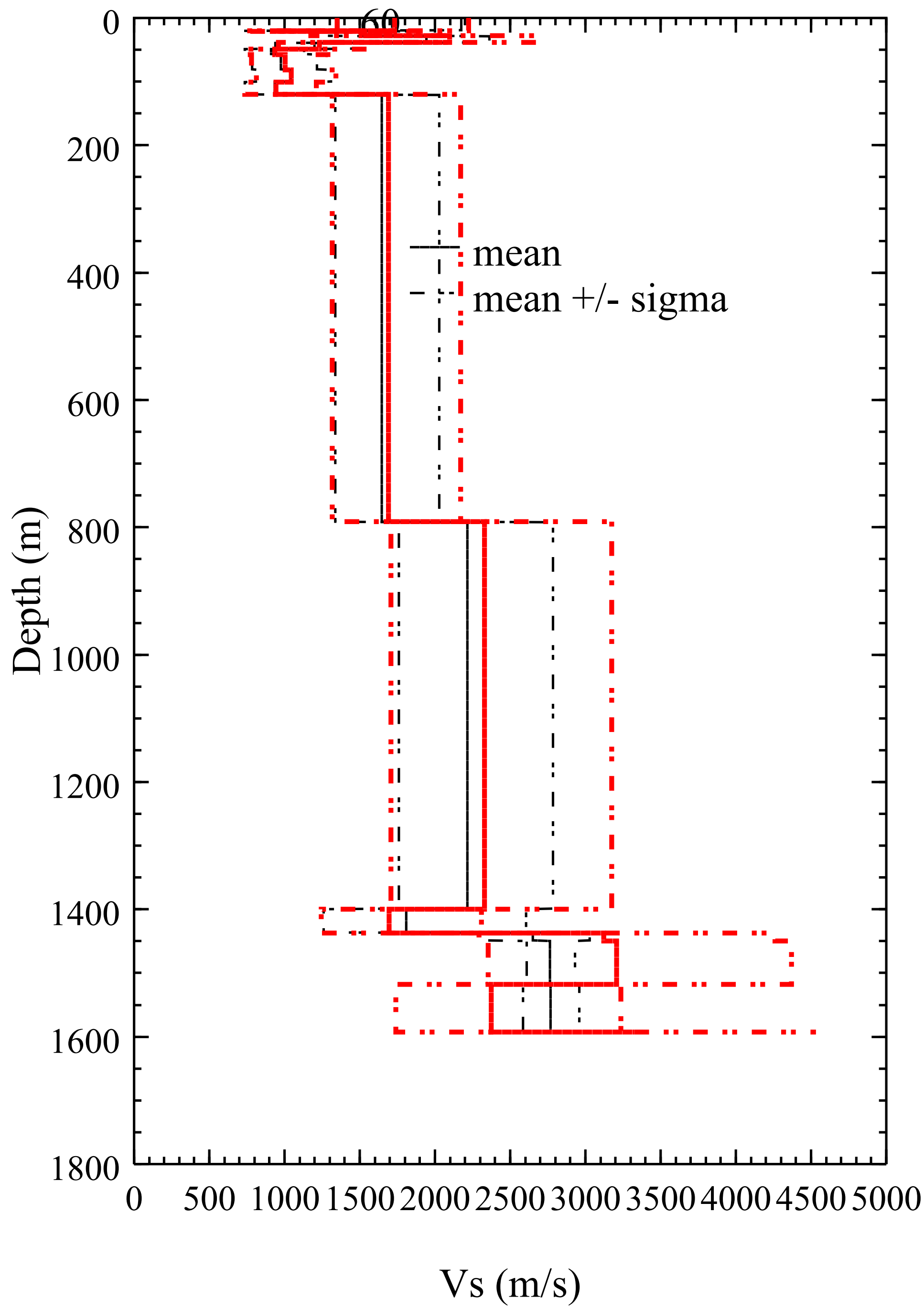


Figure 2.5.2-240 Graph of Velocity vs. Depth for the First 10 Synthetic Profiles Generated for the GMRS/FIRS1 Site Column ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4



Note: The calculated median+sigma from the artificial profiles (black dashed line) is lower than the target median+sigma at depths greater than 800 m because the distribution of Vs is truncated by the Vs of bedrock (9200 fps or 2,804 m/s) implicit in the EPRI attenuation equations.

Figure 2.5.2-241 Summary Statistics from Synthetic Profiles for GMRS/FIRS1 Site Column Compared to Values in Table 2.5.2-227. ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

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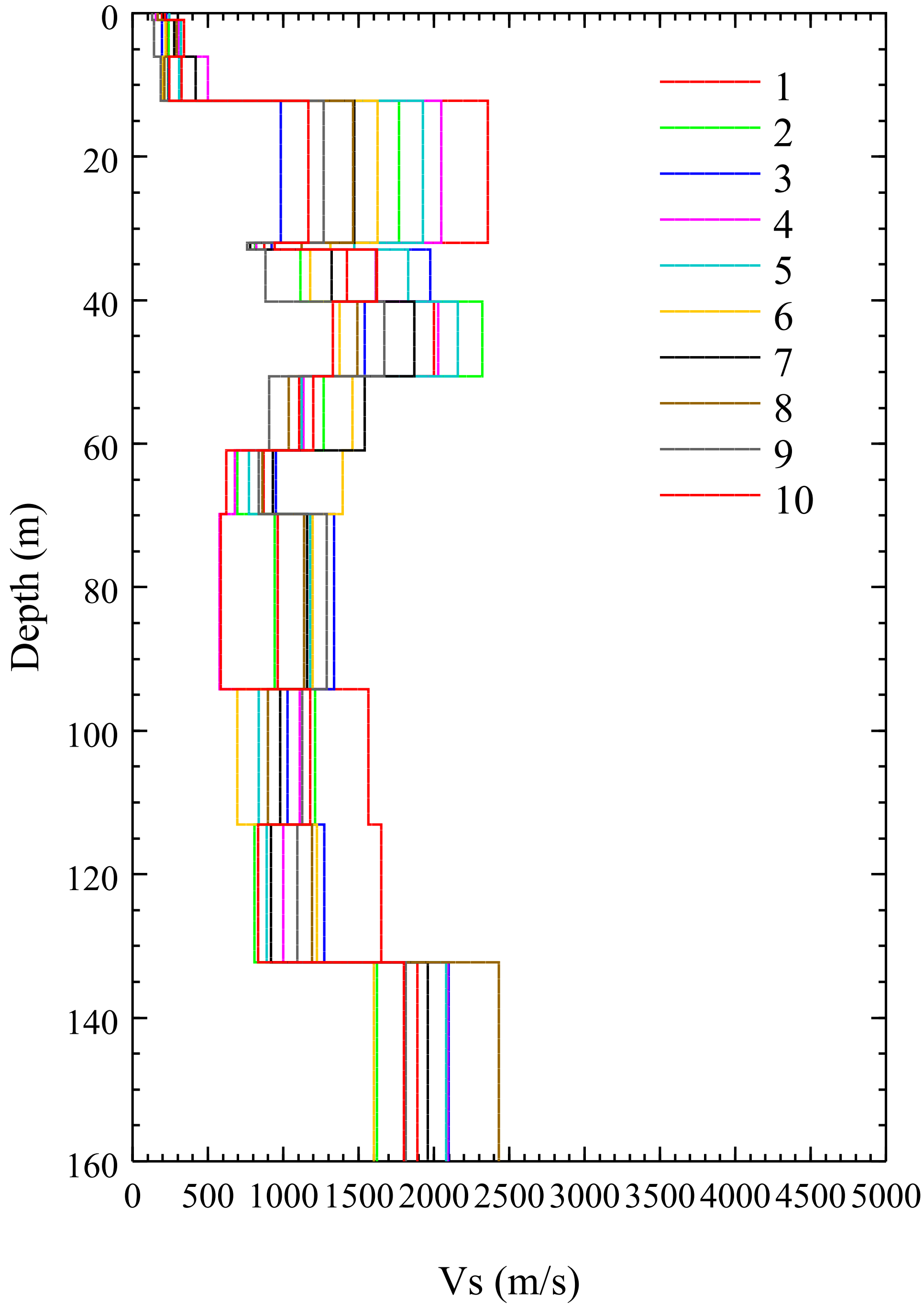

Figure 2.5.2-242 Graph of Velocity vs. Depth for the First 10 Synthetic Profiles Generated for the Top Portion of the FIRS4 Site Column ~~Rev 0~~

COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

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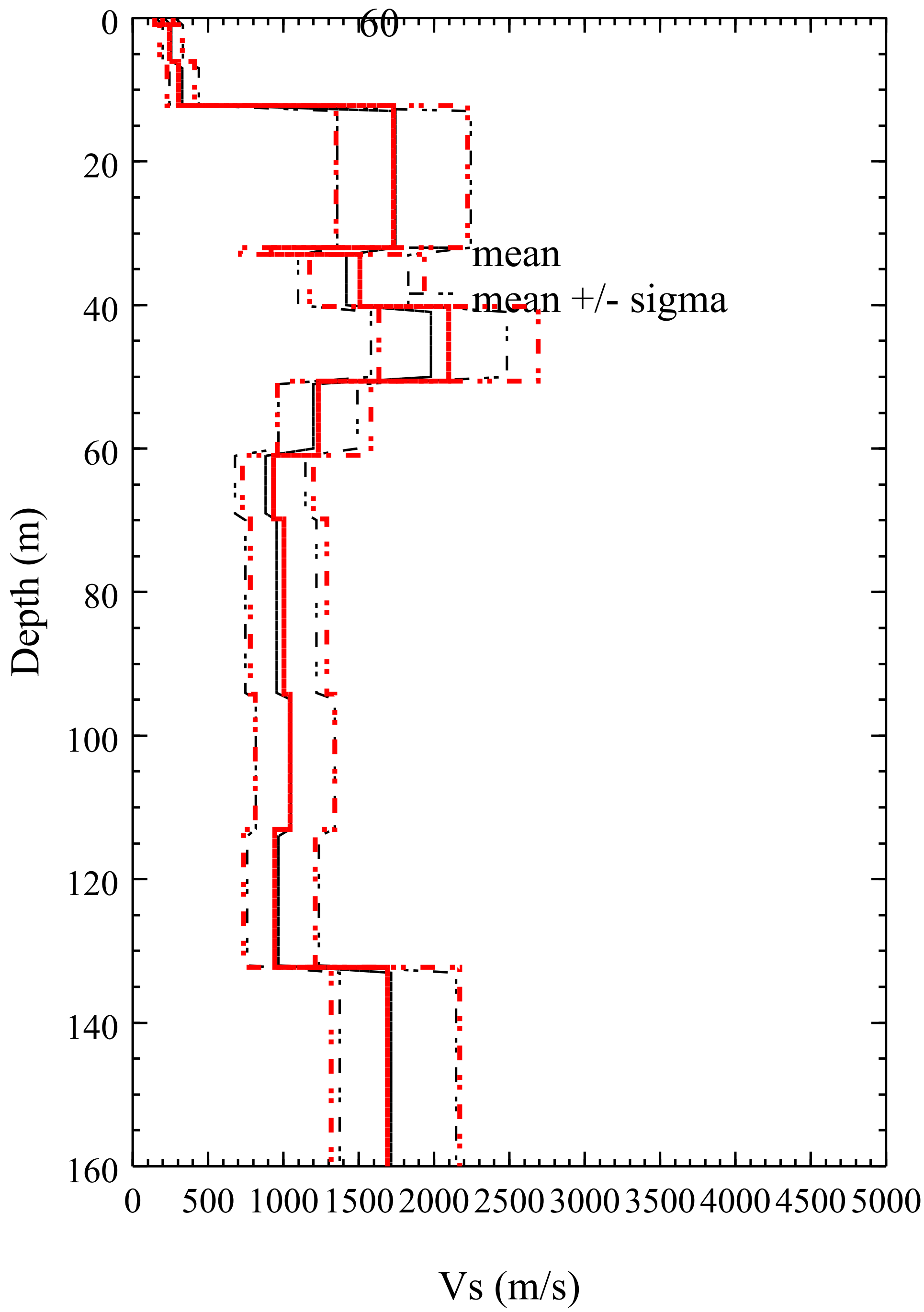
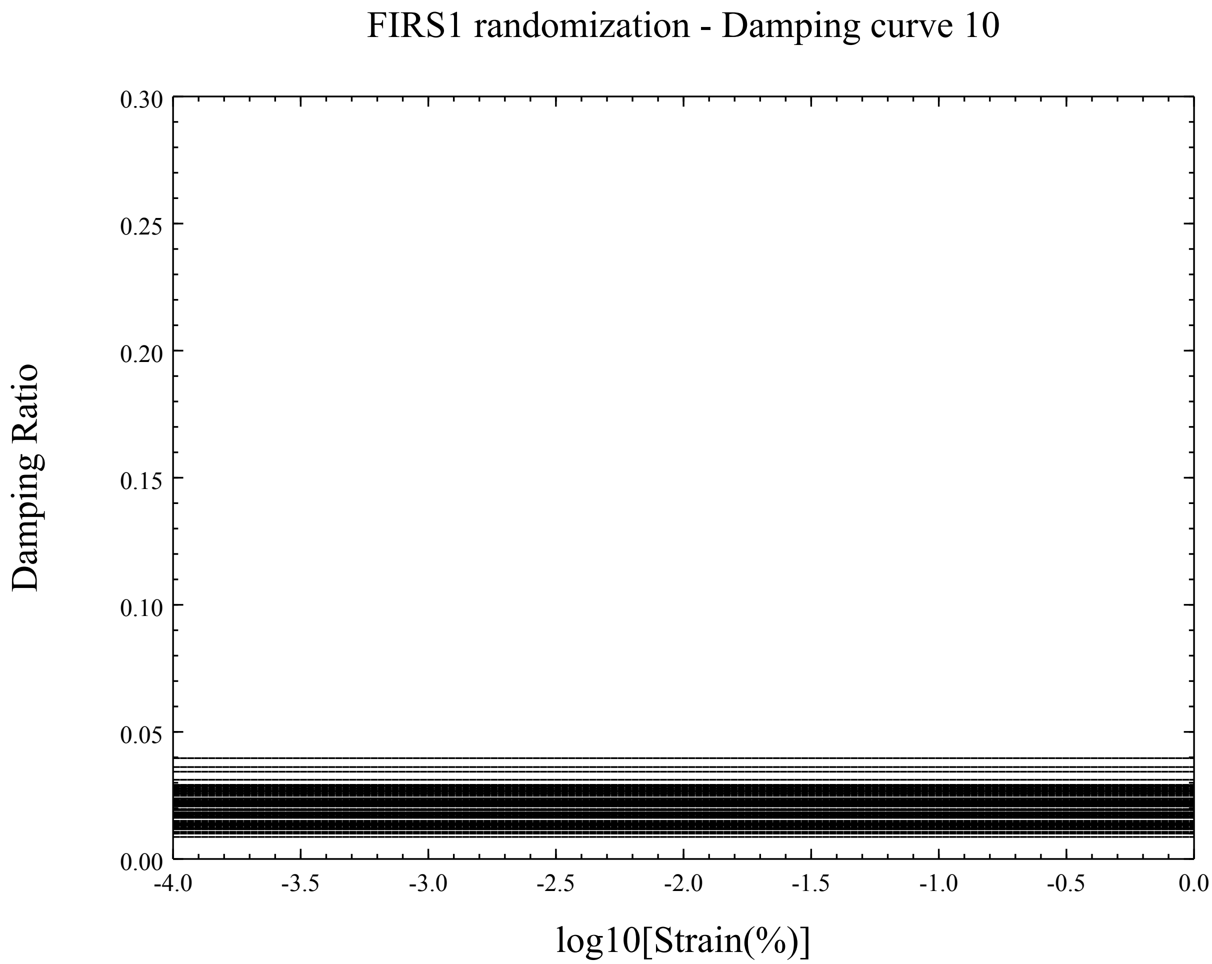


Figure 2.5.2-243 Summary Statistics from Synthetic Profiles for the Top Portion of the FIRS4 Site Column Compared to Values in Table 2.5.2-227 Rev ~~0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00515

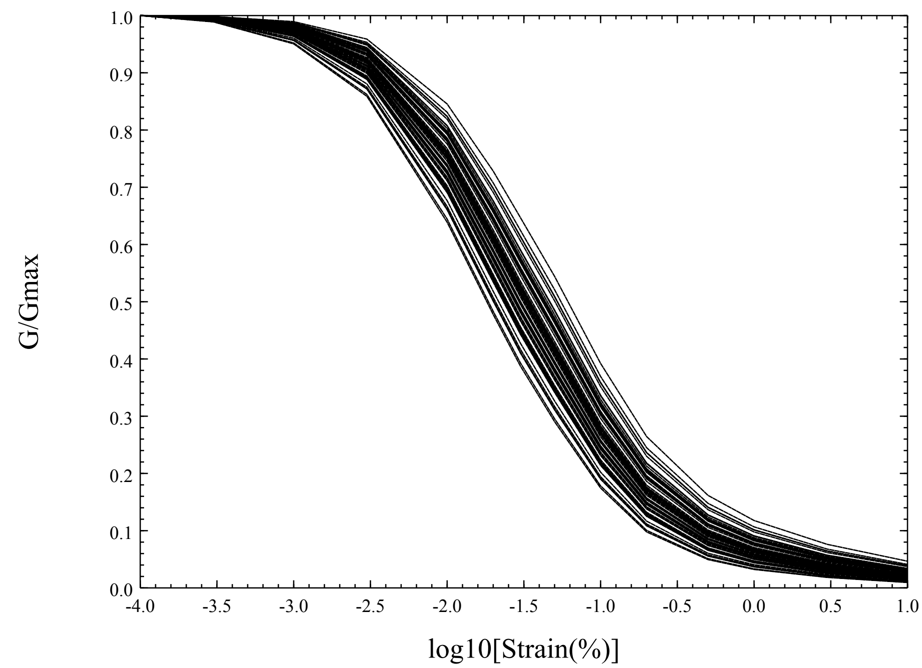


Note: damping ratios are given as fraction of critical, not as percentage of critical.

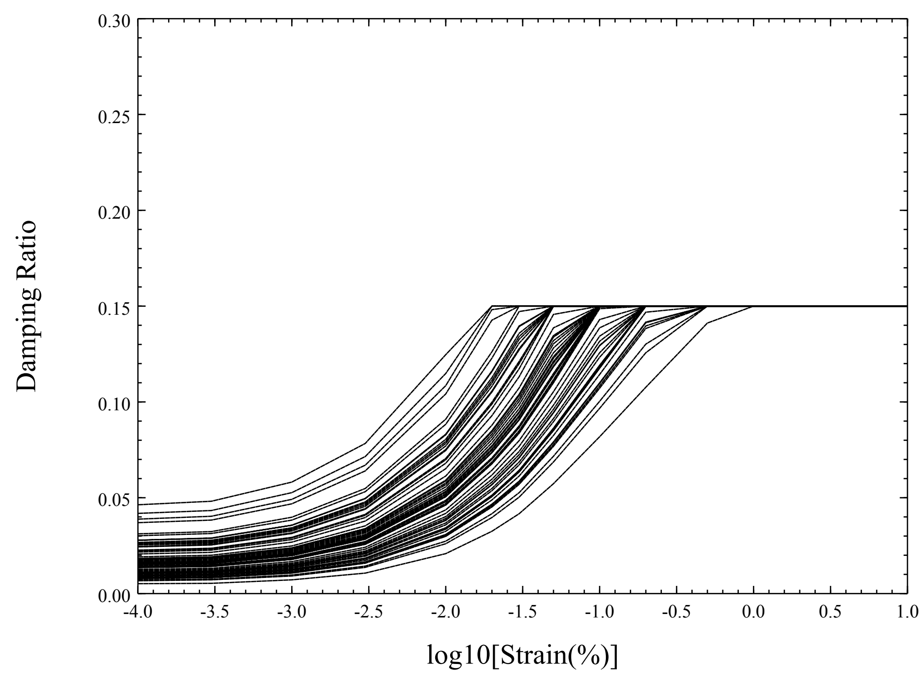
Figure 2.5.2-244 Damping Ratios vs. Strain for the Strawn Formation in the 60 Synthetic Profiles for GMRS/ FIRS1 Site Column. ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00515

FIRS4 randomization - G/Gmax curve 17



FIRS4 randomization - Damping curve 17



Note: damping ratios are given as fraction of critical, not as percentage of critical.

Figure 2.5.2-245 G/Gmax and Damping Ratios vs. Strain for the Fill (0-20 ft depth) in the 60 Synthetic Profiles for FIRS4 Site Column ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00515

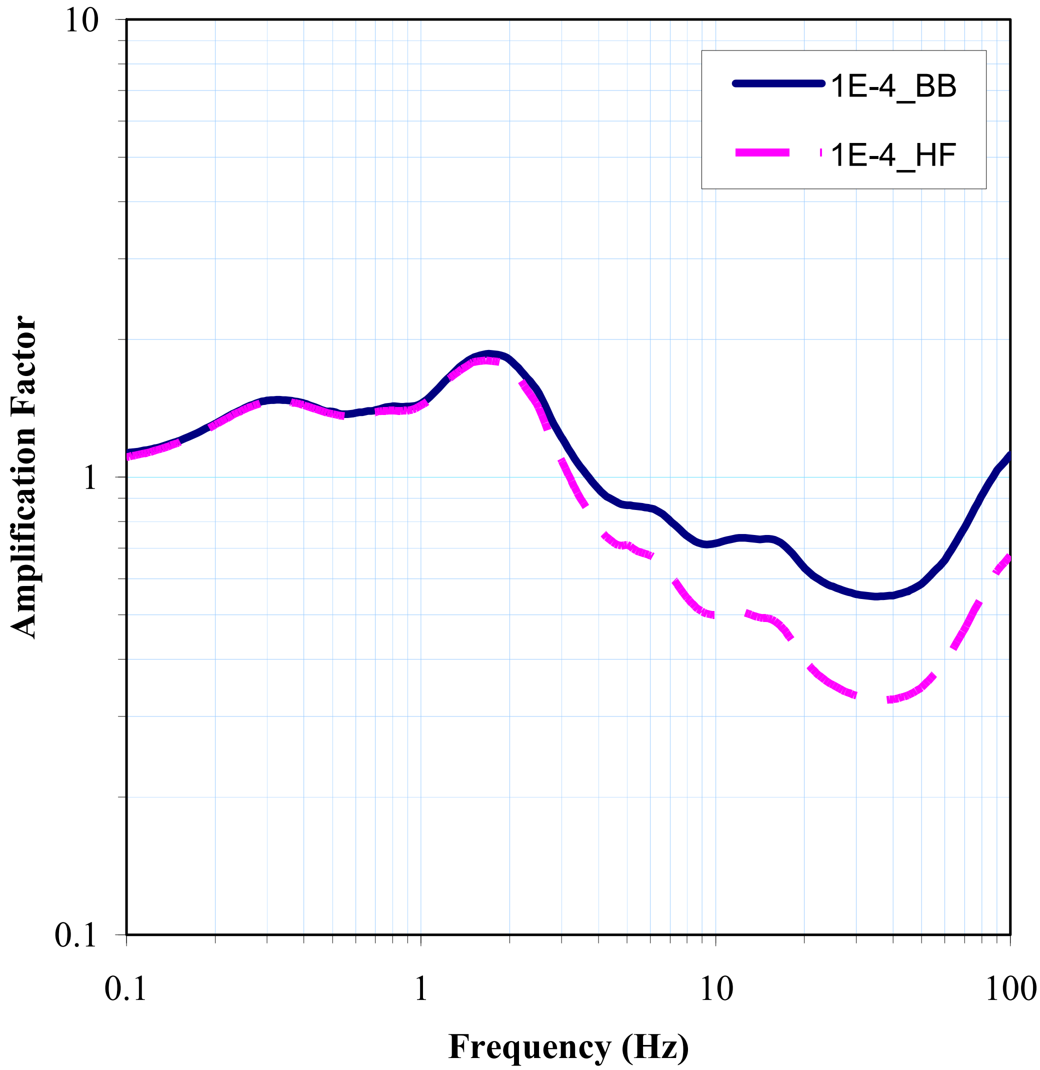


Figure 2.5.2-246 Comparison of Median Amplification Factors for GMRS/FIRS1 Site column: HF vs BB Inputs ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00516

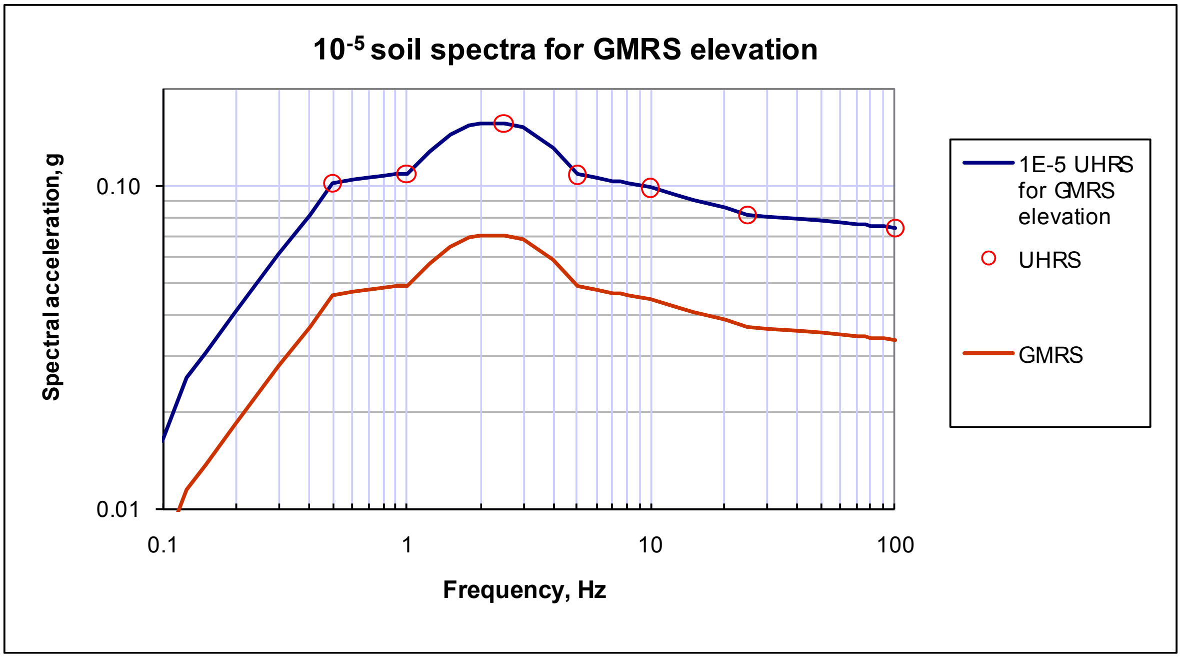


Figure 2.5.2-247 Comanche Peak 1E-5 UHRS (for GMRS Conditions) and GMRS, Horizontal and Vertical ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00516

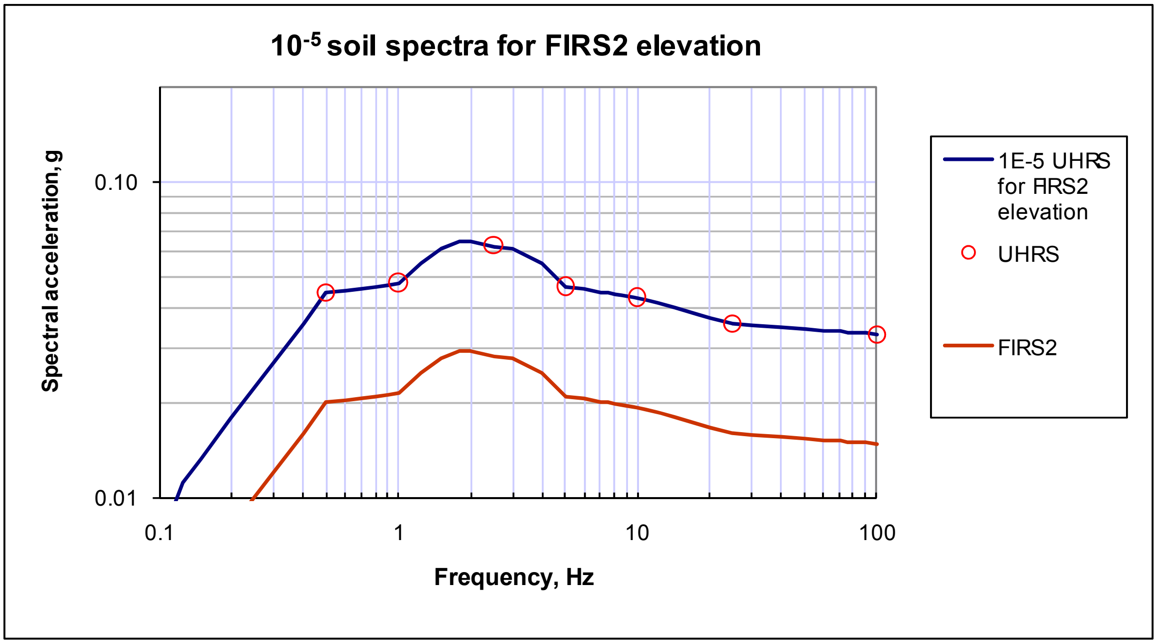


Figure 2.5.2-248 Comanche Peak 1E-5 UHRS (for FIRS2 Conditions) and FIRS2, Horizontal and Vertical

~~Rev 0~~

COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00516

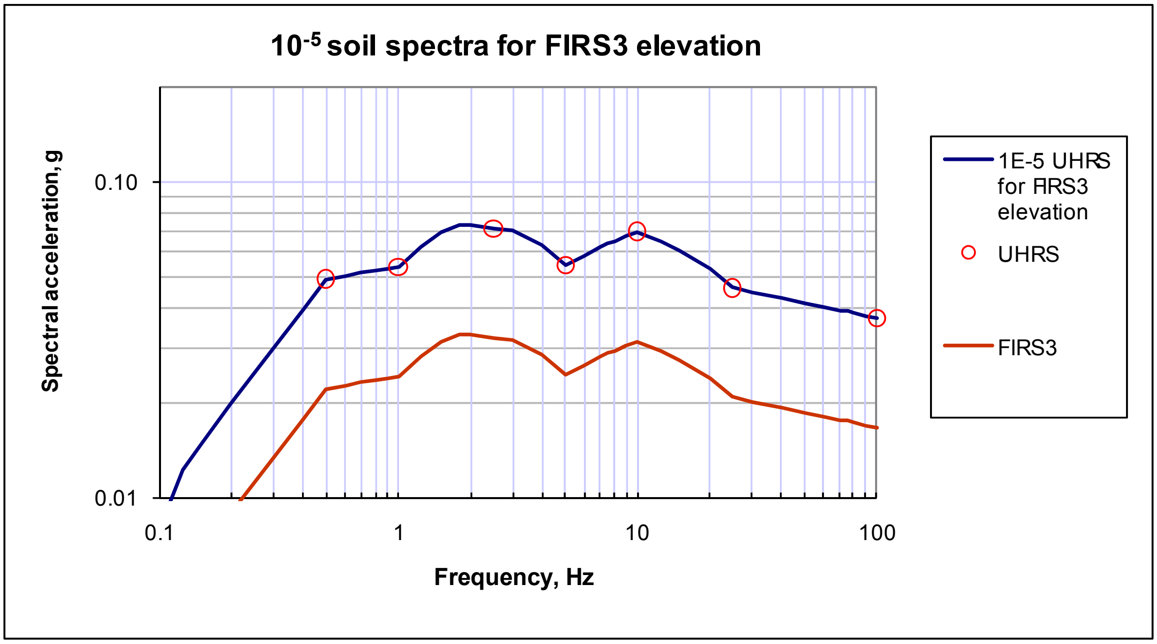


Figure 2.5.2-249 Comanche Peak 1E-5 UHRS (for FIRS3 Conditions) and FIRS3, Horizontal and Vertical ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00516

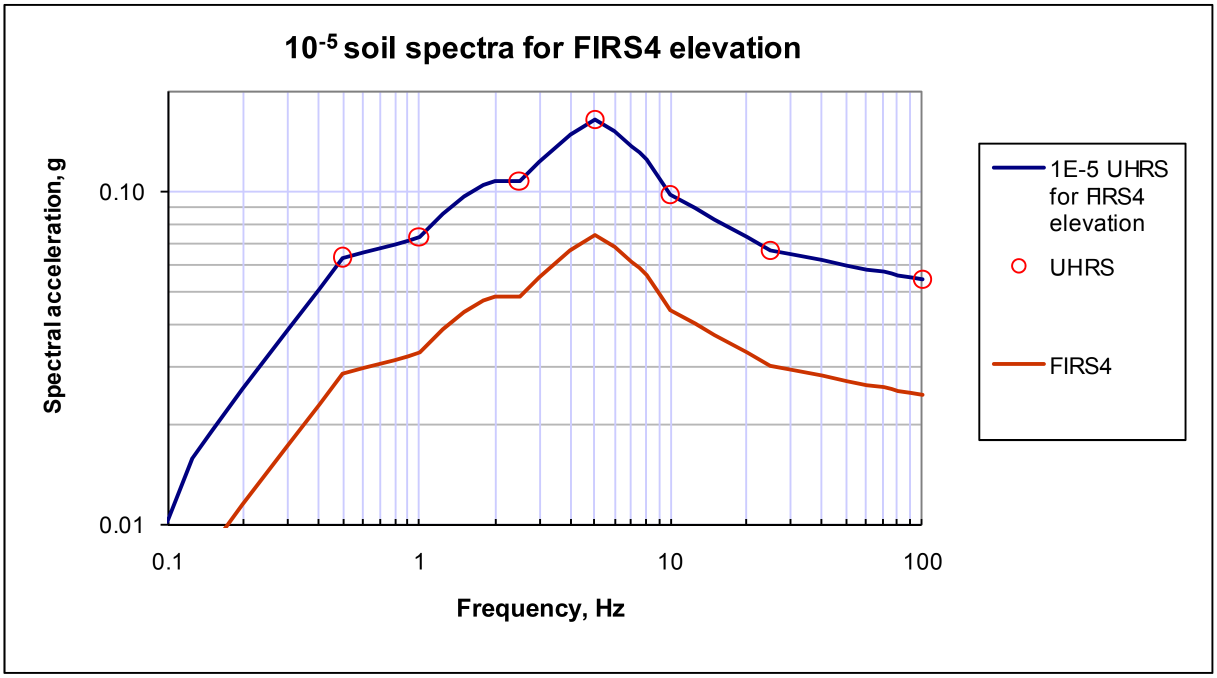


Figure 2.5.2-250 Comanche Peak 1E-5 UHRS (for FIRS4 Conditions) and FIRS4, Horizontal and Vertical ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00516

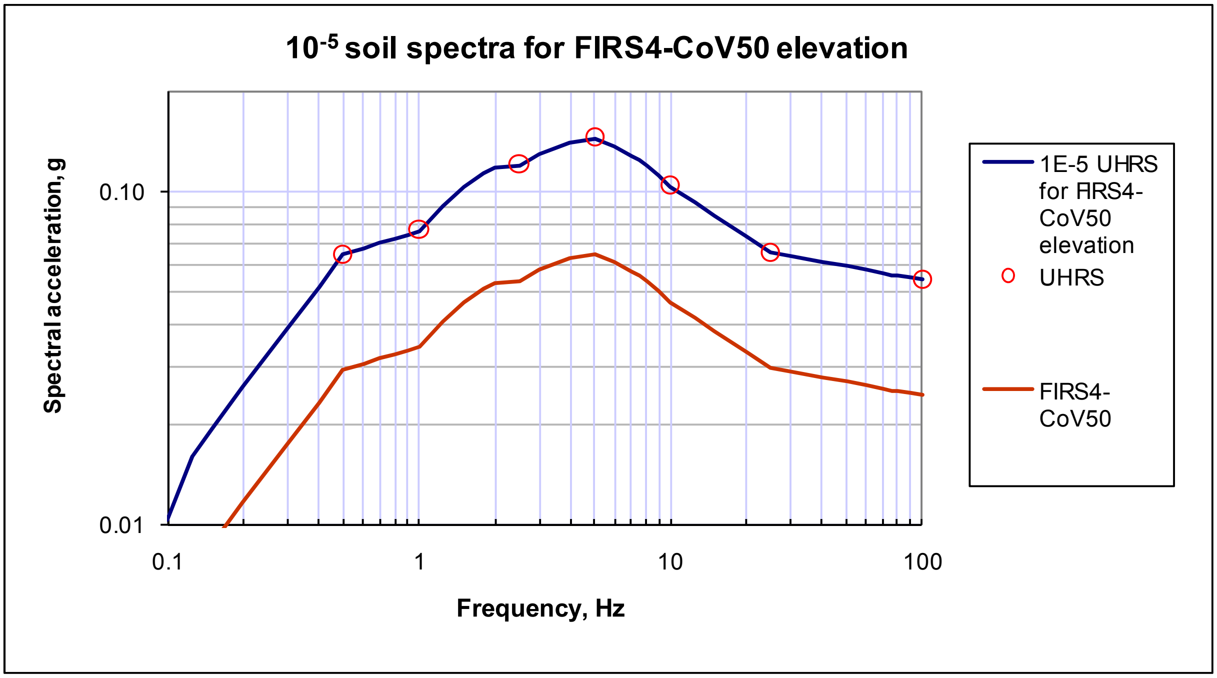


Figure 2.5.2-251 Comanche Peak 1E-5 UHRS (for FIRS4-CoV50 Conditions) and GMRS-CoV50, Horizontal and Vertical ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

CTS-00516

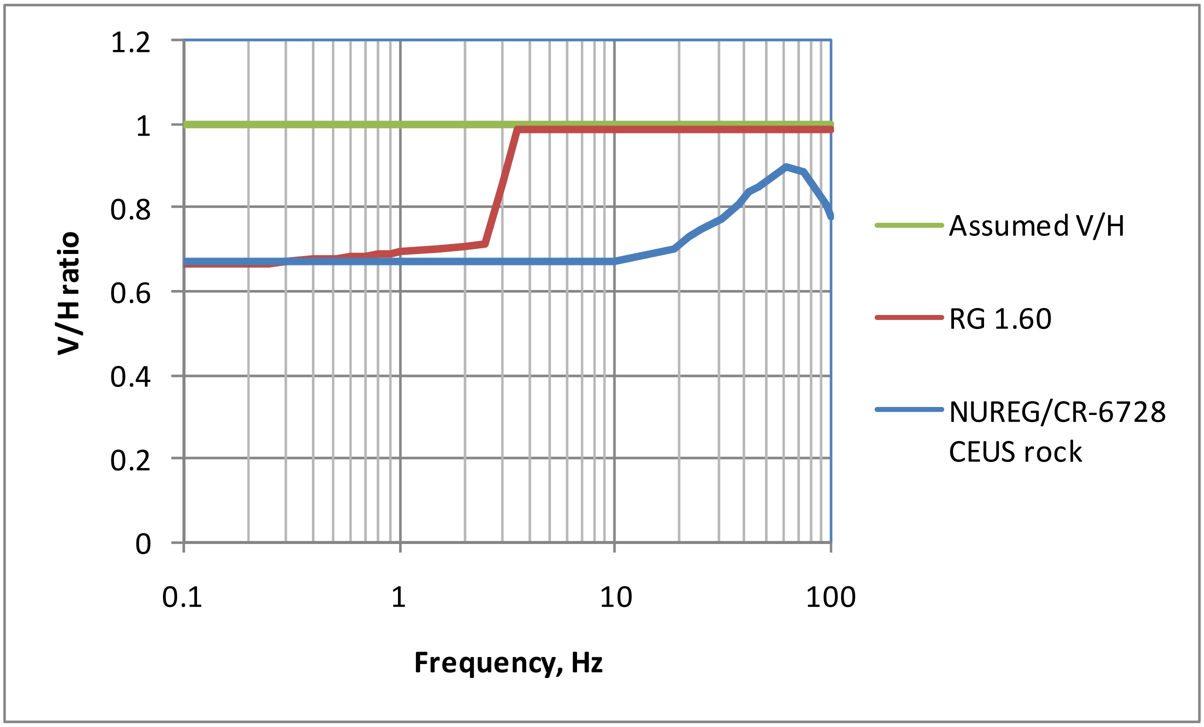


Figure 2.5.2-252 V/H Ratios from Two References, and Assumed V/H Ratio ~~Rev 0~~	COMANCHE PEAK NUCLEAR POWER PLANT UNITS 3 AND 4

Chapter 3

Chapter 3 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
CTS-00602	3.8.1	3.8-2	Clarification	Change “Chapter 2” to “Subsection 2.5.4”.	0
MAP-03-005	3.8.1.6 3.8.6	3.8-2 3.8-14	Deletion of COL item	Delete COL item.	0
MAP-03-006	3.8.1.6 3.8.6	3.8-2 3.8-14	Deletion of COL item	Delete COL item.	0
MAP-03-007	3.8.1.6 3.8.6	3.8-2 3.8-14	Deletion of COL item	Delete COL item.	0
MAP-03-008	3.8.1.6 3.8.6	3.8-2 3.8-14	Deletion of COL item	Delete COL item.	0
MAP-03-009	3.8.1.6 3.8.6	3.8-3 3.8-14	Deletion of COL item	Delete COL item.	0
MAP-03-010	3.8.1.6 3.8.6	3.8-3 3.8-14	Deletion of COL item	Delete COL item.	0
MAP-03-011	3.8.1.6 3.8.6	3.8-3 3.8-14	Deletion of COL item	Delete COL item.	0
MAP-03-012	3.8.4.7	3.8-11	Revision of COL Item	Change “Monitoring of seismic category I structures is required to be performed” to “a site-specific program for monitoring and maintenance of seismic category I structures is performed”.	0
MAP-03-014	3.10 3.10.5	3.10-1 3.10-3	Deletion of COL item	Delete COL item.	0
MAP-03-015	3.13.1.2.3 3.13.3	3.13-1 3.13-2	Deletion of COL item	Delete COL item.	0
MAP-03-016	3.13.1.2.5 3.13.3	3.13-1 3.13-2	Deletion of COL item	Delete COL item.	0

STD COL 3.8(3) Replace the second sentence of the first paragraph in DCD Subsection 3.8.1.6 with the following.

Any material changes to the site-specific materials for construction of the PCCV will meet the requirements specified in ASME Code, Section III (Reference 3.8-2), Article CC-2000, and supplementary requirements of RG 1.136 (Reference 3.8-3), as well as SRP 3.8.1 (Reference 3.8-7).

~~STD COL 3.8(4)~~ ~~Replace the fourth paragraph in DCD Subsection 3.8.1.6 with the following.~~ MAP-03-005

~~Site-specific concrete ingredients will be selected, and concrete mix design will be developed prior to construction to produce the concrete design strengths specified for the US-APWR PCCV. All the concrete mix ingredients conform to applicable codes and standards.~~

~~STD COL 3.8(5)~~ ~~Replace the fourth sentence of the seventh paragraph in DCD Subsection 3.8.1.6 with the following.~~ MAP-03-006

~~Site-specific concrete design mix is tested for creep and shrinkage parameters and compared with the creep and shrinkage parameters used in the design analysis of the PCCV. The PCCV design analysis will be revised, prior to start of the PCCV superstructure construction, if the final test results affect the conclusions of the PCCV calculations.~~

~~STD COL 3.8(6)~~ ~~Replace the fifth sentence of the seventh paragraph in DCD Subsection 3.8.1.6 with the following.~~ MAP-03-007

~~A site-specific specification that includes the concrete production and batch plant requirements, placement requirements, and all relevant quality requirements, will be prepared prior to start of construction.~~

CP COL 3.8(7) Replace the first sentence of the eighth paragraph in DCD Subsection 3.8.1.6 with the following.

Site-specific aggressivity of the ground water/soil at the CPNPP site is not applicable, as discussed in ~~Chapter 2~~Subsection 2.5.4. CTS-00602

~~STD COL 3.8(8)~~ ~~Replace the first sentence of the twelfth paragraph in DCD Subsection 3.8.1.6 with the following.~~ MAP-03-008

~~A site-specific specification will be developed to define the material, welding, testing, and quality requirements for the liner plate prior to start of fabrication.~~

STD COL 3.8(9) ~~Replace the first sentence of the thirteenth paragraph in DCD Subsection 3.8.1.6 with the following.~~ MAP-03-009

~~A site-specific specification will be prepared for the PCCV personnel airlocks and equipment hatch prior to start of procurement.~~

CP COL 3.8(10) Replace the second and third sentences of the eighteenth paragraph in DCD Subsection 3.8.1.6 with the following.

The prestressing system is designed as a strand system.

STD COL 3.8(12) ~~Replace the bullet of the twenty-fourth paragraph in DCD Subsection 3.8.1.6 with the following.~~ MAP-03-010

~~A site-specific specification will be developed per RG 1.136 (Reference 3.8-3) for the material requirements of the prestressing system, which also includes the material and special material testing requirements, and references Article CC-2400 of the ASME Code, Section III (Reference 3.8-2) for items, where applicable, prior to start of procurement.~~

STD COL 3.8(13) ~~Replace the first sentence of the thirty-first paragraph in DCD Subsection 3.8.1.6 with the following.~~ MAP-03-011

~~A site-specific specification that covers the material and special material testing requirements for the reinforcing steel system, including bars and splices and all material conforming to Article CC-2300 of ASME Code, Section III (Reference 3.8-2), will be developed prior to start of procurement.~~

3.8.1.7 Testing and Inservice Inspection Requirements

STD COL 3.8(14) Replace the third paragraph in DCD Subsection 3.8.1.7 with the following.

A site-specific preservice inspection (PSI) program for the PCCV will be completed at least 12 months prior to initial fuel load. ISI are performed during the initial and subsequent 10 year intervals as identified in Subsections IWE and IWL Article 2000, Examination Program B. The PCCV PSI and ISI programs include preservice examination, testing and ISI requirements, and also address personnel qualification requirements and responsibilities. The PCCV ISI program also provides detailed inspection plans and surveillance schedules consistent with those of the integrated leak rate test (ILRT) program, which is discussed further below and in Subsection 6.2.6. ASME Code Section XI requirements incorporated by reference in 10 CFR 50.55a on the date 12 months prior to issuance of the

3.8.5.1.3.3 PSFSVs

PSFSVs are underground structures supported by a monolithic reinforced concrete basemat. The basemat is a 6'-6" thick concrete slab with top and bottom reinforcement in each direction arranged in a rectangular grid.

The bottom of the basemat is at elevation 782 ft., and is founded directly on limestone. Shear keys are provided which extend into the limestone as shown in Figures 3.8-213 and 3.8-214.

3.8.5.4.4 Analyses of Settlement

CP COL Replace the last sentence of the first paragraph in DCD Subsection 3.8.5.4.4 with the following.

As discussed in Section 2.5.4.10.2, maximum and differential CPNPP settlements of all the major seismic category I buildings and structures at the CPNPP Units 3 and 4 site, including R/B, PS/Bs, ESWPT, UHSRS, and PSFSVs are less than ½ inch, including long-term settlements.

3.8.5.5 Structural Acceptance Criteria

CP COL Replace the second sentence of the first paragraph in DCD Subsection 3.8.5.5 with the following.

All major seismic category I buildings and structures at the CPNPP Units 3 and 4 site, including R/B, PS/Bs, ESWPT, UHSRS, and PSFSVs, are founded either directly on a limestone layer or structural concrete fill which is placed directly on the limestone. The ultimate bearing capacity of the limestone is 146,000 psf. Table 3.8-202 shows the actual bearing pressure during static and seismic load cases with minimum factor of safety.

3.8.6 Combined License Information

Replace the content of DCD Subsection 3.8.6 with the following.

~~STD COL 3.8(1)~~ ***3.8(1)*** *Deleted from the DCD.~~Reconciliation evaluations using as-built properties~~* MAP-03-003

~~This COL item is addressed in Subsection 3.8.1.4.1.3.~~

~~STD COL 3.8(2)~~ ***3.8(2)*** *Deleted from the DCD.*~~*Consistency of wobble and curvature coefficients*~~ MAP-03-004

~~*This COL item is addressed in* Subsections 3.8.1.5.1.2*, and* 3.8.1.5.2.2.~~

STD COL 3.8(3) ***3.8(3)*** *Material changes for PCCV*

This COL item is addressed in Subsection 3.8.1.6.

~~STD COL 3.8(4)~~ ***3.8(4)*** *Deleted from the DCD.*~~*Concrete ingredients*~~ MAP-03-005

~~*This COL item is addressed in* Subsection 3.8.1.6.~~

~~STD COL 3.8(5)~~ ***3.8(5)*** *Deleted from the DCD.*~~*Concrete creep and shrinkage parameters*~~ MAP-03-006

~~*This COL item is addressed in* Subsection 3.8.1.6.~~

~~STD COL 3.8(6)~~ ***3.8(6)*** *Deleted from the DCD.*~~*Specification of concrete production*~~ MAP-03-007

~~*This COL item is addressed in* Subsection 3.8.1.6.~~

CP COL 3.8(7) ***3.8(7)*** *Aggressivity of ground water/soil*

This COL item is addressed in Subsection 3.8.1.6.

~~STD COL 3.8(8)~~ ***3.8(8)*** *Deleted from the DCD.*~~*Liner plate specification*~~ MAP-03-008

~~*This COL item is addressed in* Subsection 3.8.1.6.~~

~~STD COL 3.8(9)~~ ***3.8(9)*** *Deleted from the DCD.*~~*PCCV airlocks and equipment hatch specification*~~ MAP-03-009

~~*This COL item is addressed in* Subsection 3.8.1.6.~~

CP COL 3.8(10) ***3.8(10)*** *Alternate wire prestressing system*

This COL item is addressed in Subsection 3.8.1.6.

3.8(11) *Deleted from the DCD.*

~~STD COL 3.8(12)~~ ***3.8(12)*** *Deleted from the DCD.*~~*Prestressing system specification*~~ MAP-03-010

~~*This COL item is addressed in* Subsection 3.8.1.6.~~

~~STD COL 3.8(13)~~ ***3.8(13)*** *Deleted from the DCD.*~~*Reinforcing steel specification*~~ MAP-03-011

~~*This COL item is addressed in* Subsection 3.8.1.6.~~

STD COL 3.8(14) ***3.8(14)*** *PCCV testing and ISI*

This COL item is addressed in Subsection 3.8.1.7.

Vertical loads present on the roof of the PSFSVs are carried by the perimeter and interior walls. The roof acts as a two-way slab with a single span in the north-south direction and a 3-span continuous slab with two-way action in the east-west direction. The vertical wall loads are transmitted to the mat slab and into the bedrock. The exterior walls are also designed for static and dynamic soil pressure in accordance with ASCE 4-98 (Reference 3.8-34). Walls loaded laterally by earth pressure act as two-way plate members, spreading load to the mat slab and perpendicular shear walls. For seismic load cases, the shear walls are designed to resist 100% of the applied lateral load. The shear walls transmit load to the foundation mat along their length. The load in the foundation mat is then transferred to the bedrock via friction and shear keys.

3.8.4.6.1.1 Concrete

CP COL Replace the second sentence of the first paragraph in DCD Subsection 3.8.4.6.1.1 with the following.

For ESWPT, UHSRS, and PSFSVs concrete compressive strength, f'_c = 5,000 psi is utilized.

3.8.4.7 Testing and Inservice Inspection Requirements

CP COL Replace the ~~content~~second through last paragraph of Subsection 3.8.4.7 with the following. MAP-03-012

A site-specific program for ~~M~~monitoring and maintenance of seismic category I structures is ~~required to be~~ performed in accordance with the requirements of NUMARC 93-01 (Reference 3.8-28) and 10 CFR 50.65 (Reference 3.8-29) as detailed in RG 1.160 (Reference 3.8-30). MAP-03-012

Prior to completion of construction, site-specific programs are developed in accordance with RG 1.127 (Reference 3.8-47) for ISI of seismic category I water control structures, including the UHSRS and any associated safety and performance instrumentation.

The site-specific programs address in particular ISI of critical areas to assure plant safety through appropriate levels of monitoring and maintenance. Any special design provisions (such as providing sufficient physical access or providing alternative means for identification of conditions in inaccessible areas that can lead to degradation) to accommodate ISI are also required to be addressed in the ISI program.

Because the CPNPP site exhibits nonaggressive ground water/soil (i.e., pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1,500 ppm),

3.10 SEISMIC AND DYNAMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

STD COL 3.10(3) Replace the second sentence of the fifth paragraph in

DCD Section 3.10 with the following.

As part of the equipment seismic qualification program, an equipment qualification file will be developed six months prior to procurement of equipment that contains a list of systems, equipment, and equipment supports, as defined above, and equipment qualification summary data sheets (EQSDSs) for the seismic qualification of each piece of safety-related seismic category I equipment. The data sheets will be populated during the procurement/start up testing phase.

~~CP COL 3.10(10~~) ~~Replace the sixth paragraph~~ MAP-03-014

~~in DCD Section 3.10 with the following.~~

~~An equipment seismic qualification program which addresses all requisite aspects of seismic and dynamic qualification of mechanical and electrical equipment is established, as discussed in Subsection 3.10.4.1. The equipment seismic qualification program addresses analysis and testing for qualification of site-specific equipment and components. The site-specific equipment seismic qualification program is also applied for qualification of select standard plant equipment and components, when detailed supplier characteristics cannot be verified prior to procurement. The equipment seismic qualification program incorporates all applicable requirements and guidance, including but not limited to the requirements and guidance of the reference DCD, Institute of Electrical and Electronic Engineers (IEEE) Std 344-1987 (Reference 3.10-6), IEEE Std 344-2004 (for Figure D.1 in Annex D only) (Reference 3.10-8), RG 1.100 (Reference 3.10-7), and SRP 3.10 (Reference 3.10-9).~~

~~The equipment seismic qualification program describes, in detail, the practices followed in seismic and dynamic qualification, including site-specific aspects such as site-specific seismic response spectra, and criteria, methods, and procedures used in conducting testing and analysis. The program includes establishment of an equipment qualification database which is shared with the environmental qualification (EQ) program discussed in Section 3.11.~~

3.10.1 Seismic Qualification Criteria

CP COL 3.10(8) Replace the last sentence of third paragraph in DCD Subsection 3.10.1 with the following.

Replace the content of DCD Subsection 3.10.5 with the following.

CP COL 3.10(1) ***3.10(1)*** *Equipment seismic qualification program plan*

This COL item is addressed in Subsection 3.10.4.1.

3.10(2) *Deleted from the DCD.*

STD COL 3.10(3) ***3.10(3)*** *Maintenance of equipment qualification files, including EQSDSs*

This COL item is addressed in Section 3.10.

3.10(4) *Deleted from the DCD.*

CP COL 3.10(5) ***3.10(5)*** *Previously tested components*

This COL item is addressed in Subsection 3.10.2.

3.10(6) *Deleted from the DCD.*

3.10(7) *Deleted from the DCD.*

CP COL 3.10(8) ***3.10(8)*** *Site-specific OBE*

This COL item is addressed in Subsection 3.10.1.

CP COL 3.10(9) ***3.10(9)*** *Applicability of high frequency*

This COL item is addressed in Subsection 3.10.2.

~~CP COL 3.10(10)~~ ***3.10(10)*** *Deleted from the DCD.*~~*Equipment seismic qualification program*~~ MAP-03-014

~~*This COL item is addressed in Subsection 3.10.*~~

3.13 THREADED FASTENERS (ASME CODE CLASS 1, 2, AND 3)

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

~~3.13.1.2.3 Reactor Vessel Closure Stud Bolting~~ MAP-03-015

~~STD COL 3.13(1)~~ ~~Replace the last sentence of the third paragraph in DCD Subsection 3.13.1.2.3 with the following.~~

~~Procedures will be prepared in accordance with Subsection 13.5.2.2, prior to initial installation of stud bolting to the RV head, to control the use of seal plugs, to maintain stud bolting following head removal in an area free from corrosion and contamination, to provide adequate protection for the stud bolting, and to permit ISI on the bolting while removed from the RV.~~

~~3.13.1.2.5 Fastener Thread Lubricants and Sealants~~ MAP-03-016

~~STD COL 3.13(2)~~ ~~Replace the last sentence of the second paragraph in DCD Subsection 3.13.1.2.5 with the following.~~

~~Procedures will be prepared in accordance with Subsection 13.5.2.2, prior to safety-related use, to control the use of fastener thread lubricants, sealants, and cleaning fluids that comply with the recommendations provided, including References 3.13-6 through 3.13-10.~~

3.13.1.5 Certified Material Test Reports

STD COL 3.13(3) Replace the first sentence in the first paragraph in DCD Subsection 3.13.1.5 with the following.

Quality records, including certified material test reports for all property test and analytical work performed on nuclear threaded fasteners, are maintained for the life of plant as part of the QAP described in Chapter 17.

3.13.2 Inservice Inspection Requirements

STD COL 3.13(4) Replace the last sentence of the first paragraph in DCD Subsection 3.13.2 with the following.

Compliance with the requirements of the ISI program relating to threaded fasteners, including any applicable PSI and IST, is implemented as part of the operational programs. The ISI program is baselined using PSI. A PSI program relating to threaded fasteners will be implemented after the start of construction and prior to initial plant startup to comply with the requirements of ASME Section XI (Reference 3.13-14). Additionally, in accordance with ASME Section XI, IWA-1200, the PSI code requirements may be performed irrespective of location (such as at manufacturer) once the construction Code requirements have been met.

STD COL 3.13(5) Replace the first sentence of the fifth paragraph in DCD Subsection 3.13.2 with the following.

An ISI program for the pressure testing of mechanical joints utilizing threaded fasteners is implemented in accordance with the requirements of ASME Code, Section XI, IWA-5000 (Reference 3.13-14), and the requirements of 10 CFR 50.55a(b)(2)(xxvi) (Reference 3.13-11), Pressure Testing Class 1, 2, and 3 Mechanical Joints, and Removal of Insulation, paragraph (xxvii).

3.13.3 Combined License Information

Replace the content of DCD Subsection 3.13.3 with the following.

~~STD COL 3.13(1)~~ ***3.13(1)*** *Deleted from the DCD.* ~~*Procedures for effective corrosion protection for stud bolting to allow ISI*~~ MAP-03-015

~~*This COL Item is addressed in Subsection 3.13.1.2.3.*~~

~~STD COL 3.13(2)~~ ***3.13(2)*** *Deleted from the DCD.* ~~*Procedures for final selection of lubricants, sealants, and cleaning fluids*~~ MAP-03-016

~~*This COL Item is addressed in Subsection 3.13.1.2.5.*~~

STD COL 3.13(3) ***3.13(3)*** *Quality records including certified material test reports for property test and analytical work on threaded fasteners*

This action is resolved in Subsection 3.13.1.5.

STD COL 3.13(4) ***3.13(4)*** *Compliance with ISI requirements*

This COL Item is addressed in Subsection 3.13.2.

STD COL 3.13(5) ***3.13(5)*** *Complying with requirements of ASME Code, Section XI, and 10 CFR 50.55a*

This COL Item is addressed in Subsection 3.13.2.

Chapter 4

Chapter 4 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
					0

Chapter 5

Chapter 5 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
					0

Chapter 6

Chapter 6 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
CTS-00642	6.1	6.1-1	Update	All 6.1 COL Items have been deleted from the DCD. This FSAR section is now IBR with no departures or supplements.	0
MAP-06-001	6.1.1.2.2	6.1-2	Deletion of COL Item	Delete COL Item.	0
MAP-06-002	6.1.1.1	6.1-1 6.1-2	Deletion of COL Item	Delete COL Item.	0
MAP-06-003	6.1.1.2.1	6.1-1 6.1-2	Deletion of COL Item	Delete COL Item.	0
MAP-06-004	6.1.1.2.1	6.1-1 6.1-2	Deletion of COL Item	Delete COL Item.	0
MAP-06-005	6.1.2	6.1-2 6.1-3	Deletion of COL Item	Delete COL Item.	0
MAP-06-006	6.2.1.1.3.4 6.2.1.5.7	6.2-1 6.2-3	Deletion of COL Item	Delete COL Item.	0
MAP-06-007	6.2.2.3 Table 6.2.2-2R	6.2-1 6.2-4 6.2-6	Deletion of COL Item	Delete COL Item.	0
MAP-06-008	6.2.4.2	6.2-2 6.2-3	Deletion of COL Item	Delete COL Item.	0
MAP-06-009	6.2.5.2	6.2-2 6.2-3	Deletion of COL Item	Delete COL Item.	0
DCD_06.02.06-2	6.2.6.1	6.2-3	DCD_RAI 06.02.06-2	Change “first sentence “ to “first and second sentences”.	0
CTS-00643	6.3	6.3-1	Update	All 6.3 COL Items have been deleted from the DCD. This FSAR section is now IBR with no departures or supplements.	0
MAP-06-011	6.3.2.8	6.3-1 6.3-2	Deletion of COL Item	Delete COL Item.	0
MAP-06-012	6.3.2.2.4	6.3-1 6.3-2	Deletion of COL Item	Delete COL Item.	0
MAP-06-013	6.3.2.4	6.3-1 6.3-2	Deletion of COL Item	Delete COL Item.	0
CTS-00518 CTS-00644	6.4.4.1	6.4-1	To reflect resolution of acceptance review issue	Include dose evaluation in the control room due to a post-accident release from the other US-APWR unit or existing CPNPP unit.	0

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
MAP-06-014	6.4.3 6.4.7	6.4-1 6.4-3	Revision of COL Item	Revise COL Item to only discuss automatic actions and manual procedures for the MCR HVAC system in the event of postulated toxic gas release.	0
MAP-06-015	6.4.2.2.1	6.4-1 6.4-3	Deletion of COL Item	Delete COL Item.	0
CTS-00652	6.4.4.2 6.4.7	6.4-2 6.4-3	Re-evaluation of COL Item	Associate COL 6.4(2) with Subsection 6.4.4.2.	0
MAP-06-016	6.5.1.7	6.5-1	Deletion of COL Item	Delete COL Item.	0
MAP-06-018	6.6.8	6.6-1	Revision of COL Item	Revise description to only identify the implementation milestone of the program.	0

6.1 ENGINEERED SAFETY FEATURE MATERIALS

This section of the referenced DCD is incorporated by reference with ~~the following~~no departures ~~and/~~or supplements. CTS-00642

~~6.1.1.1 Materials Selection and Fabrication~~ MAP-06-002

~~STD COL 6.1(2)~~ ~~Replace the fourth sentence of the fifth paragraph in DCD Subsection 6.1.1.1 with the following.~~

~~An augmented inservice inspection (ISI) program will be developed to ensure the structural integrity of such components during service and will be implemented in accordance with Table 13.4-201.~~

~~6.1.1.2.1 Compatibility of Construction Materials with Core Cooling Coolants and Containment Sprays~~ MAP-06-003

~~STD COL 6.1(3)~~ ~~Replace the fourth sentence of the second paragraph in DCD Subsection 6.1.1.2.1 with the following.~~

~~A program to maintain an inventory of all acids and bases within the containment to aid in control of the pH of the recirculating water will be developed prior to initial fuel load. An as-built tabulation of acids and bases will be prepared to assist in the control of pH during accident conditions. The tabulation will include inventories of acids/bases in the reactor coolant system (RCS), Accumulators, refueling water storage pit (RWSP), NaTB containers and acid generated during accident conditions (e.g., hydriodic acid, nitric acid, hydrochloric acid).~~

~~STD COL 6.1(4)~~ ~~Replace the fifth sentence of the second paragraph in DCD Subsection 6.1.1.2.1 with the following.~~ MAP-06-004

~~A list of materials within the containment that would yield hydrogen gas by corrosion from the emergency cooling or containment spray solutions will be prepared prior to initial fuel load.~~

~~6.1.1.2.2 Controls for Austenitic Stainless Steel~~ MAP-06-001

STD COL 6.1(1) Replace the fifth and sixth sentences of the first paragraph in DCD Subsection 6.1.1.2.2 with the following. MAP-06-001

Programs that support the cleaning of materials and components, cleanliness control, and pre-operational flushing for systems that contain austenitic stainless steel components will be developed and implemented under the quality assurance program referenced in Sections 17.1, 17.2, 17.3 and 17.5 prior to initial fuel load.

6.1.2 Organic Materials

MAP-06-005

CP COL 6.1(5) Replace the last two sentences of the first paragraph in DCD Subsection 6.1.2 with the following.

An as-built list of organic materials will be prepared prior to initial fuel load. Organic materials that exist in significant amounts within the containment building are identified and quantified. Such organic materials include plastics, lubricants, paint or coatings, and electrical cable insulation.

6.1.3 Combined License Information

MAP-06-001 MAP-06-002 MAP-06-003 MAP-06-004 MAP-06-005

Replace the content of DCD Subsection 6.1.3 with the following.

STD COL 6.1(1) ***6.1(1)*** *Cleanliness control program for austenitic stainless steel* MAP-06-001

This Combined License (COL) item is addressed in Subsection 6.1.1.2.2.

STD COL 6.1(2) ***6.1(2)*** *Augmented ISI program for cold-worked austenitic stainless steel components* MAP-06-002

This COL item is addressed in Subsection 6.1.1.1.

STD COL 6.1(3) ***6.1(3)*** *Control program of pH within a post LOCA environment* MAP-06-003

This COL item is addressed in Subsection 6.1.1.2.1.

STD COL 6.1(4) ***6.1(4)*** *Identification of materials that would yield hydrogen gas* MAP-06-004

This COL item is addressed in Subsection 6.1.1.2.1.

CP COL 6.1(5) ***6.1(5)*** *Identification and qualification of all organic materials in the containment* MAP-06-005

~~This COL item is addressed in Subsection 6.1.2~~ MAP-06-005

~~**6.1(6)** Deleted from the DCD.~~ MAP-06-001 MAP-06-002 MAP-06-003 MAP-06-004 MAP-06-005

6.2 CONTAINMENT SYSTEMS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

~~6.2.1.1.3.4 Description of Containment Analyses~~ MAP-06-006

~~STD COL 6.2(1)~~ ~~Replace the second sentence of the fourteenth paragraph in DCD Subsection 6.2.1.1.3.4 with the following.~~

~~The verification of passive heat sink data will be provided to confirm that the data based on as-built information is bounded by the data assumed in the maximum containment pressure analyses for postulated primary or secondary system rupture and the minimum containment pressure analyses. A report will be prepared to document the results of the verification for U.S. Nuclear Regulatory Commission (NRC) review. This report will be prepared prior to initial fuel load.~~

~~6.2.1.5.7 Passive Heat Sinks~~

~~STD COL 6.2(1)~~ ~~Replace the second sentence of the first paragraph in DCD Subsection 6.2.1.5.7 with the following.~~

~~The verification of passive heat sink data will be provided to confirm that the data based on as-built information is bounded by the data assumed in the maximum containment pressure analyses for postulated primary or secondary system rupture and the minimum containment pressure analyses. A report will be prepared to document the results of the verification for NRC review. This report will be prepared prior to initial fuel load.~~

6.2.2.3 Design Evaluation

~~STD COL 6.2(9)~~ ~~Replace the seventh paragraph of DCD Subsection 6.2.2.3 with the following.~~ MAP-06-007

~~Administrative programs which address the selection, procurement, and installation of insulation will be developed and implemented prior to the procurement phase.~~

STD COL 6.2(5) Replace the first sentence of the tenth paragraph in DCD Subsection 6.2.2.3 with the following.

Administrative procedures implement the containment cleanliness program.

Procedures to remove foreign materials and minimize the amount of debris that might be left in containment following refueling and maintenance outages address the following:

- Frequency of cleanliness control and inspection activities for operation and maintenance
- Restriction of materials introduced into the containment
- Accounting for materials introduced into and out of the containment (e.g., scaffold, tape, labels, plastic film, paper, cloth, keys, and pens)
- Cleaning of maintenance outage area, including areas associated with removal or replacement of insulation
- Cleanliness inspections and removal of debris/foreign material, including operation and maintenance areas, RWSP, debris interceptors, RWSP vent and drain lines (available for inspection), and strainer debris
- Preparation and review of entry/exit logs and inspection records

The containment cleanliness program including administrative procedures will be developed and implemented prior to initial fuel load.

~~6.2.4.2 System Design~~ MAP-06-008

~~STD COL 6.2(6)~~ ~~Replace the last sentence of the forth paragraph in DCD Subsection 6.2.4.2 with the following.~~

~~A list of as-built pipe run distances from the outer containment isolation valves to the containment penetrations will be prepared prior to initial fuel load.~~

~~6.2.5.2 System Design~~ MAP-06-009

~~STD COL 6.2(7)~~ ~~Replace the last paragraph in DCD Subsection 6.2.5.2 with the following.~~

~~The operating principle and accuracy of the hydrogen monitor (combustible gas analyzer) will be provided in procurement specifications and vendor supplied documentation prior to the procurement phase.~~ MAP-06-009

6.2.6.1 Containment Integrated Leakage Rate Testing

STD COL 6.2(8) Replace the first and second sentences of the first paragraph in DCD Subsection 6.2.6.1 with the following. DCD_06.02.06-2

The containment leakage rate test program requirements are defined by Technical Specifications Subsection 5.5.16. Implementation milestone of the containment leak rate tests program is provided in Table 13.4-201.

6.2.8 Combined License Information

Replace the content of DCD Subsection 6.2.8 with the following.

~~STD COL 6.2(1)~~ ***6.2(1)*** *Deleted from the DCD.~~Provision for as-built information of heat sinks~~* MAP-06-006

~~This COL item is addressed in Subsections 6.2.1.1.3.4 and 6.2.1.5.7~~

6.2(2) *Deleted from the DCD.*

6.2(3) *Deleted from the DCD.*

6.2(4) *Deleted from the DCD.*

STD COL 6.2(5) ***6.2(5)*** *Preparation of a cleanliness, housekeeping and foreign materials exclusion program*

This COL item is addressed in Subsection 6.2.2.3 and Table 6.2.2-2R.

~~STD COL 6.2(6)~~ ***6.2(6)*** *Deleted from the DCD.~~As-built pipe run distances from outer containment isolation valve to the containment penetration~~* MAP-06-008

~~This COL item is addressed in Subsection 6.2.4.2.~~

~~STD COL 6.2(7)~~ ***6.2(7)*** *~~Operating principle and accuracy of the hydrogen monitor~~* MAP-06-009

~~This COL item is addressed in Subsection 6.2.5.2.~~Deleted from the DCD.

STD COL 6.2(8) ***6.2(8)*** *Containment leakage rate testing program*

This COL item is addressed in Subsections 6.2.6.1.

STD COL 6.2(9) ***6.2(9)*** *Deleted from the DCD. Administrative program for controlling selection, purchase, and installation of specific insulation products* MAP-06-007

This COL item is addressed in Subsection 6.2.2.3 and Table 6.2.2-2R.

6.2(10) *Deleted from the DCD.*

MAP-06-007

Table 6.2.2-2R (Sheet 7 of 21)

Comparison of RWSP Recirculation Intake Debris Strainer Design to RG 1.82 Requirements

	No.	Regulatory Position	US-APWR Design
STD COL 6.2(9)	1.1.2.2	Insulation types (e.g., fibrous and calcium silicate) that are sources of debris known to readily transports to the sump screen and cause higher head losses may be replaced with insulation (e.g., reflective metallic insulation) that transports less readily and causes less severe head losses once deposited onto the sump screen. If insulation is replaced or otherwise removed during maintenance, abatement procedures should be established to avoid generating debris or its residue in the containment.	Particulate (e.g., Min-K-based) insulation is excluded from the containment by design. Selection, purchase, and installation of specific insulation products are addressed in Subsection 6.2.2.3.
	1.1.2.3	To minimize potential debris caused by chemical reaction of the pool water with metals in the containment, exposure of bare metal surfaces (e.g., scaffolding) to containment cooling water through spray impingement or immersion should be minimized, either by removal or by chemical-resistant protection (e.g., coatings or jackets).	The principal measures taken by the US-APWR design to preclude adverse chemical effects include the use of a buffering agent, NaTB, and minimizing the use of aluminum.
	1.1.3	**Instrumentation**	**Design Features and Capabilities**
		If relying on operator action to mitigate the consequences of the accumulation of debris on the ECC sump screens, safety-related instrumentation that provides operators with an indication and audible warning of impending loss of NPSH for ECCS pumps should be available in the MCR.	Containment spray and safety injection (SI) pump operating information is available in the main control room (MCR) to assist in net positive suction head (NPSH) evaluation and includes flow, suction, discharge pressure, and pump motor current.

6.3 EMERGENCY CORE COOLING SYSTEMS

This section of the referenced DCD is incorporated by reference with ~~the following~~no departures ~~and/~~or supplements. CTS-00643

~~6.3.2.2.4 ECC/CS Strainers~~ MAP-06-012

~~STD COL 6.3(4)~~ ~~Replace the last paragraph in DCD Subsection 6.3.2.2.4 with the following.~~

~~Technical Specifications Subsection 3.5.4 establishes the OPERABILITY requirements for the RWSP water chemistry, and Technical Specifications Subsection 3.5.5 establishes other chemical requirements to ensure proper water chemistry for post-accident conditions. Additionally, the RWSP water chemistry control procedures address chemical requirements. Implementation of the surveillances and chemistry control procedures minimizes adverse chemical effects. A program to maintain RWSP water chemistry including surveillance test procedures will be developed and implemented prior to initial fuel load.~~

~~6.3.2.4 Material Specifications and Compatibility~~ MAP-06-013

~~STD COL 6.3(6)~~ ~~Replace the second paragraph in DCD Subsection 6.3.2.4 with the following.~~

~~An as-built list of materials (by their commercial names, quantities [estimated where necessary], and chemical composition) used in or on the emergency core cooling system (ECCS) will be prepared. The list is evaluated based on the as-procured, as-built system to determine potential adverse radiolytic or pyrolytic decomposition product interactions with the ESF systems. This evaluation, based on the as-procured, as-built system, will be prepared prior to initial fuel load.~~

~~6.3.2.8 Manual Actions~~ MAP-06-011

~~STD COL 6.3(3)~~ ~~Replace the first sentence of the last paragraph in DCD Subsection 6.3.2.8 with the following.~~

~~Station operating procedures for normal, abnormal, and emergency operation of the SI pumps, accumulators, and emergency letdown, including feed-and-bleed operation, will be developed and implemented in accordance with Section 13.5~~. ~~prior to initial fuel load.~~

6.3.6 Combined License Information MAP-06-011 MAP-06-012

Replace the content of DCD Subsection 6.3.6 with the following. MAP-06-013

6.3(1) Deleted from the DCD.

6.3(2) Deleted from the DCD.

STD COL 6.3(3) *6.3(3) ECCS operating procedure* MAP-06-011

This COL item is addressed in Subsection 6.3.2.8.

STD COL 6.3(4) *6.3(4) RWSP water chemistry including surveillance test procedures* MAP-06-012

This COL item is addressed in Subsection 6.3.2.2.4.

6.3(5) Deleted from the DCD. MAP-06-011 MAP-06-012

STD COL 6.3(6) *6.3(6) Preparation of an as-built list of material used in or on the ECCS* MAP-06-013

This COL item is addressed in Subsection 6.3.2.4. MAP-06-013

6.4 HABITABILITY SYSTEMS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

6.4.2.2.1 Main Control Room Emergency Filtration Unit MAP-06-015

CP COL 6.4(4) Replace the last paragraph in DCD Subsection 6.4.2.2.1 with the following.

The type of charcoal adsorber is type III impregnated charcoal adsorber. The adsorber weight and distribution are provided in the final design in conjunction with vendor selection, as part of the procurement process. The design will be completed prior to initial fuel load.

6.4.3 System Operational Procedures

CP COL 6.4(2) STD COL 6.4(2) Replace the secondthird paragraph in DCD Subsection 6.4.3 with the following. MAP-06-014

The analyses of control room habitability during postulated release of toxic chemicals described in Subsection 6.4.4.2 identify no hazardous chemical that exceeds the IDLH criteria of RG 1.78, so that no specific automatic action of MCR HVAC system is required to protect operators within the CRE against toxic gas release event. The emergency isolation mode may be initiated by manual action as described in Subsection 6.4.4.2.Operating procedures for normal, abnormal, and emergency operation of the MCR HVAC system are developed and implemented in accordance with Section 13.5. These procedures and associated training address the applicable operating and training aspects of Regulatory Guide (RG) 1.196. The procedures will be developed and implemented prior to initial fuel load.

6.4.4.1 Radiological Protection CTS-00518

CP SUP 6.4(1) Add the following text after the paragraph in DCD Subsection 6.4.4.1: CTS-00644

The impact of a post-accident release on the maximum control room dose for the same US-APW R unit at Comanche Peak has been evaluated and addressed in the DCD. The DCD analysis credits operation of the main control room HVAC system in the pressurization mode. The dose to the control room operation at an adjacent US-APWR unit due to a radiological release from the other US-APWR unit is bounded by the dose to control room operators in the affected unit. While it is possible that the other US-APWR unit may be downwind in an unfavorable location, the dose at the downwind unit would be bounded by what has already been evaluated for a single US-APWR unit in the DCD. In addition, because the shortest distance between existing Comanche Peak Unit 1 or Unit 2 and US-APWR Unit 3 or Unit 4 is several times the separation between Unit 3 and Unit 4, the dose to either US-APWR unit control room from either existing operating unit would be bounded by a release at the same US-APWR Unit. Simultaneous post-accident radiological releases from multiple units at a single site are not considered to be credible. CTS-00518 CTS-00644

6.4.4.2 Toxic Gas Protection

CP COL 6.4(1) CP COL 6.4(2) Replace the second paragraph in DCD Subsection 6.4.4.2 with the following. CTS-00518 CTS-00652

The control room habitability analyses consider postulated releases of toxic chemicals from mobile and stationary sources in accordance with the requirements of RG 1.78. Chemicals, including chemicals in Comanche Peak Nuclear Power Plant (CPNPP) Units 1 and 2, are identified and screened as described in Subsection 2.2.3.1.3.

Several hazardous chemicals exceed the screening criteria provided in RG 1.78 and an analysis is required to determine control room concentrations. Using conservative assumptions and input data for chemical source term, CPNPP Units 3 and 4 control room parameters, site characteristics, and meteorology inputs, postulated chemical releases are analyzed for maximum value concentration to the MCR using the HABIT code, version 1.1. RG 1.78 specifies the use of HABIT 1.1 software for evaluating control room habitability. HABIT software includes modules that evaluate radiological and toxic chemical transport and exposure. For this analysis of chemical release concentrations, EXTRAN, and CHEM modules are utilized in the code. EXTRAN models toxic chemical transport from the selected release point to the heating, ventilation, and air conditioning (HVAC) intake for the MCR. CHEM is then applied by HABIT to model chemical exposure to control room personnel, based on EXTRAN output and MCR design parameters.

The meteorological conditions assumed for these cases are conservatively set at G stability and 2.5 m/s wind speed, or slightly more extreme than 95th percentile for the CPNPP site. The 2.5 m/s wind speed is higher than would be expected for G stability but is conservative in that it introduces the chemical gas into the intakes faster than at lower speeds. The analyses are thus bounding. Lower concentrations are calculated on average using F stability and 1 m/s wind speed.

The HABIT-based analysis determines the peak concentration in the MCR and compares this level to the RG 1.78 criterion, the specific chemical listed immediately dangerous to life and health (IDLH). In the cases that were analyzed, all postulated releases led to concentrations that are well below the IDLH level.

Values of IDLH for various chemicals are found in NUREG/CR-6624 (Reference 6.4-201).

The most limiting case, or the one that leads to the highest control room concentration relative to the IDLH, is the tanker truck release of chlorine on Highway FM 56, at a distance of closest approach to CPNPP Units 3 and 4 MCR intake of 1.4 miles. Chlorine is used for this case because it is one of the most hazardous Department of Transportation approved chemicals, and bounds other chemicals by toxicity, dispersibility, and quantity that may use public transportation such as Highway FM 56. Using the methodology prescribed by RG 1.78, the concentration remains below ~~5.2~~5.7 ppm at equilibrium in the MCR. This concentration (~~5.2~~5.7ppm) is less than the IDLH concentration for chlorine (10 ppm). The concentration at the MCR HVAC intakes, that is the concentration of outside, will exceed the IDLH (10 ppm) at about 2.5 minutes, remain elevated until approximately 7 minutes, and then start decreasing slowly on a scale based on the volume and ventilation rates in the MCR. CTS-00653

RG 1.78 states that it is expected that a control room operator will don a respirator and protective clothing, or take other mitigating action within two minutes after detection. The concentration in the MCR reaches the human detection threshold for chlorine (3.5 ppm) at approximately 9 minutes and reaches the maximum concentration (~~5.2~~5.7 ppm) in approximately 13 minutes. Also during a toxic gas emergency, the control room operators have the option of manually actuating the emergency isolation mode of the MCR HVAC System. CTS-00653

6.4.6 Instrumentation Requirement

CP COL 6.4(5) Replace the last paragraph in DCD Subsection 6.4.6 with the following.

Instrumentation to detect and alarm a hazardous chemical release in the vicinity of CPNPP Units 3 and 4, and to automatically isolate the control room envelope (CRE) from such releases is not required based on analyses described in Subsection 6.4.4.2. No hazardous chemicals concentrations in the MCR exceeded the IDLH criteria of RG 1.78.

6.4.7 Combined License Information

Replace the content of DCD Subsection 6.4.7 with the following.

CP COL 6.4(1) ***6.4(1)*** *Toxic chemicals of mobile and stationary sources and evaluation of the control room habitability*

This COL item is addressed in Subsection 6.4.4.2.

CP COL 6.4(2) STD COL 6.4(2) ***6.4(2)*** *Automatic and manual action for the MCR HVAC system that are required in the event of postulated toxic gas releaseNormal, abnormal, and emergency operating procedures for the MCR HVAC system* MAP-06-014

This COL item is addressed in Subsection 6.4.3 and Subsection 6.4.4.2. CTS-00652

6.4(3) *Deleted from the DCD.*

CP COL 6.4(4) ***6.4(4)*** *Charcoal adsorber weight, type, and distribution* MAP-06-015

This COL item is addressed in Subsection 6.4.2.2.1.Deleted from the DCD.

CP COL 6.4(5) ***6.4(5)*** *Toxic gas detection requirements necessary to protect the CRE*

This COL item is addressed in Subsection 6.4.6.

6.4.8 References

Add the following reference after the last reference in DCD Subsection 6.4.8.

6.4-201 U.S. Nuclear Regulatory Commission, *Recommendations for Revision of Regulatory Guide 1.78*, NUREG/CR-6624, Washington, DC, 1999.

6.5 FISSION PRODUCT REMOVAL AND CONTROL SYSTEMS

This section of the referenced DCD isincorporated by reference with ~~the following departures and/or supplements~~no departures or supplements. MAP-06-016

~~6.5.1.7 Materials~~

~~STD COL 6.5(4)~~ ~~Replace the second sentence in DCD Subsection 6.5.1.7 with the following.~~

~~An as-built list of materials by their commercial names, quantities (estimated where necessary), and chemical composition used in or on the Annulus Emergency Exhaust System and MCR HVAC System will be prepared. The list is evaluated based on the as-procured, as-built system to confirm that there are no adverse radiolytic or pyrolytic decomposition product interactions with the ESF systems. This evaluation will be prepared prior to initial fuel load.~~

~~6.5.6 Combined License Information~~

~~Replace the content of DCD Subsection with the following.~~

~~***6.5(1)** Deleted from the DCD.*~~

~~***6.5(2)** Deleted from the DCD.*~~

~~***6.5(3)** Deleted from the DCD.*~~

~~STD COL 6.5(4)~~ ~~***6.5(4)** Provision for an as-built list of material used in or on the ESF filter systems*~~

~~*This COL item is addressed in* Subsection 6.5.1.7.~~

6.6 INSERVICE INSPECTION OF CLASS 2 AND 3 COMPONENTS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

STD COL 6.6(1) Replace the second sentence of the second paragraph in DCD Section 6.6 with the following.

A preservice inspection program (non-destructive base line examination) and an Inservice inspection program for American Society of Mechanical Engineers (ASME) Code Section III Class 2 and 3 systems, components (pumps and valves), piping, and supports will be developed and implemented in accordance with Table 13.4-201.

6.6.8 Augmented ISI to Protect Against Postulated Piping Failures

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STD COL 6.6(2) Replace the first sentence of the second paragraph in DCD Subsection 6.6.8 with the following.

~~The non-destructive examination method is 100 percent volumetric examination of circumferential and longitudinal welds in the affected piping during each 10-year inspection interval, except as exempted by ASME Code, Section XI, IWC-1220.~~ Implementation milestones of the augmented ISI program are the same as that specified for inservice inspection of Class 2 and 3 components provided in Table 13.4-201. MAP-06-018

6.6.9 Combined License Information

Replace the content of DCD Subsection 6.6.9 with the following.

STD COL 6.6 (1) ***6.6(1)*** *Preparation of a preservice inspection program and an inservice inspection program*

This COL item is addressed in Section 6.6.

STD COL 6.6(2) ***6.6(2)*** *Preparation of an augmented inservice inspection program for high-energy fluid system piping*

This COL Item is addressed in Subsection 6.6.8.

Chapter 7

Chapter 7 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
					0

Chapter 8

Chapter 8 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
CTS-00641	8.2.1.2.1.1	8.2-6	Erratum	Change “is” to “are”.	0
CTS-00477	8.2	8.2-6	Clarification	Change description of offsite power system.	0

Phase step-distance and ground directional-overcurrent protection ~~is~~are also provided as backup protection. Each plant switching station bus has dual independent differential protection schemes. Each transmission tie line has differential protection and phase step-distance and ground directional-overcurrent protection. The relay protection schemes for independent transmission lines are designed so that any single failure or incident, such as control house fire or cable dig-in, will not cause loss of both circuits in any combination of two independent transmission lines. The relay panels for independent transmission lines are physically located in separate control house and the control cables are physically separated. The design for every protection zone has fully redundant and electrically independent protection systems. This fully redundant concept is also applied to the breaker-failure schemes. CTS-00641 CTS-00477

CP COL 8.2(9) The primary ac power supply for the plant switching station is provided from existing local electric distribution system. The backup ac power is supplied by a separate power source from the primary ac power.

CP COL 8.2(11) Any combination of two of the four outgoing transmission lines (DeCordova, Parker, Johnson, and Whitney), except for the combinations of DeCordova and Johnson and Parker and Whitney, are two independent offsite power circuits from the ERCOT transmission network to the plant switching station. Any credible single incident or single failure of a transmission line or a plant switching station component does not result in simultaneous failure of ~~all combinations~~both circuits in any combination of two independent offsite power circuits. The FMEA presented in Table 8.2-203 indicates that at least one of the two independent offsite power circuits would remain available to perform its design basis functions under a postulated single incident or a single failure. The FMEA examines the various ways in which a failure may occur and the effects of this failure on the ability of the equipment to continue to perform its intended function. Each piece of critical equipment was reviewed to determine how it might fail. Physical as well as electrical failures were examined. Failures caused by external influences as well as failures due to overloading or over stressing of equipment were examined. CTS-00477

Each type of failure was evaluated to determine if it would affect any other equipment. For instance, if the trip out of a transmission line might cause other lines to be overloaded or interrupt an offsite power circuit.

The effects were analyzed to determine if critical functions of the plant switching station would be affected. There should be no single failure that results in un-availability of ~~all combination of two independent offsite~~at least two power circuits and compromise the ability of the plant to maintain containment integrity and other vital functions. Failure modes and effects of the following equipment of the plant switching station were analyzed. CTS-00477

- Transmission line towers.
- Transmission lines.

Chapter 9

Chapter 9 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
DCD_09.05.01-6	9.5.1.3 9.5.9	9.5-3 9.5-18	DCD_RAI 09.05.01-6	Add Subsection 9.5.1.3.	0
DCD_09.05.01-15	Table 9.5.1-1R	9.5-46	DCD_RAI 09.05.01-15	Add LMNs in Table 9.5.1-1R and Table 9.5.1.2R.	0
DCD_09.05.01-7	Table 9.5.1-1R	9.5-55	DCD_RAI 09.05.01-7	Add “see Subsection 9.5.1.3” to Table 9.5.1.1R.	0
DCD_09.05.01-5	Table 9.5.1-1R	9.5-56	DCD_RAI 09.05.01-5	Fill in Remarks on Table 9.5.1-1R.	0
DCD_09.05.01-15	Table 9.5.1-2R	9.5-112 9.5-113	DCD_RAI 09.05.01-15	Add LMNs in Table 9.5.1-1R and Table 9.5.1.2R.	0

9.5.1.3 Safety Evaluation

DCD_09.05.01-6

CP COL 9.5(1) Replace the eight paragraph in DCD Subsection 9.5.1.3 with the following

DCD_09.05.01-6

The Final FHA and safe-shutdown evaluation based on the final plant cable routing, fire barrier ratings, fire loading, ignition sources, purchased equipment and equipment arrangement will be performed. The final FHA and safe-shutdown evaluation will include a review against the assumptions and requirements stated in the initial FHA and safe-shutdown evaluation. The final FHA and safe-shutdown evaluation will also include a detailed post-fire safe-shutdown circuit analysis performed and documented using a methodology similar to that described in NEI 00-01, "Guide for Post-Fire Safe-Shutdown Circuit Analysis," using as-built data. The final FHA will be performed in accordance with Table 13.4-201.

CP COL 9.5(1) Add the following new subsections after DCD Subsection 9.5.1.5.

9.5.1.6 Fire Protection Program

During construction, a site construction FPP is in place that addresses the requirements of Chapter 11, NFPA 804. This initial FPP is under the responsibility of the construction superintendent. Program responsibility is transferred to the Site Vice President as operational testing approaches. The CPNPP senior management position responsible for the operational program is the Site Vice President. The Site Vice President has delegated to the Operations Review Committee the responsibility to assess the effectiveness of the FPP, which is accomplished through periodic audits. Recommendations and the findings from these audits are reported to the Site Vice President.

The CPNPP FPP is developed in accordance with guidance provided in RG 1.189, as described in the following sections. The CPNPP FPP policy is captured in a formal plant document that defines management authorities, authority for conflict resolution, programmatic responsibilities, and establishes the general policy for the site FPP.

The CPNPP FPP is established to ensure that a fire will not affect safe-shutdown capabilities and will not endanger the health and safety of the public. Fire protection at CPNPP is accomplished by using a defense-in-depth approach to include fire detection, extinguishing systems and equipment, administrative controls, procedures, and trained personnel.

In accordance with Table 13.4-201, procedures for implementing the CPNPP FPP are developed and implemented prior to start-up. All elements of the CPNPP FPP are reviewed every 2 years and updated as necessary.

unconfirmed removal of strategic special nuclear material in accordance with 10 CFR 73.45(e)(2)(iii).

9.5.9 Combined License Information

Replace the content of DCD Subsection 9.5.9 with the following.

CP COL 9.5(1) ***9.5(1)*** *Fire protection program, fire fighting procedures, and quality assurance*

This *COL item is addressed in Subsections 9.5.1, 9.5.1.3, 9.5.1.6, Table 9.5.1-1R and Table 9.5.1-2R.* DCD_09.05.01-6

CP COL 9.5(2) ***9.5(2)*** *Site specific fire protection aspects*

This COL item is addressed in Subsection *9.2.1.2.1, 9.5.1.2.1, 9.5.1.2.2, 9.5.1.2.3, 9.5.1.2.4, Table 9.5.1-1R, Table 9.5.1-2R, Figure 9.5.1-201, Figure 9.5.1-202 and Appendix 9A.*

CP COL 9.5(3) ***9.5(3)*** *Apparatus for plant personnel and fire brigades*

This COL item is addressed in Subsection 9.5.1.6.1.8 and Table 9.5.*1-2R.*

CP COL 9.5(4) ***9.5(4)*** *Communication system interfaces external to the plant (offsite locations)*

This COL item is addressed in Subsection 9.5.2, 9.5.2.2.2, 9.5.2.2.2.2 and 9.5.2.2.5.1.

CP COL 9.5(5) ***9.5(5)*** *The emergency offsite communications*

This *COL item is addressed in Subsection 9.5.2.2.2, 9.5.2.2.2.2 and 9.5.2.2.5.2.*

CP COL 9.5(6) ***9.5(6)*** *Connections to the Technical Support Center*

This *COL item is addressed in Subsection 9.5.2.2.5.2*

CP COL 9.5(7) ***9.5(7)*** *Continuously manned alarm station*

This *COL item is addressed in Subsection 9.5.2.2.5.2. and 9.5.2.3.*

CP COL 9.5(8) ***9.5(8)*** *Offsite communications for the onsite operations support center.*

This *COL item is addressed in Subsection 9.5.2.2.5.2*

CP COL 9.5(9) ***9.5(9)*** *Emergency communication system*

This *COL item is addressed in Subsection 9.5.2.2.5.2.*

Table 9.5.1-1R (Sheet 26 of 53)
CPNPP Units 3 & 4 Fire Protection Program Conformance with RG 1.189

	Regulatory Position	Position Number	Conformance	Remarks	
	Floor drains sized to remove expected firefighting water without flooding equipment important to safety should be provided in areas where fixed water fire suppression systems are installed. Floor drains should also be provided in other areas where hand hose lines may be used if such firefighting water could cause unacceptable damage to equipment important to safety in the area. Facility design should ensure that fire water discharge in one area does not impact equipment important to safety in adjacent areas.	4.1.5	Conform		
	Emergency lighting should be provided throughout the plant as necessary to support fire suppression actions and safe-shutdown operations, including access and egress pathways to safe shutdown areas during a fire event.	4.1.6	Conform		
	Emergency lighting should be provided in support of the emergency egress design guidelines in outlined in Regulatory Position 4.1.2.3 of this guide.	4.1.6.1	Conform		
	Lighting is vital to post-fire safe-shutdown and emergency response in the event of fire. The licensee should provide suitable fixed and portable emergency lighting.	4.1.6.2	Conform		
CP COL 9.5(1)	The communication system design should provide effective communication between plant personnel in all vital areas during fire conditions under maximum potential noise levels.	4.1.7	Conform	In plant repeaters used where required.	DCD_09.05.01-15
CP COL 9.5(2)	In situ and transient explosion hazards should be identified and suitable protection provided. Transient explosion hazards that cannot be eliminated should be controlled and suitable protection provided.	4.1.8	Conform	US-APWR design addresses in situ explosion hazards and provides protection. See Subsection 9.5.1.6.	

Table 9.5.1-1R (Sheet 36 of 53)
CPNPP Units 3 & 4 Fire Protection Program Conformance with RG 1.189

	Regulatory Position	Position Number	Conformance	Remarks	
	primary coolant boundary, or rupture of the containment boundary. Licensees should ensure that fire protection features are provided for structures, systems, and components important to safe shutdown that are capable of limiting fire damage so that one success path of systems necessary to achieve and maintain hot shutdown conditions from either the MCR or emergency control station(s) is free of fire damage.				
	For normal safe shutdown, redundant systems necessary to achieve cold shutdown may be damaged by a single fire, but damage should be limited so that at least one success path can be repaired or made operable within 72 hours using onsite capability or within the time period required to achieve a safe-shutdown condition, if less than 72 hours.	5.2	N/A	The US-APWR as an evolutionary plant design must be able to achieve cold shutdown without equipment repairs being involved. Cold shutdown can be achieved as a normal course of action using two of the four redundant safety trains.	
	Fire barriers or automatic suppression, or both, should be installed as necessary to protect redundant systems or components necessary for safe shutdown.	5.3	Conform	Fire barriers are installed to provide separation of redundant safety trains. Automatic suppression is installed to minimize damage to safety-related equipment where app.	
CP COL 9.5(2)	The post-fire safe-shutdown analysis must ensure that one success path of shutdown SSCs remains free of fire damage for a single fire in any single plant fire area. The NRC acknowledges Chapter 3 of industry guidance document, NEI-00-01, Revision 1, in RIS 2005-30, as providing an acceptable deterministic methodology for analysis of post-fire safe-shutdown circuits, when applied in conjunction with the RIS.	5.3.1	Conform	See FHA (Appendix 9A.) See Subsection 9.5.1.3	DCD_09.05.01-7

Table 9.5.1-1R (Sheet 37 of 53)
CPNPP Units 3 & 4 Fire Protection Program Conformance with RG 1.189

Regulatory Position	Position Number	Conformance	Remarks	
The licensee should evaluate the circuits associated with Hi/Low pressure interfaces for the potential to adversely affect safe shutdown. For example, the residual heat removal (RHR) system is generally a low-pressure system that interfaces with the high-pressure primary coolant system. Thus, the interface most likely consists of two redundant and independent motor-operated valves. Both of these two motor-operated valves and their power and control cables may be subject to damage from a single fire. This single fire could cause the two valves to spuriously open, resulting in an interfacing system LOCA through the subject Hi/Low-pressure system interface.	5.3.2	Conform	The US-APWR design considers the impact of high/low pressure interfaces.	
The post-fire safe-shutdown analysis should describe the methodology necessary to accomplish safe shutdown, including any operator actions required. Manual actions may not be credited in lieu of providing the required protection of redundant systems located in the same fire area required by Section III.G.2 of Appendix R to 10 CFR 50, unless the NRC has reviewed and approved a specific operator manual action for a specific plant through the exemption process of 10 CFR 50.12.	5.3.3	Conform	Four redundant trains of safety-related equipment are individually separated with 3-hour fire rated barriers. Should MCR fire involvement prevent safe operation, a completely independent remote shutdown console is located in a separate fire area. No operator manual actions are required, except evacuation and switch transfer for the MCR fire event.	
The post-fire safe-shutdown circuit analysis must address all possible fire-induced failures, including multiple spurious actuations. Although some licensees have based this analysis on the assumption that multiple spurious actuations will not occur simultaneously or in rapid succession, cable fire testing performed by the industry had demonstrated that multiple	5.3.4	Conform	Conformance with this regulatory position is based on the criteria of RG 1.189, Rev. 1 not the one-at-a-time assumption used in NFPA 804 that is not endorsed by the NRC.	DCD_09.05.01-5

Table 9.5.1-2R (Sheet 40 of 75)
CPNPP Units 3 & 4 Fire Protection Program Conformance with NFPA 804

	Standard Requirement	Paragraph	Conformance	Remarks	
	Other raceways shall be made of noncombustible materials.	8.8.7.4	Conform		
	Buildings shall be protected from exposure fires by any one of the following: (1) Listed 3-hour fire barrier with automatic or self-closing fire doors having a fire protection rating of 3 hours and listed penetration protection of a 3-hour rating. (2) Spatial separation of at least 50 ft. (3) Exterior exposure protection.	8.9	Conform		
	The electrical design and installation of electrical generating, control, transmission, distribution, and metering of electrical energy shall be provided in accordance with NFPA 70, National Electrical Code, or ANSI/IEEE C2, National Electrical Safety Code, as applicable.	8.10	Conform		
CP COL 9.5(1)	The plant-approved voice/alarm communications system in accordance with NFPA 72, National Fire Alarm Code, shall be available on a priority basis for fire announcements, directing the plant fire brigade, and fire evacuation announcements.	8.11.1	Conform		DCD_09.05.01-15
CP COL 9.5(1)	A portable radio communications system shall be provided for use by the fire brigade and other operations personnel required to achieve safe shutdown.	8.11.2	Conform		
CP COL 9.5(1)	The radio communications system shall not interfere with the communications capabilities of the plant security force.	8.11.3	Conform		
CP COL 9.5(1)	The impact of fire damage on the communications systems shall be considered when fixed repeaters are installed to permit the use of portable radios.	8.11.4	Conform		
CP COL 9.5(1)	Repeaters shall be located such that a fire-induced failure of the repeater will not also cause failure of the other communications systems relied on for safe shutdown.	8.11.5	Conform		
CP COL 9.5(1)	Plant control equipment shall be designed so that the control equipment is not susceptible to radio frequency interferences from portable radios.	8.11.6	Conform		DCD_09.05.01-15

Table 9.5.1-2R (Sheet 41 of 75)
CPNPP Units 3 & 4 Fire Protection Program Conformance with NFPA 804

	Standard Requirement	Paragraph	Conformance	Remarks	
CP COL 9.5(1)	Preoperational tests and periodic testing shall demonstrate that the frequencies used for portable radio communications will not affect actuation of protective relays or other electrical components.	8.11.7	Conform		DCD_09.05.01-15
	A fire hazards analysis shall be conducted to determine the fire protection requirements for the facility.	9.1.1	Conform	See Appendix 9A.	
	All fire protection systems, equipment, and installations shall be dedicated to fire protection purposes unless permitted by the following: (1) The requirement of 9.1.2 shall not apply to fire protection systems, equipment, and installations where in accordance with 9.4.10. (2) Fire Protection Systems shall be permitted to be used to provide redundant backup to nuclear safety–related systems provided that both the following criteria are met: (a) The fire protection systems shall meet the design basis requirements of the nuclear safety–related systems. (b) Fire protection systems used in 9.1.2(2)(a) shall be designed to handle both functions.	9.1.2	Conform	The fire protection system may provide backup functions for severe accident mitigation if the system is available.	
	All fire protection equipment shall be listed or approved for its intended service.	9.1.3	Conform		
CP COL 9.5(2)	The fire water supply shall be calculated on the basis of the largest expected flow rate for a period of 2 hours but shall not be less than 300,000 gal (1,135,500 L), and the following criteria also shall apply: (1) The flow rate shall be based on 500 gpm (1892.5 L/min) for manual hose streams plus the largest design demand of any sprinkler or fixed water spray system as determined in accordance with this standard, with NFPA 13, Standard for the Installation of Sprinkler Systems, or with NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection. (2) The fire water supply shall be capable of delivering the design demand specified in 9.2.1(1) with the hydraulically least demanding portion of the fire main loop out of service.	9.2.1	Conform	See Subsection 9.5.1.2.2.	

Chapter 10

Chapter 10 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
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Chapter 11

Chapter 11 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
MAP-11-001	11.3.3.3	11.3-2, 11.3-3	Deletion of COL Item	Delete COL Item.	0

CP COL 11.3(6) Replace the fifth and sixth paragraph in DCD Subsection 11.3.3.1 with the following.

The site-specific long-term annual average atmospheric dispersion factors (χ/Q) are given in Tables 2.3-340 through 2.3-346 are bounded by the value given in DCD Table 2.0-1 (1.6E-05 s/m^3). These values are calculated by methods presented in RG1.111. Therefore, also the radioactive concentrations at exclusion area boundary (EAB) are bounded by the values given in DCD Tables 11.3-5 through 11.3-7. The maximum individual doses are calculated using the GASPAR II Code (Reference 11.3-17) which implements the exposure methodology described in RG1.109. The site-specific parameters for the GASPAR II Code calculation are tabulated in Table 11.3-8R. Calculated doses are tabulated in Table 11.3-9R. The gamma dose in air is 5.77E-03 mrad/yr and the beta dose in air is 4.46E-02 mrad/yr, which are less than the criteria of 10 mrad/yr and 20 mrad/yr, respectively, that are required in 10 CFR 50, Appendix I. All of the dose to total body, the dose to skin, and the dose to organ are less than the criteria in 10 CFR 50, Appendix I: 4.72E-02 mrem/yr for 5 mrem/yr, 8.55E-02 mrem/yr for 15 mrem/yr, and 1.40E+00 mrem/yr [child's bone] for 15 mrem/yr, respectively. The compliance with 10 CFR 20.1302 is also demonstrated.

The population doses within the 50mi are calculated using the GASPAR II Code (Reference 11.3-17). The GASPAR II Code input parameters for the population dose are tabulated in Table 11.3-8R and Table 11.3-201. Calculated doses are 1.58 person-rem(Total body) and 1.98 person-rem(Thyroid).

Additionally, the dose from the evaporation pond is also calculated using the GASPAR II Code (Reference 11.3-17). The half of the liquid effluent is assumed to be diverted into the evaporation pond. Conservatively, all of the radioactive nuclides in the evaporation pond are assumed to be discharged to atmosphere as aerosol and vapor. The annual release rates from the evaporation pond to atmosphere are listed in Table 11.3-202, and parameters for the GASPAR II Code calculation are listed in Table 11.3-203. Calculated individual doses are listed in Table 11.3-204. And population doses are 1.01 person-rem(Total body) and 0.995 person-rem(Thyroid). Moreover, the total of individual doses from the vent stack and the evaporation pond are listed in Table 11.3-205. And the total of population doses are 2.59 person-rem(Total body) and 2.97 person-rem(Thyroid). The results are well below the dose criteria in 10 CFR 50 Appendix I. According to NUREG-0543 (Reference 11.3-201), there is reasonable assurance that sites with up to four operating reactors that have releases within Appendix I design objective values are also in conformance with the EPA Uranium Fuel Cycle Standard, 40 CFR 190. Once the proposed CPNPP Units 3 and 4 are constructed, the Comanche Peak site will consist of four operating reactors.

~~11.3.3.3 Offsite Dose Calculation Manual~~

MAP-11-001

CP COL 11.3(5) Replace the content of DCD Subsection 11.3.3.3 with the following. MAP-11-001

The ODCM provides the methodology for calculating the radiation doses to offsite personnel from released effluents. This document is site-specific as it must take into consideration local meteorology, land use patterns, and distances to the site boundary. The ODCM also provides the rationale for compliance with the radiological effluent Technical Specifications and for the calculation of appropriate setpoints for radioactive effluent monitors. The ODCM is developed using the guidance of Nuclear Energy Institute (NEI) Technical Report 07-09, and is implemented in accordance with the milestone listed in Table 13.4-201. CPNPP Units 1 and 2 also have an existing ODCM (Reference 11.3-202) that is to reflect the new reactor units.

11.3.7 Combined License Information

Replace the content of DCD Subsection 11.3.7 with the following.

11.3(1) *Deleted from the DCD.*

11.3(2) *Deleted from the DCD.*

CP COL 11.3(3) ***11.3(3)*** *Onsite vent stack design parameters*

This COL item is addressed in Subsection 11.3.2*.*

11.3(4) *Deleted from the DCD.*

CP COL 11.3(5) ***11.3(5)*** *Offsite dose calculation manual*

This COL item is addressed in Subsection 11.3.3.3. *Deleted from the DCD.* MAP-11-001

CP COL 11.3(6) ***11.3(6)*** *Site-specific dose calculation*

This COL item is addressed in Subsection 11.3.3.1*,* Table 11.3-8R*,* Table 11.3-9R*,* Table 11.3-201*,* Table 11.3-202*,* Table 11.3-203*,* Table 11.3-204 *and Table 11.2-205.*

11.3(7) *Deleted from the DCD.*

11.3(8)*Site-specific cost-benefit analysis*

This COL item is addressed in Subsection 11.3.1.5*.*

11.3(9) *Piping and instrumentation diagrams*

This COL item is addressed in Subsection 11.3.2 *and* Figure 11.3-201*.*

11.3.8 References

Chapter 12

Chapter 12 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
DCD_12.01-2	12.1.3	12.1-2	Delete Outdated RG	Delete RG8.20, 8.26, and 8.32.	0
DCD_12.02-15	12.2.1.1.10	12.2-1	DCD_RAI 12.02-15	Add “40 CFR 190”.	0
CTS-00463	12.5	12.5-1	Clarification	Change description about entry into the interim waste storage building.	0

CP COL 12.1(3) Replace the contents in DCD Subsection 12.1.3 with the following.

The operational radiation protection program for ensuring that operational radiation exposures are as low as reasonably achievable (ALARA) is discussed in Section 12.5, by utilizing of NEI 07-03 (Reference 12.1-26) in combination with existing or modified CPNPP Units 1 and 2 site program information. The program follows the guidance of RG 8.2, 8.4, 8.6, 8.7, 8.9, 8.13, 8.15, ~~8.20,~~ 8.25, ~~8.26~~ 8.27, 8.28, 8.29, ~~8.32,~~ 8.34, 8.35, 8.36, and 8.38. DCD_12.01-2

12.1.4 Combined License Information

Replace the content of DCD Subsection 12.1.4 with the following.

CP COL 12.1(1) ***12.1(1)*** *Policy considerations regarding plant operations*

This Combined License (COL) item is addressed in Subsections 12.1.1.3.1*, 12.1.1.3.2 and* 12.1.1.3.3*.*

12.1(2) *Deleted from the DCD.*

CP COL 12.1(3) ***12.1(3)*** *Following the guidance regarding radiation protection*

This COL item is addressed in Subsection 12.1.3*.*

12.1(4) *Deleted from the DCD.*

CP COL 12.1(5) ***12.1(5)*** *Radiation protection program*

This COL item is addressed in Section 12.5*.*

12.2 RADIATION SOURCES

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

12.2.1.1.10 Miscellaneous Sources

CP COL 12.2(2) Replace the second and third sentences of the sixth paragraph in DCD Subsection 12.2.1.1.10 with the following.

CPNPP Units 3 and 4 have no additional storage space for radwaste inside the plant structures. CPNPP Units 3 and 4 have a plan to store temporarily radioactive wastes/materials in Interim Radwaste Storage/Staging Building outside the plant structures. The radiation protection program (see Section 12.5) is in place to ensure compliance with Title 10, Code of Federal Regulations (CFR) Part 20, 40 CFR 190 and to be consistent with the recommendations of RG 8.8. DCD_12.02-15

CP COL 12.2(2) Replace the second sentence of the seventh paragraph in DCD Subsection 12.2.1.1.10 with the following.

CPNPP Units 3 and 4 have no additional radwaste facilities for dry active waste.

CP COL 12.2(1) Replace the last paragraph in DCD Subsection 12.2.1.1.10 with the following.

Any additional solid, liquid and gaseous radiation sources that are not identified in Subsection 12.2.1, including radiation sources used for instruments calibration or radiography, will be provided when such site-specific information would become available in the procurement phase.

12.2.3 Combined License Information

Replace the content of DCD Subsection 12.2.3 with the following.

CP COL 12.2(1) ***12.2(1)*** *Additional sources*

This COL item is addressed in Subsection 12.2.1.1.10.

CP COL 12.2(2) ***12.2(2)*** *Additional storage space and radwaste facilities*

12.5 OPERATIONAL RADIATION PROTECTION PROGRAM

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

CP COL 12.1(5) Replace the contents in DCD Section 12.5 with the following.

NEI 07-03, Generic FSAR Template Guidance for Radiation Protection Program Description, Revision 5, is incorporated by reference. Site specific information in radiation protection program will be implemented in accordance with the milestones listed in Table 13.4-201, by utilizing of NEI 07-03 and NEI 07-08, Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA), Revision 1, in combination with existing or modified CPNPP Units 1 and 2 site program Information.

Revise the contents of NEI 07-03 with the following.

CP COL 12.2(2)
CP COL 12.3(1)
CP COL 12.3(5)

Add the following information after the first paragraph in Subsection 12.5.3.3 of NEI 07-03.

In case the National Institute for Occupational Safety and Health/Mine Safety and Health Administration certified equipments are not used, equipments are used to be compliance with 10 CFR 20.1703(b) and 20.1705.

Add the following information after the paragraph in the discussion on Radwaste Handling in Subsection 12.5.4.2 of NEI 07-03.

CPNPP Units 3 and 4 have a plan to store temporarily radioactive wastes/materials in Interim Radwaste Storage/Staging Building outside the plant structures. Entry ~~to~~into the radiologically controlled areas of this building is allowed only through the issuance of a Radiation Work Permit. Non-radiologically controlled areas allow for general access. CTS-00463

Add the following information after the third paragraph in Subsection 12.5.4.4 of NEI 07-03.

The locations and radiological controls of the radiation zones on plant layout drawings are located in DCD Subsection 12.3.1.2. Administrative controls for restricting access to Very High Radiation Area are provided by Plant Manager's (or designee) approval. Access control for Very High Radiation Areas is controlled

Chapter 13

Chapter 13 Tracking Report Revision List

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Chapter 14

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Chapter 15

Chapter 15 Tracking Report Revision List

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Chapter 16

Chapter 16 Tracking Report Revision List

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Chapter 17

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Chapter 18

Chapter 18 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
					0

Chapter 19

Chapter 19 Tracking Report Revision List

Change ID No.	Section	Page	Reason for change	Change Summary	Rev. of T/R
MAP-19-001	19.1.5.1.1	19.1-8 19.3-1	Deletion of COL Item	Delete COL Item.	0
MAP-19-002	19.2.5	19.2-1 19.3-1	Deletion of COL Item	Delete COL Item.	0

Transportation and Nearby Facility Accidents

These events consist of the following:

- Hazards associated with nearby industrial activities, such as manufacturing, processing, or storage facilities
- Hazards associated with nearby military activities, such as military bases, training areas, or aircraft flights
- Hazards associated with nearby transportation routes (aircraft routes, highways, railways, navigable waters, and pipelines)

In Subsection 2.2.3.1, design basis events internal and external to the nuclear power plant are defined as those events that have a probability of occurrence on the order of about 10^{-7}/RY or greater and potential consequences serious enough to affect the safety of the plant to the extent that the guidelines in 10 CFR Part 100 could be exceeded. The following categories are considered for the determination of design basis events: explosions, flammable vapor clouds with a delayed ignition, toxic chemicals, fires, collisions with the intake structure, and liquid spills.

The effects of these events on the safety-related components of the plant are insignificant as discussed in Subsection 2.2.3.1. These events meet the preliminary screening criteria of ANSI/ANS-58.21-2007 (Reference 19.1-8).

Aircraft Crash

As described in Subsection 3.5.1.6, the probability of aircraft-related accidents for CPNPP Units 3 and 4 is less than the order of 10^{-7} per year for aircraft, airway, and airport information reflected in Subsection 2.2. Thus, this event is not addressed further.

~~19.1.5.1.1 Description of the Seismic Risk Evaluation~~ MAP-19-001

~~CP COL 19.3(5)~~ ~~Replace the description of the bullet item “Fragility analysis” with the following.~~

~~Seismic fragility will be re-evaluated considering the site-specific designs before the first fuel load. Seismic fragilities of the structures are developed using the methodology in Reference 19.1-36.~~

19.1.5.2.2 Results from the Internal Fires Risk Evaluation

19.2 SEVERE ACCIDENT EVALUATION

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

~~19.2.5 Accident Management~~ MAP-19-002

~~CP COL 19.3(6)~~ ~~Add the following text after the last paragraph in DCD Subsection 19.2.5.~~

~~An accident management program will be developed based on such as the severe accident management guidance (SAMG) prepared by Westinghouse Owners Group (WOG). Important operator actions will be included in operating procedures, and training procedures will also be developed as part of the accident management program. Training for operators will be completed prior to the first fuel load.~~

19.2.6.1 Introduction

CP COL 19.3(4) Replace the content of DCD Subsection 19.2.6.1 with the following

This section is prepared using site-specific PRA information to consider potential design improvements as required under 10 CFR 50.34(f) and follows content guidance provided in NRC Regulatory Guide 1.206. Information for this section is from the PRA, Subsection 19.1, and from Subsections 7.2 and 7.3 of the Environmental Report, Part 3 of the Combined License (COL) Application.

19.2.6.1.1 Background

CP COL 19.3(4) Add the following text after the last paragraphs in DCD Subsection 19.2.6.1.1.

Design or procedural modifications that could mitigate the consequences of severe accidents are known as severe accident mitigation alternatives (SAMAs). For design certification, SAMAs are known as severe accident mitigation design alternatives (SAMDAs), which focus on design changes and do not consider procedural modifications for SAMAs. For an existing plant with a well-defined design and established procedural controls, the normal evaluation process for identifying potential SAMAs includes four steps:

19.3 OPEN, CONFIRMATORY, AND COL ACTION ITEMS IDENTIFIED AS UNRESOLVED

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

19.3.3 Resolution of COL Action Items

Replace the content of DCD Subsection 19.3.3 with the following.

CP COL 19.3(1) ***19.3(1)*** *Update of PRA and SA evaluation for input to RMTS*

This COL item is addressed in Subsection 19.1.7.6.

19.3(2) *Deleted from the DCD.*

STD COL 19.3(3) ***19.3(3)*** *PRA input to a reactor oversight process*

This COL item is addressed in Subsection 19.1.7.3.

CP COL 19.3(4) ***19.3(4)*** *Update of PRA and SA evaluation based on site-specific information*

This COL item is addressed in Subsections 19.1.1.2.1, 19.1.4.1.2, 19.1.4.2.2, 19.1.5, 19.1.5.2.2, 19.1.5.3.2, 19.1.6.2, 19.2.6.1, 19.2.6.1.1, 19.2.6.2, 19.2.6.4, 19.2.6.5 and 19.2.6.6, Tables 19.1-201, 19.1-202, 19.1-203 and 19.2-9R, and Figure 19.1-201.

~~CP COL 19.3(5)~~ ***19.3(5)*** *Deleted from the DCD.~~SSC fragilities~~* MAP-19-001

~~*This COL item is addressed in Subsection 19.1.5.1.1.*~~

~~CP COL 19.3(6)~~ ***19.3(6)*** *Deleted from the DCD.~~Accident management program~~* MAP-19-002

~~*This COL item is addressed in Subsection 19.2.5.*~~